

Sectoral Impacts of Drought and Climate Change

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End Users: Arizona Parks and Trails; Arizona Department of Water Resources; Bureau of Reclamation; Central Arizona Project; Arizona Agribusiness and Water Council; Graham and Greenlee County governments; Arizona Farm Bureau; Upper Gila Watershed Alliance; National Parks Conservation Association; Arizona House of Representatives, Agriculture and Water Committee; National Integrated Drought Information System (NIDIS)

Additional Resource Support: National Integrated Drought Information System (NIDIS); Arizona Department of Water Resources; Arizona Parks and Trails

Project Dates: 2017 – 2023

Summary of Impact

Increasing understanding on the economic impacts of drought: This project provided valuable insights regarding the economic impacts of drought in Arizona, particularly for agricultural and outdoor recreation sectors. A main finding regarding Arizona agriculture is that crops are highly irrigation-dependent, meaning that drought's primary effect is not on crop yields but on planted acreage. A main finding for tourism and outdoor recreation shows an increase in recreational visits during periods of short-term drought, but a decrease in visits over periods of longer-term drought.

Communicating drought impacts: CLIMAS researchers directly addressed Arizona stakeholder requests for information by providing findings in presentations and publicly accessible reports.

Problem Statement

To effectively address the impacts of drought on Arizona's rural economies, government agencies, businesses, and natural resource managers need a clear understanding of how drought affects these communities. This knowledge is essential for informed decision-making and the development of drought mitigation and response plans.

Research Focus

In response to numerous stakeholder requests, this project examined the impacts of drought on two climate sensitive sectors in the Southwest: agriculture and outdoor recreation.

Project Activities

Data collection and analysis: Economic research and data analysis for development into stakeholder reports, presentations, and publications.

Interaction with partners: Ongoing meetings, emails, zoom calls, and conversations with societal partners and research stakeholders.

Project Outputs

Peer-Reviewed Publications:

Duval, D., A. Bickel, G. Frisvold. 2024. Differential effects of drought on Arizona state park Visits: Implications for visitor spending and local economies. *Journal of Regional Analysis & Policy* 54(2) (in press).

Duval, D., A.K. Bickel, G. Frisvold. 2021. Effects of Reservoir Levels on Arizona National Recreation Area Visitation, Visitor Spending, and Local Economies. *JAWRA – Journal of the American Water Resources Association*. <https://doi.org/10.1111/1752-1688.12962>

Reports:

Frisvold, G., D. Duval, C. Montaña. 2024 Economic Impacts of Groundwater Restrictions in the Gila Bend and Willcox Basins. Briefing Report to the Arizona Farm Bureau.

Bickel, A.K., D. Duval, G. Frisvold. 2021. Drought and Agriculture in Arizona. Final Report to the Arizona Department of Water Resources. University of Arizona Cooperative Extension,

Bickel, A.K., D. Duval, G. Frisvold. 2021. The Effects of Drought on Arizona Forage Production. Final Report to NOAA – National Integrated Drought Information System (NIDIS). Boulder, CO.

Bickel, A.K., D. Duval, G. Frisvold. 2021. Drought and Insured Crop Losses in Arizona. Final Report to NOAA – National Integrated Drought Information System (NIDIS). Boulder, CO.

Bickel, A.K., D. Duval, G. Frisvold. 2020. [Agriculture in Graham and Greenlee Counties](#). Department of Agricultural and Resource Economics, University of Arizona.

Duval, D., A.K. Bickel, A.K., G. Frisvold. 2021. The Costs of Wildfire in Arizona: A Survey of Methods, Data, and Estimates. Final Report to the Arizona Department of Water Resources. University of Arizona Cooperative Extension.

Duval, D., A.K. Bickel, G. Frisvold. 2021. The Effects of Reservoir Levels on Arizona National Recreation Area Visitation, Visitor Spending, and Local Economies. Final Report to NOAA – National Integrated Drought Information System (NIDIS). Boulder, CO.

- Duval, D., A.K. Bickel, G. Frisvold. 2021. Drought Effects on Arizona State Park Visits, Visitor Spending, and Local Economies. Final Report to NOAA – National Integrated Drought Information System (NIDIS). Boulder, CO.
- Duval, D., A.K. Bickel, G. Frisvold. 2021. Drought Effects on National Park Visits, Visitor Spending, and Local Economies. Final Report to NOAA – National Integrated Drought Information System (NIDIS). Boulder, CO.
- Duval, D., A.K. Bickel, G. Frisvold. 2020. [County Agricultural Economy Profiles for Southern Arizona](#). (MAP Dashboard) White Paper #14. Economic and Business Research Center. Eller College of Management. University of Arizona, Tucson.
- Duval, D., A.K. Bickel, G. Frisvold. 2020. [Arizona County Agricultural Economy Profiles](#). Tucson: University of Arizona Cooperative Extension.
- Duval, D., G. Frisvold, A.K. Bickel. 2020. [The economic value of trails: A travel cost method study](#). Final Technical Report to the Arizona Parks Board. Department of Agricultural and Resource Economics, University of Arizona.
- Duval, D., A.K. Bickel, G. Frisvold, X. Wu, C. Hu. 2018. [Contribution of Agriculture to the Maricopa County and Gila River Indian Community Economies](#). Department of Agricultural & Resource Economics, Cooperative Extension Report. University of Arizona, Tucson, AZ.

Presentations:

- Economic impacts of groundwater restrictions in the Gila Bend and Willcox Basins. 2024. Presentation before the Arizona Legislature Joint Legislative Ad Hoc Committee on Water Security. Phoenix, AZ
- Economic Effects of Drought and Fire: Presentation for ADWR working on drought response policy. 2022.
- Is Agriculture Any of Your Business? Keynote Speaker. 2018. Agribusiness & Water Council of Arizona Annual Meeting and Water Conference. Tempe, AZ.
- The Water-Energy Nexus. 2018. University of Arizona Cooperative Extension Waterwise Talk. University of Arizona. Sierra Vista, AZ.
- Agriculture in Arizona's Economy: The Role of Modeling and Implications for Water – Keynote. 2017. Arizona Farm Bureau's 96th Annual Convention. Mesa, AZ.

Media Coverage:

- [The Southwest's Most Important River is Drying Up](#). 2021. *CNN*.
- US Southwest, already parched, sees 'virtual water' drain abroad. 2021. [Grist](#). [UnDark](#). [Mother Jones](#).
- [Climate change could shake up Arizona agriculture](#). Arizona Sonora News Service.

Leveraged Funding

Supporting this project:

- Arizona Department of Water Resources (\$49,600)
- National Integrated Drought Information System (\$42,776)

Selected Scientific Findings:

Regarding drought and agriculture: In Arizona, short-term drought has little effect on crop yields, because most croplands are irrigated. Longer-term drought that results in reduced irrigation water supply, will cause farmers to cut back acreage. However, yields on remaining planted acres stay relatively stable. Drought effects on irrigated crops in Arizona are different than those on rainfed crops in the Plains and Midwest.

Regarding drought and outdoor recreation: The effect of drought on outdoor recreation also depends on the length of the drought measure. Short-term drought (measured by the one-month Standard Precipitation Index (SPI)) is associated with more recreation visits, while longer-term drought (measured by the 24-month SPI) is associated with fewer visits. People may avoid or delay outdoor recreation in especially rainy months (short-term effect). Longer-term drought can reduce streamflow, water in seeps in springs, and wildlife viewing opportunities, while increasing wildfire-related park closures. Figure 1 below shows the effect of changes in SPI (1-month) and SPI (24-month) on visits to Arizona state parks.

On communicating to wide audiences:

They did a great job assessing the economic value of trails. The economic impact study took very complex analyses and made them very, very understandable to a nontechnical audience

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Dawn Collins, Arizona State Parks and Trails

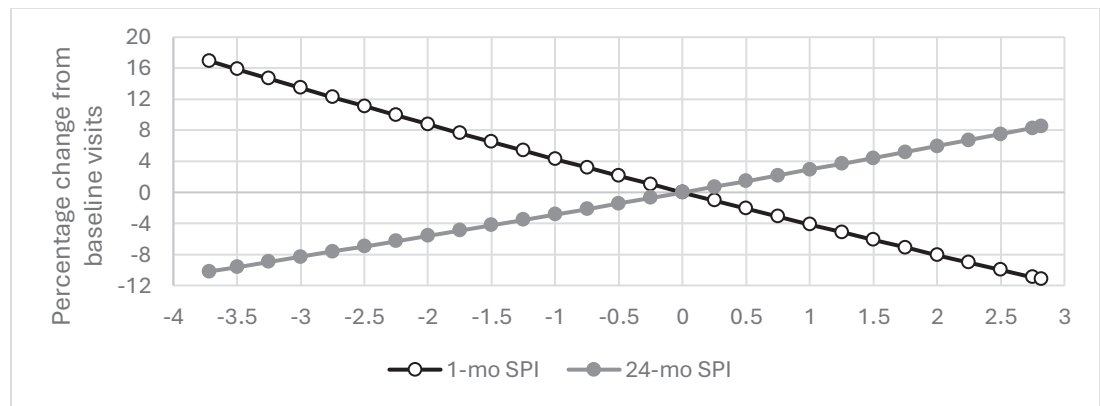


Figure 1. Percentage change in visits to Arizona state parks from baseline visits with changes in SPI (1-mo) and SPI (24-mo)

Regarding economy and outdoor recreation: Arizona residents generate an estimated \$8.3 billion in annual economic activity around non-motorized trail use. Trail users travel

furthest to access areas that are more heavily forested, have cooler average maximum and minimum temperatures, and have steeper and more varied slopes.

Societal Impacts by Category

Conceptual:

- Research summaries from project-related reports were provided to Craig McLean, the Assistant Administrator for Oceanic and Atmospheric Research (OAR) at NOAA to prepare for his briefing to the House Natural Resources Subcommittee on Waters, Oceans, and Wildlife on May 25, 2021.

On value of scientific expertise:

George and his team provide a link between academic peer-reviewed research on natural resources and information we collect. We get information from the public – what do they like to do, what are their concerns – and we get information from recreation providers. But it is all from persona, and passionate perspectives. The information from George and his team provide a missing piece by providing expert, scientific data and context to help us understand the current state of our natural resources

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Dawn Collins, Arizona State Parks and Trails*

- The economic value of trails report for the Arizona Parks Board was made publicly available on multiple websites: Arizona State Parks and Trails, Prescott Living Magazine, Arizona Heritage Alliance, Arizona Trail News, Arizona Trail Backpacking, and Tucson Hikers.

- CLIMAS researchers provided information on the economic effects of potential irrigation water cutbacks on Graham and Greenlee agriculture and their broader economies to county officials, irrigation districts and watershed management organizations.

- Data and information were provided to all Arizona County Extension Directors on county land and water use patterns.

Capacity Building:

- Arizona Department of Water Resources requested a comprehensive assessment of drought effects on different segments of

agriculture statewide. They used the final report to inform their general planning efforts.

- Arizona Department of Water Resources requested that the research team give a presentation on project findings about the economic effects of drought and fire. This session offered agency employees to ask questions about the findings. ADWR shared results with other state agencies and drought organizations.