HYDROGEOCHEMICAL ASSESSMENT OF THE SPATIOTEMPORAL EVOLUTION OF GROUNDWATER IN TEXAS AQUIFERS (1985-2014)

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INTRODUCTION

- Rising industrial, domestic and agricultural demands are putting pressure on global groundwater resources, leading to significant social, economic and ecological impacts.
- Texas one of the fastest growing U.S states with a projected population increase from 29.5 million in 2020 to 51 million by 2070, securing the quantity and quality of limited groundwater resources is critical.

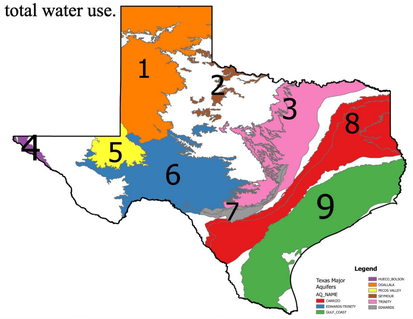
RESEARCH QUESTIONS

This study addresses the following questions:

- What are the spatiotemporal variations in groundwater chemistry and hydro geochemical trends across major Texas aquifers from 1985 to 2014?
- What are the dominant geochemical processes controlling the hydro geochemical dynamics in major Texas aquifers, and how do they vary spatially and temporally?
- How does climate variability and land use changes influence groundwater hydrochemistry in major Texas aquifers over time?

THE STUDY AREA

Texas has a diverse climate, ranging from arid in the west to humid and subtropical in the east. Texas relies heavily on groundwater, with nine (9) major aquifers covering 71% of its land and supplying 60% of its total water use.

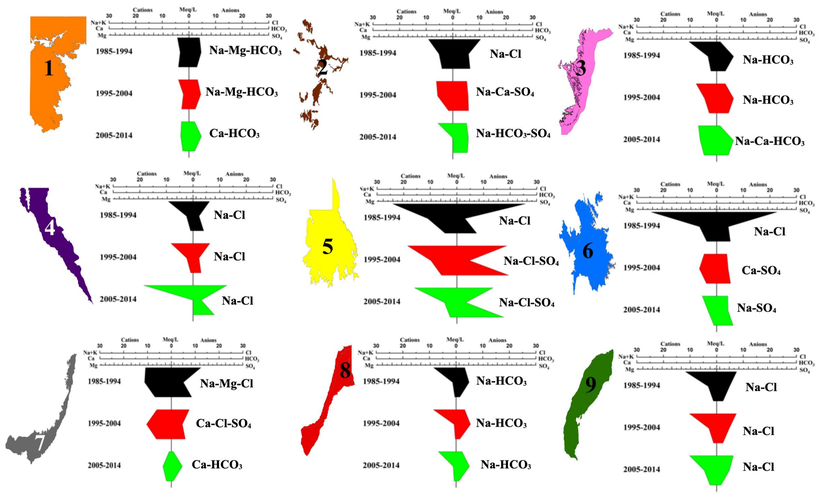


DATASETS & METHODS

Datasets for this project was acquired from the Texas Water Development Board (**groundwater chemistry**), Landsat 8 satellite dataset from CHRS (**precipitation estimation**) and Landsat 8/9 dataset from MRLC (**land use and land cover changes**).

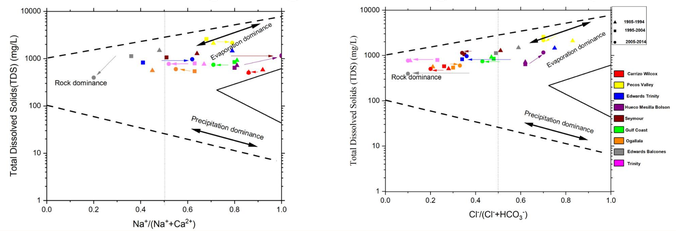
RESULTS & DISCUSSION

Stiff diagram representing groundwater ionic composition



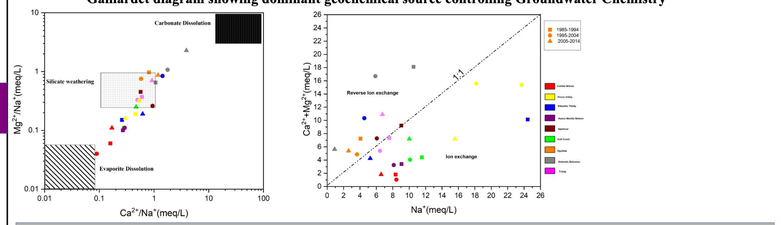
- **Groundwater shows notable chemical shifts in the Ogallala, Seymour, Pecos Valley, Edwards Trinity, Edwards Balcones and Trinity aquifers.**
- **Hueco Mesilla Bolson, Carrizo Wilcox and Gulf Coast aquifers remain chemically stable .**

Gibbs diagram showing mechanisms controlling Groundwater Chemistry



- **More than 90% of aquifers in the Evaporative dominant show concentration of dissolved solids and precipitation of Calcium minerals leaving water enriched in Sodium.**
- **About 70% of aquifers in the Rock dominated aquifers show higher HCO_3 relative to Cl^-**

Gaillardet diagram showing dominant geochemical source controlling Groundwater Chemistry

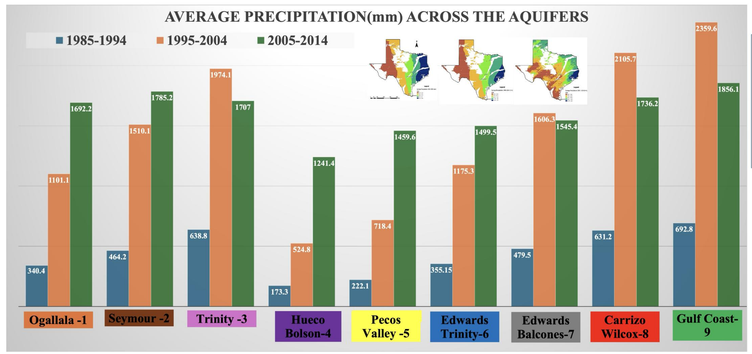


- **Chemistry of groundwater in the aquifers is largely controlled by Silicate weathering with few aquifers showing carbonate and evaporite dissolution.**

	AQUIFER	DOMINANT MINERALOGY
1	Ogallala	Sand, gravel, clay and silt
2	Seymour	Gravel, conglomerate, sand and silty clay
3	Trinity	Limestone, sand, clay, gravels and conglomerate
4	Hueco Mesilla Bolson	Silt, sand, gravel and clay
5	Pecos Valley	Alluvial and windblown deposits.
6	Edwards trinity	Limestone, dolomite and sand.
7	Edwards Balcones Fault Zone	Limestone, sand and Paleozoic rocks
8	Carrizo Wilcox	Sand locally interbedded with gravel, silt, clay and lignite.
9	Gulf Coast	Sand, silt, clay and gravel beds

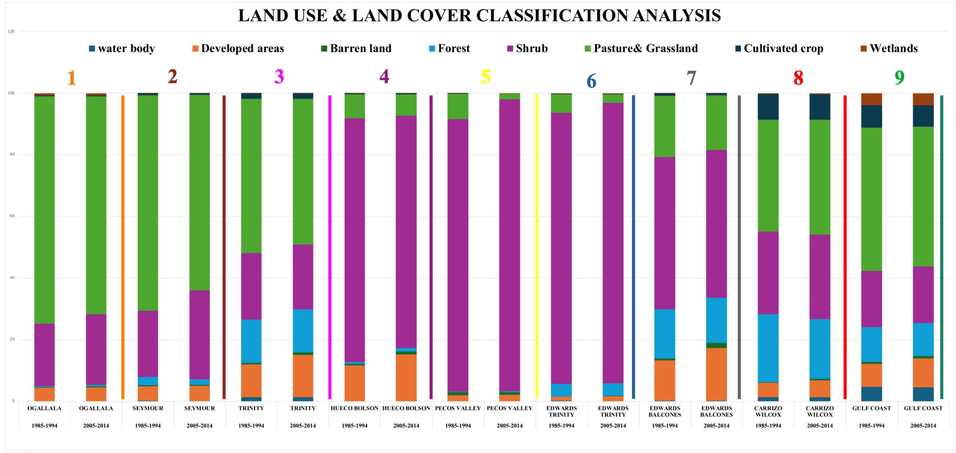
Mineral composition of an aquifer plays a critical role in controlling the chemical composition of groundwater.

AVERAGE PRECIPITATION(mm) ACROSS THE AQUIFERS



How does Precipitation -driven mineral weathering influence the evolution of groundwater chemistry?

LAND USE & LAND COVER CLASSIFICATION ANALYSIS



What impact do land use and land cover changes have on the hydro geochemistry of groundwater in Texas Aquifers?

FUTURE RESEARCH WORK

Investigate groundwater geochemistry in the Trinity aquifer, focusing on the rapidly urbanizing Fort Worth and Dallas areas to assess the impact of urban growth and human activities on groundwater geochemistry to inform sustainable management.