WATER CONSERVATION

Climate Projections for Drought Assessments in the Edwards Aquifer Region

Comal Springs fed by the Edwards Aquifer/Scott Bauer

INTRODUCTION

The Edwards Aquifer provides water for municipal, agricultural, industrial, and recreational uses, while also supporting environmental flows that are crucial for the habitats of threatened and endangered species at some of its major springs. This karst aquifer is characterized by subsurface channels, conduits, sinkholes, and interconnected caves, which allow it to be effectively replenished by rain events. However, rapid recharge can make the aquifer susceptible to contamination, and constant discharge from springs can make it more susceptible to drought.

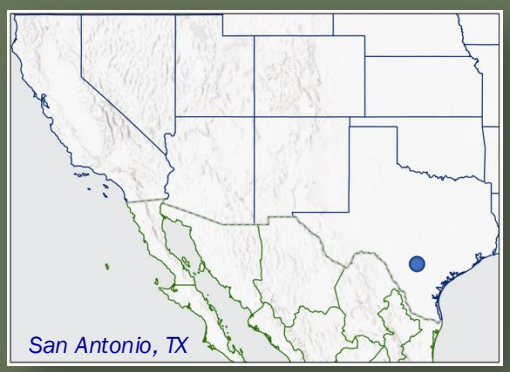
The Edwards Aquifer Authority (EAA) manages groundwater withdrawals to ensure the sustainability of the aquifer and maintenance of spring flows during drought conditions. The EAA collaborated with a climatologist from the South Central Climate Adaptation Science Center (South Central CASC) to develop customized downscaled climate projections to achieve more informed management decisions.

KEY ISSUES ADDRESSED

Global Climate Models (GCMs) are essential tools for understanding future climate conditions. The projected climate data from these models can be statistically downscaled to project regional daily temperatures and precipitation patterns. However, producing accurate regional projections requires advanced software and expertise in selecting appropriate climate models and emission scenarios. The EAA needs downscaled climate projections to assess future climate-related impacts on the aquifer, evaluate current mitigation and conservation strategies, and to develop sustainable and drought-resilient management practices.

PROJECT GOALS

- Identify GCMs and downscaling techniques that best represent regional patterns.
- Downscale GCMs to produce high resolution climate projections.
- Summarize output from multiple models and emission scenarios.
- Examine how future climate conditions may impact aquifer recharge and affect drought risk.



PROJECT HIGHLIGHTS

Select Methodologies, Models, and Emissions Scenarios for Regionally Scaled Climate Projections: The EAA partnered with a climatologist from the South Central CASC to downscale climate projections for the Edwards Aquifer. Climatological expertise ensured the proper methods and models were selected and developed with statistical downscaling techniques.

Partnerships Enhance Understanding of Possible Future Climate Conditions: This collaboration led to 19 sets of climate projections downscaled to the Edwards Aquifer Region that show daily precipitation and temperature under high and intermediate emission scenarios. With a high spatial resolution, these models allow EAA planners to evaluate how future conditions may impact aquifer recharge, groundwater levels, and spring flows. Projections show that through the end of the century, the Edwards Aquifer Region can expect to face drought conditions similar to those it has experienced since the 1950s.

Evaluate Management Outcomes to Enhance Drought Planning: The project team developed and used Counterfactual AI to assess what would have happened in past droughts without EAA management. Results showed that current measures have made a positive impact on the sustainability of the aquifer and spring flows.

Fountain Darter/Taylor James

LESSONS LEARNED

As a regional groundwater management agency, the EAA has limited resources to develop climate projections. Working closely with an experienced climatologist to select appropriate models and downscaling approaches helped the EAA make efficient use of financial and computing resources in the time allotted for the project.

Throughout this project, EAA water resource managers enhanced their ability to integrate climate data and uncertainty into EAA management plans. EAA and Edwards Aquifer Habitat Conservation Plan stakeholders had opportunities to engage in discussion with the South Central CASC Climatologist. This raised awareness and provided education to build support for climate-informed decision making.

While some downscaled climate data is publicly available, EAA planners and South Central CASC partners required regionally-specific projections. Financial support from the USGS provided the South Central CASC climate scientist with resources, time, and data necessary to develop reliable downscaled projections for drought planning efforts. Collaborative funding efforts overcome barriers, driving greater project success.

NEXT STEPS

- Update climate projections as new climate and emission scenario data becomes available.
- Utilize NASA evapotranspiration data to expand understanding of regional water balance and drought projections.
- Examine how key recharge zones may shift to ensure these areas remain protected.

PARTNERS

- See online for full list of partners
- For more information, contact Adrienne Wooten: amwootte@ou.edu

edwards aquifer AUTHORITY

SOUTH CENTRAL CLIMATE ADAPTATION SCIENCE CENTER

CART Author: Jessica Zimmerman, July 2025
For more information on CART, visit https://www.fws.gov/CART

Read the full Case Study: