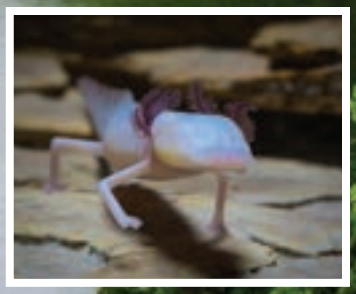
American Farmland Trust



Enhancing Riparian Habitats for Thriving Rural Landscapes for People and Wildlife in Texas

ANN SORENSEN • SARAH FULTON-SMITH • THERESA NOGEIRE-McRAE • BILLY VAN PELT • CASEY MITCHELL • CHARLES RANDKLEV • ROEL LOPEZ • SAMUEL SMIDT

September 2024

Acknowledgments

This work would not have been possible without Conservation Science Partners (CSP). Justin Suraci and Sarah McTeague from CSP not only provided the technical mapping for the project, but they also contributed several CSP-generated data layers related to critical conservation attributes. Our mapping of the critical agricultural lands in the Guadalupe River Basin also benefited from the observations of Kristy Oates, USDA–NRCS Texas State Conservationist who encouraged us to examine riparian systems. We thank Chad Ellis of Texas Agricultural Land Trust for helping us narrow our focus to the Guadalupe River Basin, and for his support and consultation throughout the project. Critical funding for this project was provided by Mrs. Jess Y. Womack, II. We are grateful for her passion and dedication to conservation in Texas. In addition, the AFT-NRCS Contribution Agreements 68-3A75-14-214 and 68-3A75-18-005 funded the creation of several of the data layers used in the mapping, including agricultural lands in the Basin, and allowed us to show future development in the Guadalupe River Basin.

COVER PHOTOS: GUADALUPE RIVER BY LAURETTE45/CC2.0/HTTPS://TINYURL.COM/43TF94V6; GOLDEN-CHEEKED WARBLER BY JOHN CAHILL/USFWS; TEXAS CATTLE BY MARTINA BIRNBAUM/ALAMY; TEXAS BLIND SALAMANDER BY RYAN HAGERTY/USFWS

INTRODUCTION

Between 1997 and 2017, Texas lost about 2.2 million acres of working lands to non-agricultural uses, resulting in weakened rural economies, reduced food security, and degraded natural ecosystems (Smith et al., 2019). By 2040, American Farmland Trust's (AFT) *Farms Under Threat 2040* analysis projects that Texas could lose an additional 2.2 million acres to development under a business-as-usual development scenario—or almost 2.8 million acres if low-density residential development in Texas accelerates (Hunter et al., 2022).

TEXAS CATTLE MARTINA BIRNBAUM/ALAMY

In addition to agricultural benefits, Texas farmland also provides a key habitat for wildlife. Fragmenting and converting vital farms and ranches through urban development can also threaten the habitats of tens of thousands of native animal and plant species, hundreds of which occur only in Texas. These adverse outcomes can be partly mitigated or avoided by (1) restoring streamside vegetation in high-priority locations to improve water quality and provide riparian habitat for wildlife and (2) accelerating the protection of strategically located working farms and ranches in high-priority watersheds to better direct urban development away from these key areas.

FOUNTAIN DARTER RYAN HAGGERTY/USFWS

Notably, Texans have a long history of successfully managing their agricultural lands for both food production and wildlife habitat, and there is a growing interest in farmland protection. Nearly 80% of surveyed landowners in Texas would consider participating in permanent land protection programs (Smith et al., 2019), and permanent land protection correlates with holistic land management outcomes like the adoption of riparian buffers along streams and the use of cover crops (Dempsey, 2023).

This report describes a pilot study conducted to identify threatened farm and ranchlands where habitat restoration along streams and rivers can have broadscale and positive agroecosystem impacts in Texas. The results of this study can be used to identify priority areas for coalition building and farmland protection, which is timely in response to an unprecedented increase in funding for agricultural conservation programs.

SITE SELECTION FOR CO-LOCATING AGRICULTURAL PRODUCTION AND WILDLIFE HABITAT

The Guadalupe River Basin is ideal for an agroecological study because it includes vital agricultural production and wildlife habitat that are both threatened by high development pressure. For example, the *Texas Land Use Trends* fragmentation risk index shows that the farm and ranchlands in most of the Guadalupe River Basin counties are at the highest risk of further fragmentation (Smith et al., 2019).

Here, AFT joined with Texas A&M University's Natural Resources Institute (TAMU NRI), the Texas Agricultural Land Trust (TALT), and Conservation Science Partners (CSP) to combine land cover and land use data, important conservation attributes of working farms and ranches, future development threats, and wildlife movement data for the Guadalupe River Basin (Figure 1).

FIGURE 1: LOCATION OF THE GUADALUPE RIVER BASIN IN TEXAS

STUDY APPROACH

Specifically, this project: 1) mapped the wildlife habitat quality and connectivity potential of working farms and ranches, 2) attributed the land quality metrics and other important conservation benefits these lands provide, 3) selected critical mussel habitat as a target for ecosystem prioritization, 4) projected future development threats, and 5) synthesized these data products to identify high-priority watersheds within the Guadalupe basin for farmland protection and habitat restoration. In total, this study utilized nine indicators for prioritizing watersheds (Table 1).

TABLE 1. INDICATORS OF CRITICAL CONSERVATION ATTRIBUTES ON AGRICULTURAL LANDS IN THE GUADALUPE RIVER BASIN.

INDICATOR	DESCRIPTION
PRODUCTIVITY, VERSATILITY AND RESILIENCE	Measures several critical indicators of land quality at a given location and identifies the agricultural lands best suited for long-term cultivation (Freedgood et al., 2020).
CONNECTIVITY	Measures agricultural land's contribution to wildlife movement, specifically the ability of a given location to support the natural movement of organisms and provide linkages between areas of high-quality habitat (Suraci et al. 2023a).
RECOGNIZED BIODIVERSITY VALUE	Captures the variety of fish and wildlife that lands can support and estimates the total number of species likely to occur in each area (Hamilton et al., 2022).
ECOLOGICAL INTACTNESS	Indicates the degree to which a given location remains in a natural state, i.e., minimal or no cultivation or other disturbances that may disrupt communities of organisms (Suraci et al., 2023b).
CLIMATE ACCESSIBILITY	Estimates the degree to which the current climate conditions in a given location will be accessible by the year 2055. Areas of high climate resilience will help organisms adapt to climate change both through local and long-distance movements (Suraci et al., 2023b).
CLIMATE STABILITY	Describes the similarity between the present climate (averaged between 1981 and 2010) and the future climate (2055) at a given location. If a location is climatically stable, its climate won't change that much in the future (Suraci et al., 2023b).
TOTAL CARBON STORAGE	Measures the amount of carbon the land sequesters, which helps to reduce greenhouse gas emissions (Suraci et al., 2023b).
INDEX OF FLOODPLAIN INTEGRITY	Measures the land's contributions to the integrity of floodplains so that these areas better attenuate flooding, store more groundwater, and provide more wildlife habitat and other natural resource benefits (Morrison et al., 2023).
MUSSEL HABITAT SUITABILITY	Identifies acres of suitable mussel habitat for the three endangered mussels in the GRB. (Kiser et al., 2022).

For additional information, see CSP 2024

We identified the agricultural lands in the Guadalupe River Basin using the land cover and land use product developed by CSP and AFT for *Farms Under Threat: The State of the States* (Freedgood et al., 2020). The threat of development to these lands was determined by using a mapping layer of projected urban and highly developed land use and low-density residential land use in 2040 developed for AFT's Business-as-Usual scenario (Hunter et al., 2022; Xie et al., 2023). Urban and

highly developed (UHD) land uses include moderate- to high-density residential development, commercial and industrial sites, and even solar fields and other energy development, as identified in the U.S. Geological Survey National Land Cover Database. Low-density residential (LDR) land uses range from large-lot subdivisions to rural areas with homes on relatively small (based on local ranch sizes) 20- to 40-acre lots, which fragment the landscape (Freedgood et al., 2020).

This study included critical mussel habitat because mussels are one of the most imperiled groups of animals in the U.S. and are often the first species to vanish when environmental conditions change or decline. This response to environmental change makes them an important marker of impaired water quality, which typically respond to land cover and land use changes in a broader basin. In addition, their priority status as endangered species can help facilitate the process of securing funding for farmers and ranchers to restore streamside habitats. The three endangered mussel species in the Guadalupe River Basin are the Guadalupe Orb (*Cyclonaias necki*), Guadalupe Fatmucket (*Lampsilis bergmanni*) and False Spike (*Quincuncina mitchelli*).

After mapping the indicators on all acres of agricultural land in the basin, we determined a 75% threshold value for each indicator. We summed the total acreage above these thresholds (i.e., the top 25% of agricultural area according to each indicator) within each watershed. We then chose, for each indicator, the five watersheds with the most lands above this threshold.

Since the 23 watersheds vary greatly in size, we normalized indicators across each watershed by their total areas to allow for direct comparison of unequally sized watersheds. The final rankings helped to identify areas where riparian buffer restoration work and agricultural easement adoption would catalyze protection in the highest priority watersheds (i.e., we prioritized watersheds for protection and habitat restoration while maintaining agricultural productivity on working farms and ranches by identifying the total agricultural lands that may deliver the highest environmental conservation benefits within each watershed).

Notably, the Meadows Center for Water and the Environment, along with its partners, developed a detailed Strategic Conservation Plan in 2019 to enhance the health and livability of this basin (Siglo Group 2019). The Meadows Plan used stakeholder engagement to prioritize lands for conservation and assigned weights to various conservation resources based on a prioritization model. The study area included all land in the basin and identified the conservation resources related to agricultural lands as larger parcel size (weighted highly) and prime farmland soils (weighted as moderate). Although the AFT geospatial analysis differs considerably from the Meadows Plan, it is complimentary. AFT and its partners focus solely on the contributions of agricultural lands (64% of the basin land area) by isolating the 23 watersheds within the basin (Linke et al., 2019) and prioritizing them for farm and ranchland conservation based on the potential impact for benefitting habitat and local agroecosystems.

PRIORITIZED WATERSHEDS AND DEVELOPMENT THREAT

We identified Watersheds 2, 7, 12, 18, and 21, as shown in Figure 2 below, as the highest priority for agricultural land conservation. These watersheds vary considerably across the 400-mile river basin in terms of the composition of agricultural lands and their value for wildlife habitat and other conservation indicators.

FIGURE 2: WATERSHEDS IN THE GUADALUPE RIVER BASIN. OUR ANALYSIS IDENTIFIED THE WATERSHEDS OUTLINED IN BLUE AS THE TOP WATERSHEDS TO WORK IN.

Across the basin, agricultural lands cover about 66% of the total area (2.5 million acres). Of this agricultural land, 32% (799,810 acres) is in cropped farmlands, and 68% (1.7 million acres) is in pasture and rangeland. The remaining land covered in the basin includes forestland, shrubland, developed lands, barren lands, parks or conserved lands, and wetlands (Siglo Group 2019).

Although developed land use occupies a small percent of the land mass in the basin (3%), it has an outsized impact on the Guadalupe River Basin. Three of the counties in the upper and central part of the basin have the highest growth rates in Texas (Comal, Kendall and Hays counties) (Smith et al. 2019), where changes in these counties have downstream impacts on the river basin.

If development continues at the same pace and in the same patterns, AFT projects that, by 2040, the basin will lose an additional 4% of its intact, large blocks of agricultural lands. If sprawl accelerates, the basin could lose over 5% of its agricultural lands.

AFT's past analysis showed that between 2001 and 2016, the basin lost nearly 2% of its agricultural lands (over 60,000 acres) to development. If development continues at the same pace and in the same patterns, AFT projects that, by 2040, the basin will lose an additional 4% of its intact, large blocks of agricultural lands. If sprawl accelerates, the basin could lose over 5% of its agricultural lands.

While these percentages are relatively low, agricultural lands in the basin are vital for the state. Almost 40% of the agricultural lands in the Guadalupe River Basin qualify as Texas's best agricultural lands for long-term production (Freedgood et al., 2020).

WATERSHED SUMMARIES

BROWN PELICAN ERNESTO GOMEZ/USFWS

Watershed 2 is near the southern tip of the basin and includes Victoria, Texas. Agricultural lands occupy 51% of the watershed, of which 19% is cropland and 81% is pasture and rangeland. The agricultural lands in this watershed rank in the top five watersheds for climate stability (52%). Its 69,190 acres of stream reach provide critical habitat for two endangered mussel species. Seventy-nine percent of the stream acres are potential habitat for *C. necki* and 13% of the stream acres are potential habitat for *Q. michelli*. Nearly 64% of the agricultural lands are above the threshold for high biodiversity. Parts of this watershed face the greatest flood risk in the Guadalupe River Basin and have the greatest mitigation needs (GRFPG 2023). The lower parts of the basin provide important habitat for muskrats, mink, gulls, terns, and pelicans (Siglo Group 2019).

Watershed 7 straddles the Central and Lower Basins and the Blackland Prairie and Post Oak Savannah ecoregions. Agricultural lands make up 24% of the watershed area, 66% of which is cropland, and 34% is pasture and rangeland. This watershed ranks in the top five for percent of developed land by 2040 (5.8% of the watershed area). The soils that support the farms and ranches in this watershed also rank in the top five for the long-term suitability for agricultural production (37% of the cropland area). This watershed provides critical habitat for one endangered mussel species (*C. necki*). Thirty-one percent of the 111,200 acres of stream reach in the watershed are potential habitat for this species. Parts of this watershed face the greatest flood risk in the Guadalupe River Basin and have the greatest mitigation needs (GRFPG 2023). The Central Basin houses many species endemic

to central Texas, including the fountain darter, the Texas blind salamander, and the Comal riffle beetle (Siglo Group 2019).

TEXAS BLIND SALAMANDER
RYAN HAGERTY/USFWS

Watershed 12 surrounds San Marcos in the Central Basin. Agricultural lands cover 32% of the watershed area, where 11% is cropland, and the remainder is pastureland and ranchland. This watershed ranks in the top five for high-biodiversity agricultural lands (98% of the agricultural land) and top carbon sequestration (43% of its agricultural lands). This watershed provides critical habitat for one endangered mussel species (*C. necki*). Thirteen percent of the 27,180 acres of stream reach in the watershed are potential habitat for this species. Parts of this watershed face the greatest flood risk in the Guadalupe River Basin and have the greatest mitigation needs (GRFPG 2023).

GOLDEN-CHEEKED WARBLER
MELISSA CHEATWOOD/USFWS

Watershed 18 surrounds Kerrville in the Upper Basin on the Edwards Plateau. Agricultural lands make up 55% of the watershed area, which is mostly pastureland and rangeland (94% of the agricultural lands), with the remainder in cropland (6% of the agricultural lands). The agricultural lands in this watershed rank in the top five watersheds for percent climate accessibility (100%) and top carbon (45%). This watershed houses critical habitat for two endangered mussel species, *C. necki* and *L. bergmanni.* Thirty-four percent of the 93,900 acres of stream reach in the watershed are potential habitat for *C. necki* and 29% are potential habitat for *L. bergmanni*. The Upper Basin also houses the endangered Golden-cheeked Warbler.

Watershed 21 is in the Upper Basin and the Edwards Plateau ecoregion. Agricultural lands make up 73% of the land in the watershed, with almost all (99% of the agricultural lands) in pasture and rangeland. Agricultural lands in this watershed rank in the top five for biodiversity (91% of the agricultural area), connectivity (82% of the agricultural area), ecological intactness (86% of the agricultural area), and climate resilience (100% of the agricultural area). The watershed provides a critical habitat for two mussel species. Fifty percent of the 4,940 acres of stream reach in the watershed are potential habitat for *C. necki* and 50% of the 4,940 acres of stream reach are potential habitat for *L. bergmanni*.

EMPOWERING A BETTER FUTURE FOR THE GUADALUPE RIVER BASIN

The Guadalupe River Basin faces growing human populations, greater water demands, increased periods of drought, and more intense river flooding. Collectively, these challenges can compromise the quality of life for local communities and decrease overall biodiversity in the ecosystems that are at risk. But farmers and ranchers and the land they steward are a critical part of the solution to these environmental challenges throughout the basin.

This study identified high priority areas within the Guadalupe River Basin where conservation of agricultural lands can preserve high quality soils, contribute to wildlife habitat and movement, increase biodiversity, withstand a changing climate, sequester carbon to help reduce greenhouse gases, reinforce flood plains, and protect streams that house endangered mussels.

GUATALUPE RIVER BASIN MOLLY258/CC2.0/ HTTPS://TINYURL.COM/2NKACY6R

The results of this study can be used as a timely resource for coalition building in Texas, as the federal Inflation Reduction Act has allocated an unprecedented $20 billion to support farm bill conservation programs over the next five years. This influx of federal dollars presents a once-in-a-generation opportunity to facilitate change and help increase the resilience of farmers and ranchers by preparing their lands to better withstand floods, droughts, and fires. At the same time, restoring riparian areas and protecting more working lands will help maintain local food production, improve water quality, address water scarcity, preserve local agriculture, and benefit wildlife. Acting now to preserve farmland and promote habitat in Texas while funds are available is ultimately more cost-effective than restoring natural resources in the future when funds may be limited, lands may be more degraded, and costs may be higher.

REFERENCES

Freedgood, J, M. Hunter, J. Dempsey, and A. Sorensen. 2020. *Farms Under Threat: The State of the States.* Northampton, MA: American Farmland Trust. May 13, 2020. 68 pp.

Conservation Science Partners (CSP). 2024. *Quantifying co-benefits of riparian-adjacent agricultural lands restoration in the Guadalupe Basin. Spatial layer metadata.* Truckee, CA. April 17, 2024.

Dempsey J. 2023. *Analyzing the Lasting Impacts of the Farm and Ranch Lands Protection Program.* Northampton, MA: American Farmland Trust. September 5, 2023. 16 pp.

Guadalupe Regional Flood Planning Group. 2023. *Final 2023 Region 11 Flood Plan.* Volume 1. 278 pp.

Hamilton, H., R. Smythe, B. Young, T. Howard, C. Tracey, S. Breyer, D. Cameron, et al. 2021. *Increasing taxonomic diversity and spatial resolution clarifies opportunities for protecting US imperiled species*. Ecological Applications, Volume 32(3). April 2022. Map of Biodiversity Importance (NatureServe).

Hunter, M., A. Sorensen, T. Nogeire-McRae, S. Beck, S. Shutts, and R. Murphy. 2022. *Farms Under Threat 2040: Choosing an abundant future*. Washington, DC: American Farmland Trust. 80 pp. June 29, 2022.

Kiser, A., K. Cummings, J. Tiemann, C. Smith, N. Johnson, R. Lopez, and C. Randklev. 2022. *Using a multi-model ensemble approach to determine biodiversity hotspots with limited occurrence data in understudied areas: An example using freshwater mussels in México. Ecology and Evolution, 12*(5), e8909.

Linke, S., B. Lehner, C. Ouellet Dallarie, J. Ariwi, G. Grill et al. 2019. *Global hydro-environmental sub-basin and river reach characteristics at high spatial resolution.* Scientific Data Volume 6. Article no. 283 (2019).

Morrison, R., K. Simonson, R. McManamay and D. Carver. 2023. *Degradation of floodplain integrity within the contiguous United States*. Communications Earth & Environment Volume 4, Article no. 215 (2023).

Smith, L., R. Lopez, A. Lund, B. Wegner, J. Cathey, A. Lopez, R. Anderson, G. Powers, K. Skow and M. Crawford. 2019. *Status Update and Trends of Texas Working Lands.* Texas A&M Natural Resources Institute (NRI), College Station, TX, USA

Siglo Group. 2019. *Guadalupe River Basin: Strategic Conservation Plan*. Produced for the Meadows Center for Water and the Environment. Fall 2019. 46 pp.

Suraci, J., C. Littlefield, C. Nicholson, M. Hunter, A. Sorensen and B. Dickson. 2023a. *Mapping connectivity and conservation opportunity on agricultural lands across the conterminous United States.* Biological Conservation Volume 278: 109896

Suraci, J., L. Farwell, C. Littlefield, P. Freeman, L. Zachmann, V. Landau, J. Anderson and B. Dickson. 2023b. *Achieving conservation targets by jointly addressing climate change and biodiversity loss*. Ecosphere Volume 14(4). April 2023.

Xie, Y., M. Hunter, A. Sorensen, T. Nogeire-McRae, R. Murphy, J. Suraci, S. Lischka, and T. Lark. 2023. *U.S. Farmland Under Threat of Urbanization: Future Development Scenarios to 2040.* Land 2023, Volume 12(3), 574. February 27, 2023.

For more information about this effort or partnering with American Farmland Trust, please visit **farmland.org** or contact Sarah Fulton-Smith, Texas Director, AFT, at sfultonsmith@farmland.org


American Farmland Trust
SAVING THE LAND THAT SUSTAINS US


Conservation
Science Partners


TEXAS
AGRICULTURAL
LAND TRUST


TEXAS A&M
NRI
NATURAL RESOURCES INSTITUTE