CONSERVING TEXAS

QUANTIFYING ECOLOGICAL
RETURN ON INVESTMENT

AN ASSESSMENT REPORT
PREPARED BY

TEXAS A&M
NRI
NATURAL RESOURCES INSTITUTE

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REPORT PURPOSE

Proactive measures to protect the ecological and economic gains held in our open spaces are critical to ensuring a prosperous future for our state. Land conservation supports numerous economic benefits for Texas while protecting wildlife habitat, enhancing water resources, preserving working agricultural and forest lands, and providing public access to outdoor recreational areas. The goal of this report is to better understand the current benefits and need for financial investment in our state's natural resources to best support our growing state population, thriving economy, and healthy landscape. We're aiming to:

- Provide an approximate statewide ecological return on investment (eROI) assuming a significant investment in land conservation.

- Describe the demand for land conservation and increased public access.

- Illustrate areas of high conservation priority for each focal area of concern.
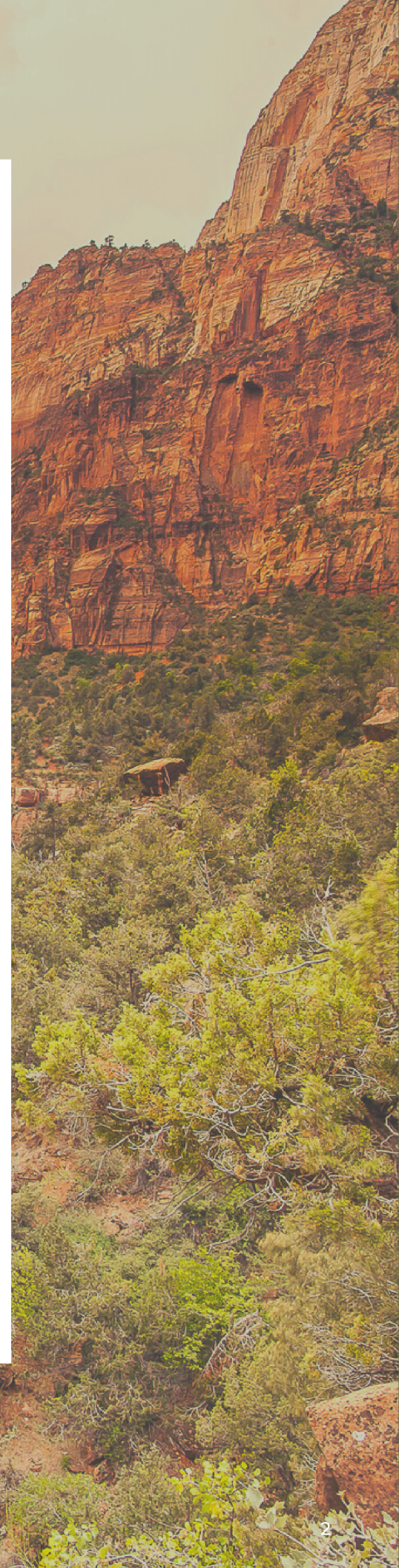
FRAMING THE ISSUE

Open space is a commonly used term for any undeveloped piece of land that includes rural working lands and public green spaces, which play a vital role in the lives of all Texans. These open spaces provide food and fiber, support rural economies, create recreational opportunities, and provide fundamental ecological services like wildlife habitat, clean air, and fresh water. There is a critical need to protect and sustain our natural areas and their collective benefits supporting both urban and rural communities; yet, we face complex challenges with competing interests. One major challenge is rapid population growth, which spurs suburbanization, unchecked rural development, and the need for expanding renewable and traditional energy infrastructure, often leading to degraded or eliminated ecological services in impacted natural areas. In addition, financial investment in open spaces must compete with other equally important initiatives like revitalized rural healthcare and education systems, and increased rural broadband access, all of which provide essential benefits to citizens.

In Texas, where ~95% of our land lies in private ownership, we must rely on collaborative solutions and public-private partnerships to support the

stewardship and conservation of our natural resources for the public good. Furthermore, taking action to secure accessible green space for our state's growing population to experience the outdoors is timely, as the price and demand for rural land surrounding urban centers and transportation corridors has and will continue to rise rapidly (Figure 1). While many organizations have on-going land conservation efforts in place, less than 4% of the Texas landscape is currently protected from development under federal, state, local, or private mechanisms and 3% is accessible for public recreational use. (Figure 2 and 3).

Here, we illustrate the often-overlooked contributions our open spaces provide, emphasizing the need for dedicated funding to support land conservation along with increased public access to open space. We describe these needs through four distinct focal areas:

1. FARM, RANCH, & FOREST LANDS

2. WATER RESOURCES

3. WILDLIFE HABITAT

4. RECREATION & PUBLIC ACCESS

LAND FRAGMENTATION

Key factors such as rapid urbanization, rising land market values, and aging landowners influence land use conversion and fragmentation rates, ultimately impacting the associated public benefits of rural working lands.

AVERAGE RURAL LAND MARKET VALUE BY ACRE

2022
$2,488

2007
$1,196

1997
$500

Major Highway
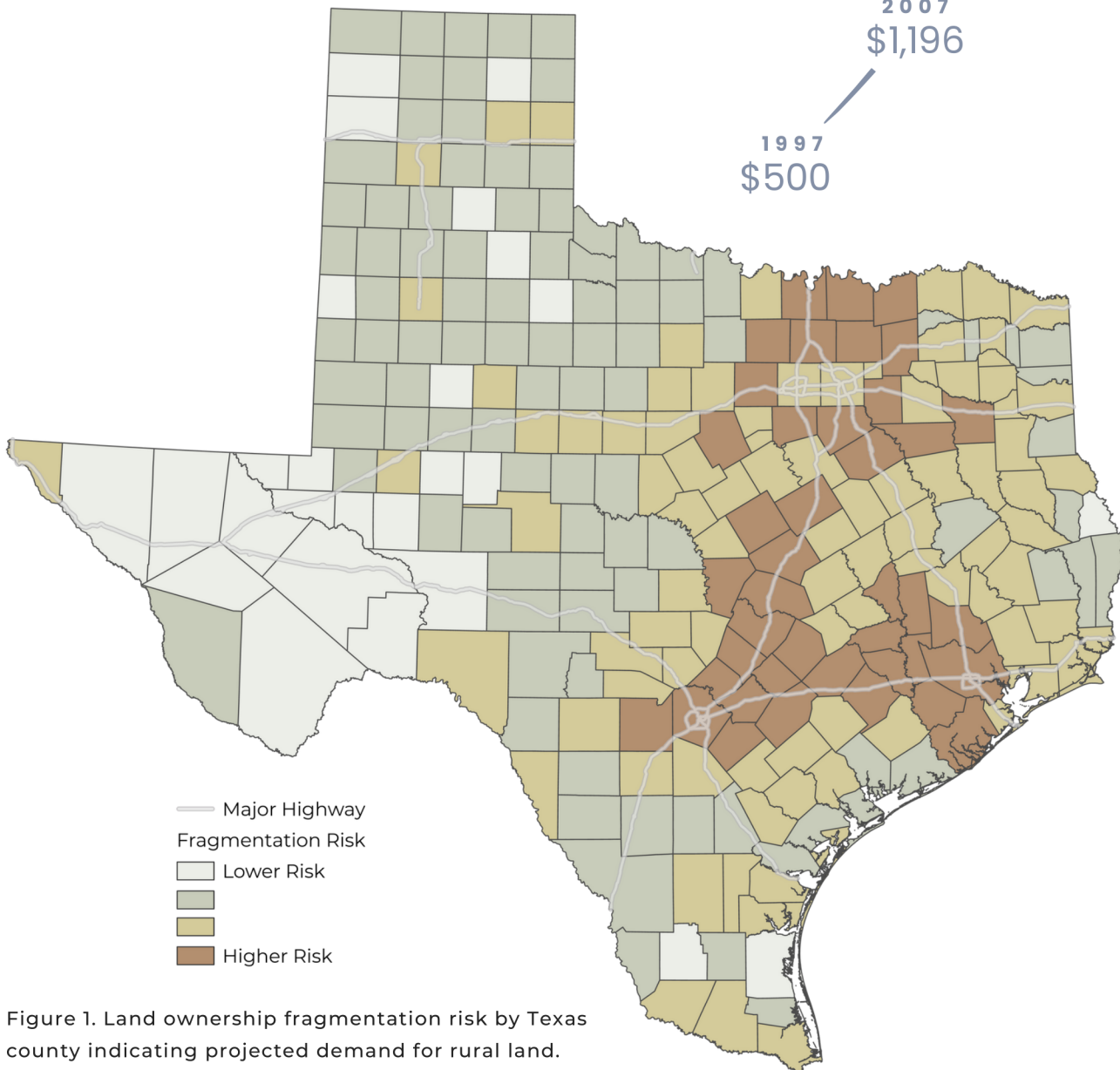
Fragmentation Risk

Lower Risk

Higher Risk

Figure 1. Land ownership fragmentation risk by Texas county indicating projected demand for rural land.

PROTECTED LANDS

Of the protected lands in Texas, only a small portion are conserved in perpetuity via conservation easements or similar mechanisms.

<4%

OF LAND IN TEXAS IS UNDER SOME FORM OF PROTECTION
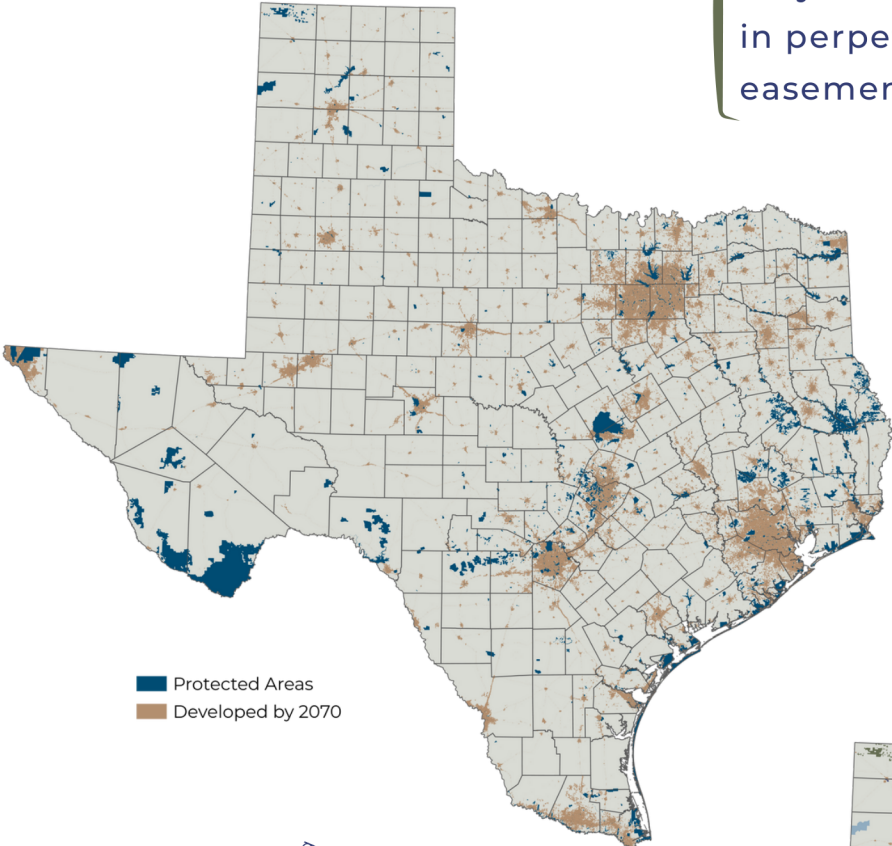
Protected Areas
Developed by 2070

Private working lands

Other private lands

State
Federal
Local

TOTAL LAND IN TEXAS:
172M ACRES

OWNERSHIP BY ENTITY
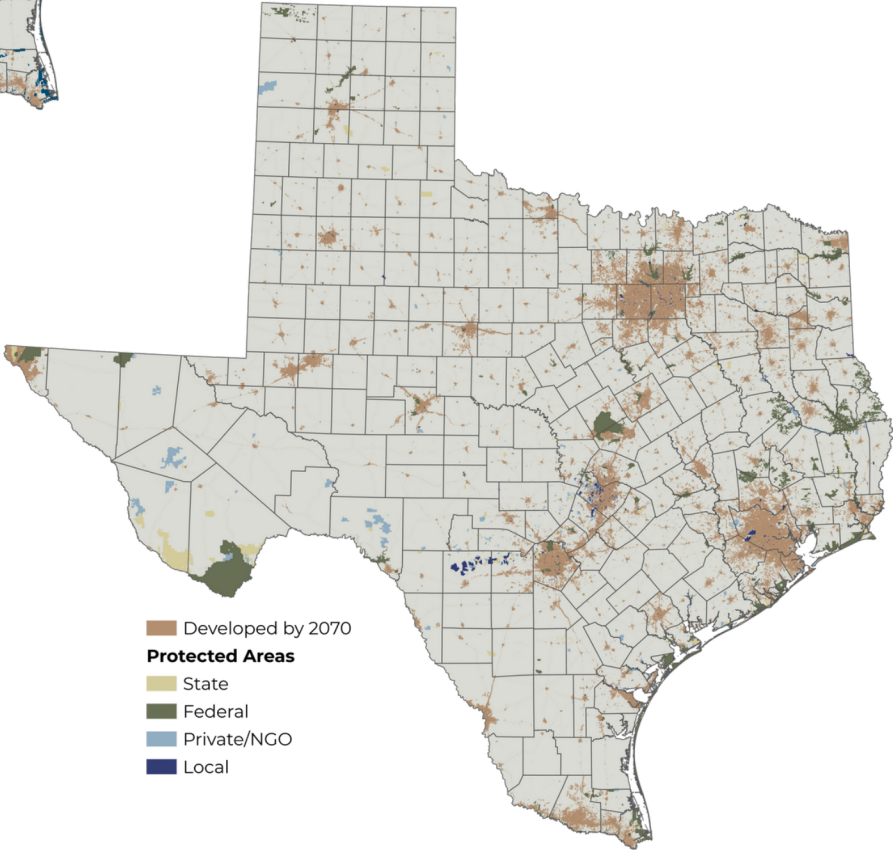
Developed by 2070
Protected Areas
State
Federal
Private/NGO
Local
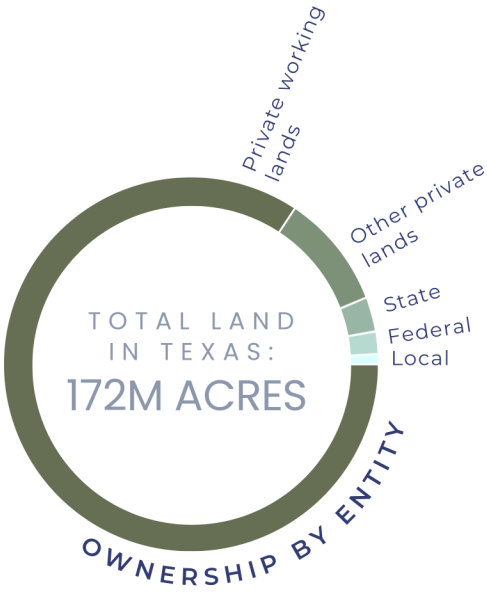
Figures 2 and 3. Current protected lands and projected development (2070).

INVESTING IN CONSERVATION

Long-term, significant state investment in conservation would play a pivotal role in protecting and restoring important lands and waters in Texas, helping to mitigate the effects of growth and development on our natural resources. In addition, this would help provide essential matching funds to leverage federal and philanthropic dollars for agricultural and natural resource conservation.

As an example of what these types of investments can yield, we calculated the potential ecological return on investment (eROI) from a one-time investment of $200M in statewide land conservation efforts.
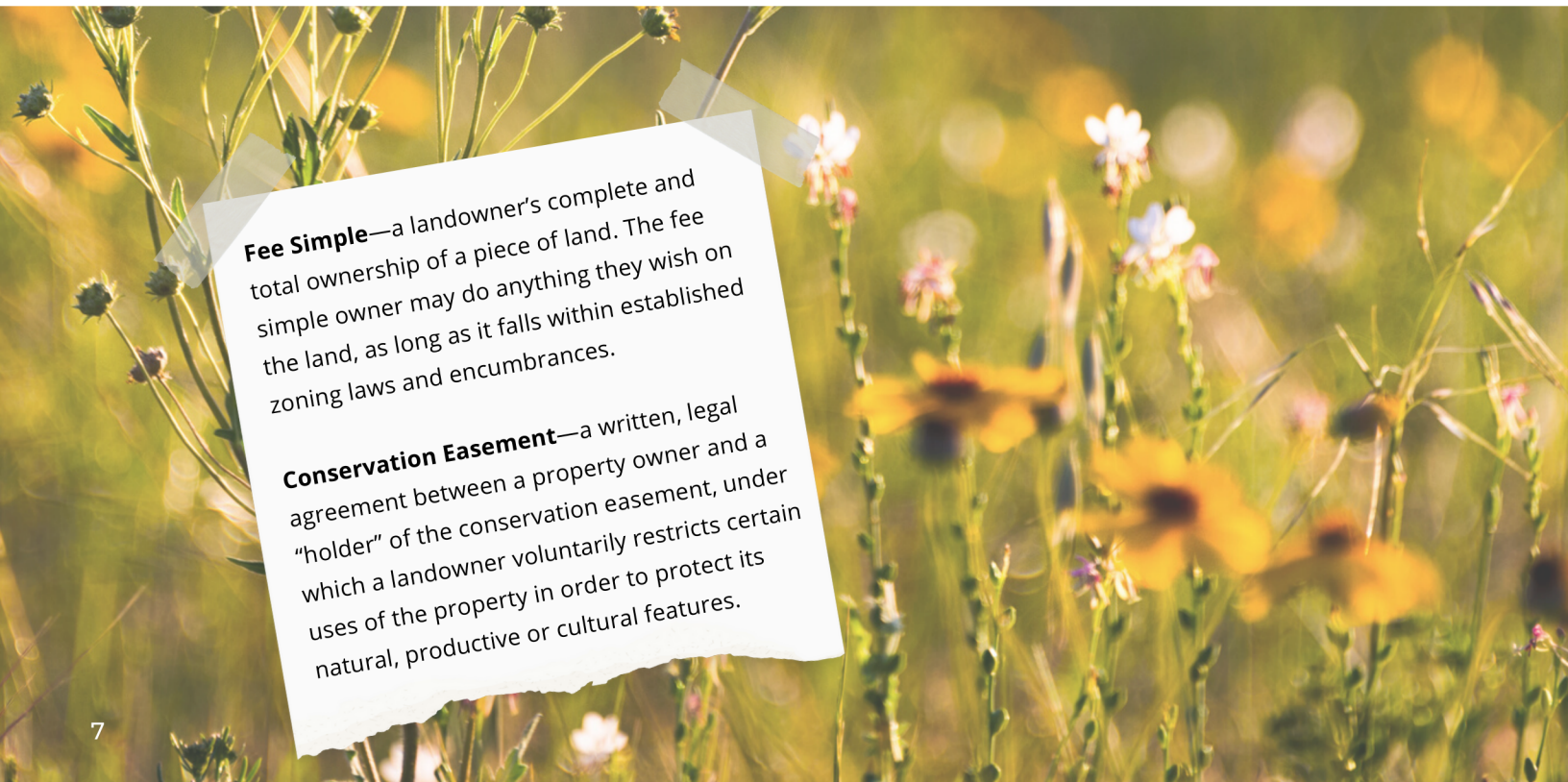
These calculations describe one of many opportunities this funding could provide, and the ecological return on investment from land and easement purchases. Because of the extreme variability in purchase agreements and funding mechanisms, these calculations only illustrate a representative example of what could be realized with significant funding for land conservation, restoration, and public access. Restoration-focused projects could require considerably less funding, while fee simple acquisitions could cost more. In addition, numerous federal and state programs and grants are currently available to leverage partnerships, extending the reach of state investment even further.

Fee Simple—a landowner's complete and total ownership of a piece of land. The fee simple owner may do anything they wish on the land, as long as it falls within established zoning laws and encumbrances.

Conservation Easement—a written, legal agreement between a property owner and a "holder" of the conservation easement, under which a landowner voluntarily restricts certain uses of the property in order to protect its natural, productive or cultural features.

RETURN ON INVESTMENT

INVESTMENT = $200M
- **30% FEE SIMPLE**
- **70% CONSERVATION EASEMENT**

1-YEAR eROI
- **185K ACRES** PROTECTED
- **$116.3 MILLION*** ECOSYSTEM SERVICES

20-YEAR eROI

185K ACRES PROTECTED

$2.3 BILLION* ECOSYSTEM SERVICES

∗ The value of investment in today's market. An average ecosystem service value of $629/acre was used for calculations (Putman et al. 2022).

ECOSYSTEM SERVICES

Ecosystem Services are the set of functions or products benefitting human wellbeing, encompassing many life sustaining products such as carbon sequestration, flood mitigation, air purification, and pollination, among others.

FARM, RANCH & FOREST LANDS

Texas farms, ranches, and forests, otherwise known as rural working lands, are characterized by over 248,000 operations that specialize in agricultural productions spanning crops to livestock to timber. Contributions from the 141 million acres of working lands in the state are significant, with a reported economic impact of $159 billion annually to the food and fiber sector and employment that makes up 14% of the state's workforce. Studies show Texas is losing more high-quality working lands to non-agricultural uses than any other state in the nation. Once lost to development, these lands will no longer produce food, fuel or the same level of environmental benefit as before. Efforts to conserve, restore, and better steward working lands, especially those of high agricultural significance, would help to combat losses already sustained and protect these resources for generations to come (Figure 4).

"Saving the water and soil must start where the first raindrop falls."
-Lyndon B. Johnson, 36th U.S. President

RURAL WORKING LANDS

From 2012 to 2017, there was a net loss of ~1.2M acres of working lands, averaging 657 acres per day. Two-thirds of landowners are at retirement age, indicating an impending land transfer is on the horizon.

Texas Farm and Ranch Lands Conservation Program

To help safeguard the public benefits from working lands, the Texas Legislature created the TFRLCP, with the purpose of funding agricultural conservation easements on private lands. Though private landowner interests in the program are high, only 49% of applications have gone under conservation easement due to program funding shortfalls.

79.2M ACRES
OF PRIORITY CONSERVATION AREAS
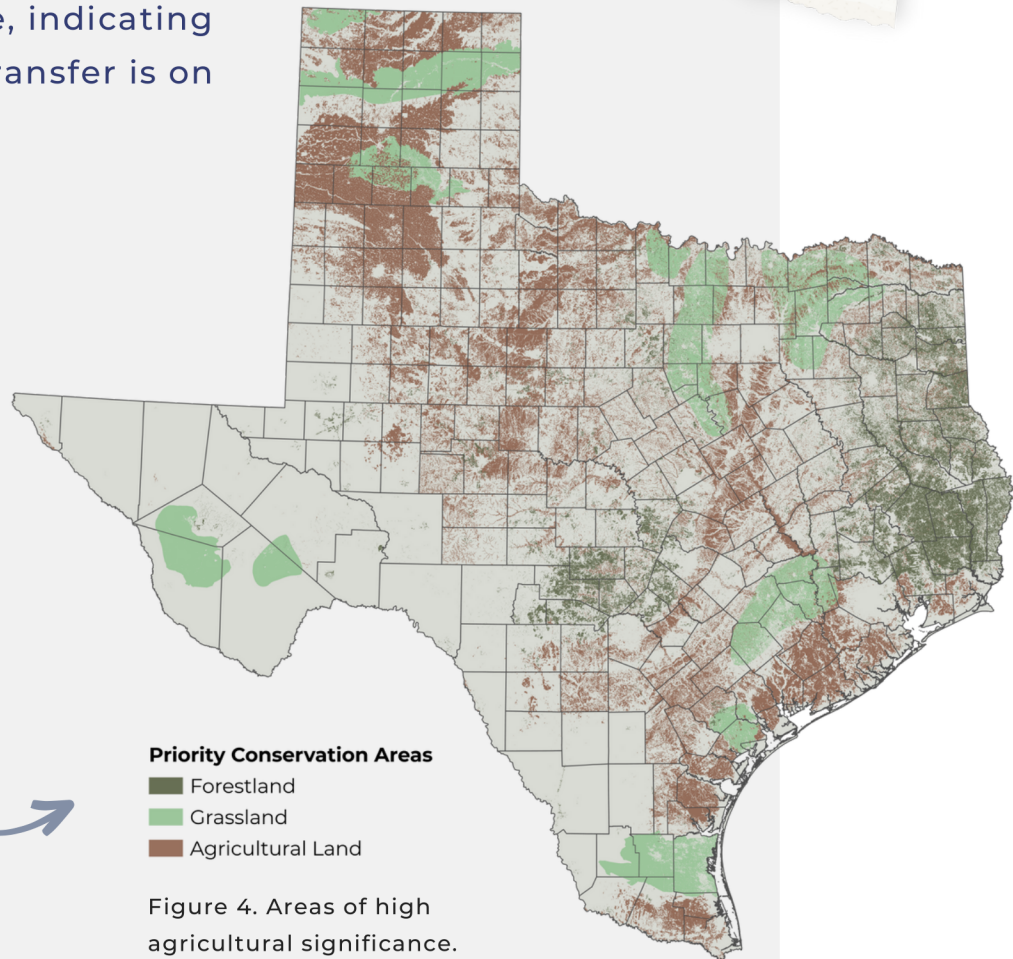
Priority Conservation Areas
- Forestland
- Grassland
- Agricultural Land

Figure 4. Areas of high agricultural significance.

WHY CONSERVE?

- A large portion of Texas' agricultural land is considered "Nationally Significant," meaning that it is among the nation's best land for growing food and crops.

- Almost 50% of the state's freshwater resources originate on forestlands, which cover 1/3 of the state.

- A recent landowner survey showed that ~80% of Texas landowners are open to participating in a permanent land protection program.

WATER RESOURCES

> "Health and function of aquatic and terrestrial ecosystems, which also support numerous human uses, rely on how and if good quality freshwater makes its way from raindrop to aquifer and river to estuary to Gulf of Mexico."
>
> -Texas Conservation Action Plan

Water is a fundamental resource in Texas, and some of the most challenging issues facing our state involve water development, management, and distribution. We are faced with meeting the needs of a growing population, in addition to protecting the wellbeing of our distinct flora and fauna. Between water basins and aquifers, our state currently relies on about 17.7M acre-feet of water these systems produce, and an estimated $17.2 billion in water management strategies to avoid potential water shortages. The countless miles of rivers and streams provide habitat for over 255 species of fish alone, not to mention numerous endemic aquatic species only found in Texas. Maintaining adequate water supplies and enhancing its quality to meet all our needs is complex. By targeting key areas for water protection, we can help mitigate stressors, strengthening the state's water supply (Figure 5).

WATER RESOURCES

Trends indicate our state population will nearly double while water supplies will decline ~18% in the next 50 years, resulting in a 6.9-million-acre-foot water deficit.

Priority Conservation Areas
- Diminished Stream Flow
- Freshwater
- Native Fish
- Watershed
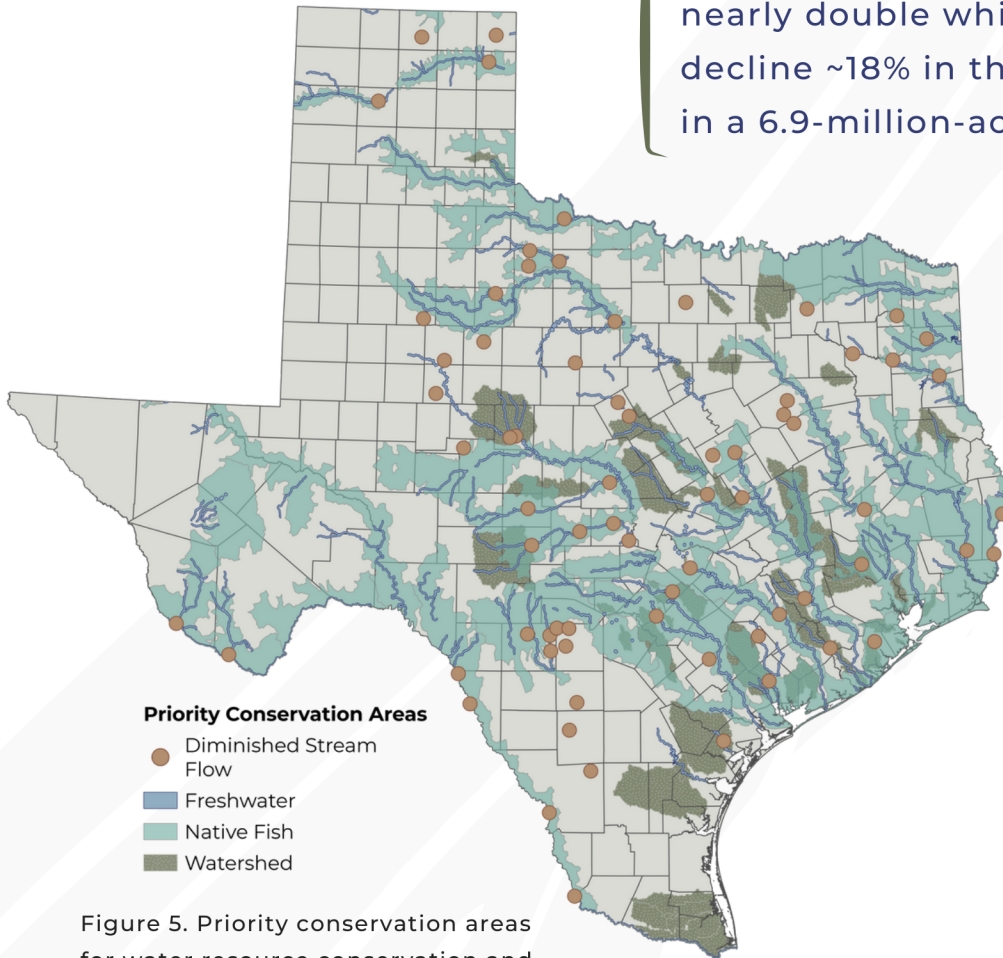
Figure 5. Priority conservation areas for water resource conservation and enhancement.

70% OF RIVER BASINS HAVE HIGHLY DIMINISHED STREAM FLOWS

178 STREAMS CRITICAL TO BIODIVERSITY

49 WATERSHED PROTECTION PLANS

WHY CONSERVE?

- Nearly half of native freshwater fish are considered imperiled, due largely to human alteration causing flow depletions.

- Conserving undeveloped, permeable lands can help mitigate water issues by capturing rainfall, reducing runoff, and increasing groundwater recharge.

- 70% of bays and estuaries in Texas are impacted by water withdrawals that threaten ecosystems and coastal communities and economies.

WILDLIFE HABITAT

Texas is ranked as one of the most biologically diverse states, featuring ten ecoregions defined by their distinct natural communities and species. The unique aquatic and terrestrial environments found throughout the state support a rich variety of plants and animals, many of which are found no place else. Outdoor recreation such as fishing, hunting, birding, and nature tourism plays a large role in the state's economy and well-being, with an estimated $6.2B in associated expenditures generated from these activities on an annual basis. By conserving wildlife habitat, we can better safeguard biological diversity, provide ample opportunities for recreation while also boosting essential ecosystem services and our state's economy (Figure 6).

"Conservation will ultimately boil down to rewarding the private landowner who conserves the public interest."
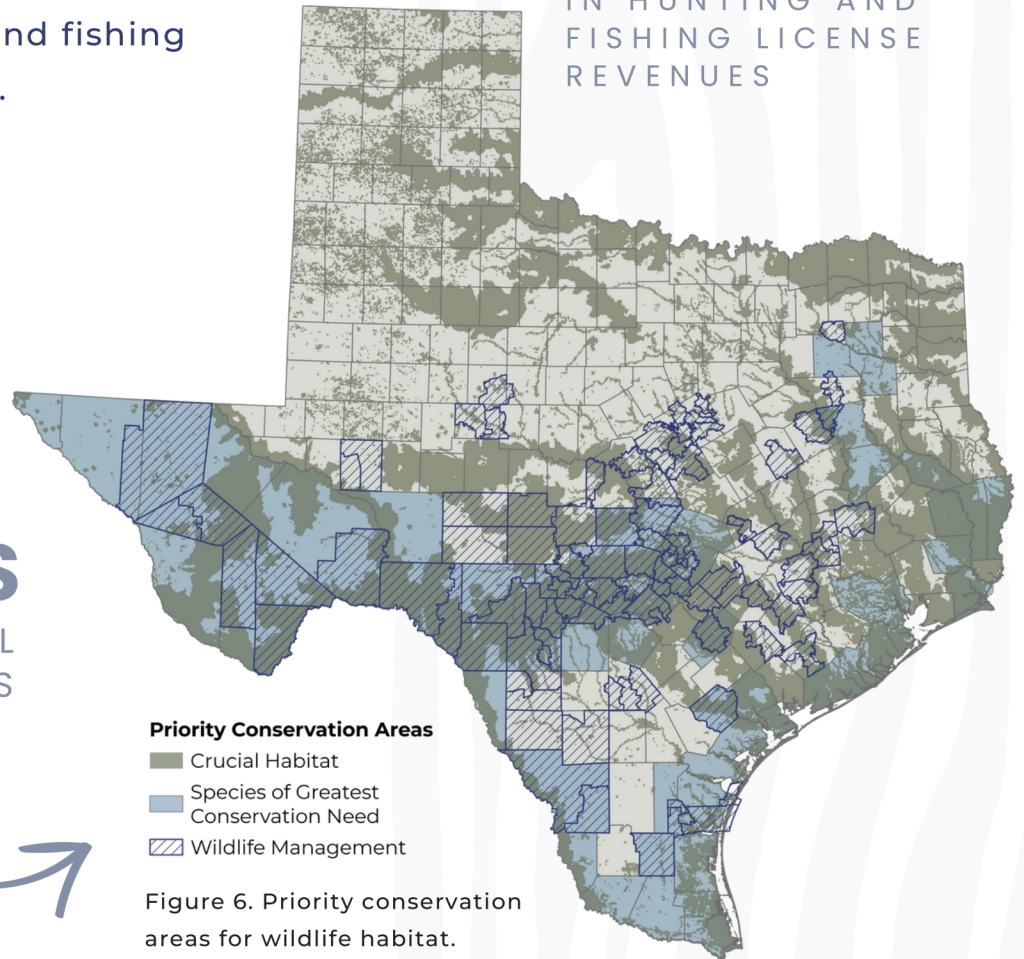
-Aldo Leopold, renowned naturalist

WILDLIFE HABITAT

Only ~1M acres of public hunting lands are available in Texas, yet interest in hunting and fishing has grown in recent years with over 3.4M state hunting and fishing licenses sold in 2022.

$113M

IN HUNTING AND FISHING LICENSE REVENUES

13.5M ACRES

THAT MEET ALL PRIORITY NEEDS

Priority Conservation Areas

■ Crucial Habitat
■ Species of Greatest Conservation Need
▨ Wildlife Management

Figure 6. Priority conservation areas for wildlife habitat.

WHY CONSERVE?

- Texas supports over 1,300 species of greatest conservation need, whose existence relies on the availability and suitable condition of critical habitat.

- Landscape-level conservation is needed to protect habitat ranges for species, and to maintain habitat connectivity lost from land fragmentation.

- 94% of hunting activities in Texas occur on private lands, highlighting the pivotal role private lands play in providing consumptive recreational opportunities and stewarding wildlife habitat.

RECREATION & PUBLIC ACCESS

"In every walk with nature one receives far more than he seeks."

-John Muir, American conservationist

Public access to trails, greenways, and open space is vital to our physical and mental health. Parks and outdoor recreation serve as key factors in advancing health equity, improving individual and community-level health outcomes, and enhancing quality of life. Financially speaking, the outdoor recreation industry contributes greatly to the Texas economy, generating $37.5B annually, accounting for over 314K jobs and $15.5B in wages and salaries. Studies suggest there is a need to proactively plan for additional local and state parks and recreational opportunities relative to population growth and distribution. Land acquisition efforts to develop parks and recreation areas closer to population centers can help provide much needed public access to the outdoors (Figure 7).

PUBLIC ACCESS

It is recommended that Texas maintain a ratio of 55 acres of parks per 1,000 people. Meeting this goal would require an additional 249K acres of land to meet projected populations.
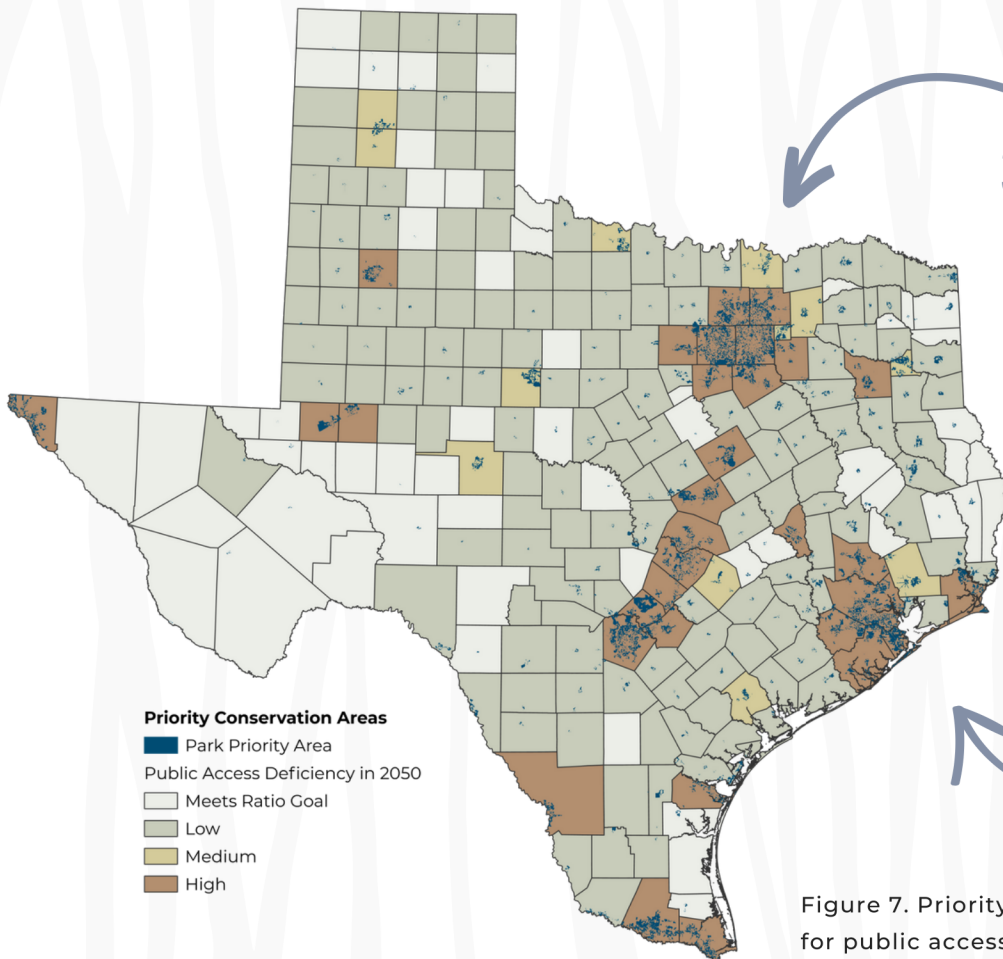
3.4M ACRES
OF PARK PRIORITY AREAS

78% OF COUNTIES
PROJECTED TO BE PARK DEFICIENT

Priority Conservation Areas
- Park Priority Area

Public Access Deficiency in 2050
- Meets Ratio Goal
- Low
- Medium
- High

Figure 7. Priority conservation areas for public access and recreation.

WHY CONSERVE?

- The Texas Local Park Grant Program assists local governments with the acquisition and/or development of public recreation areas but have only been able to fund 52% of application requests due to $55M in funding shortfalls.

- A century ago, most Texans lived in rural areas and were closer to nature. Today, the urbanized areas of the "Texas Triangle" house ~66% of the total population and ~80% of the state's population growth since 2000.

SUMMARY

Texas is facing unprecedented challenges in protecting its natural resources, with a projected state population increase of nearly 73% in the next 50 years, from 29.7M to 51.5M residents, and the highest rural land conversion rate in the nation. Yet, Texas is one of the few states without a dedicated funding source for land conservation.

Historically, private landowners and their stewardship have safeguarded the many ecological benefits we all enjoy; however, an aging landowner population coupled with lucrative land development opportunities results in an uncertain future for our state's rural land infrastructure, signaling a call to action for proactive, permanent land conservation.

> For every $1 invested in land conservation, we can expect a 20-year return in economic value of nearly $12 in natural goods and services.

Goods and services from conserved lands will continue to be provided in perpetuity, increasing the total return on investment well beyond the calculations presented in this report. Additionally, Texas' investment in conservation leverages funding from non-state entities, maximizing the purchasing power and increasing subsequent ecological benefits obtained from the added acreages conserved.

APPENDICES

REFERENCES

DATA SOURCES & METHODS

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DATA SOURCES & METHODS

FIGURE 1

Fragmentation Index

Fragmentation risk was identified through a representative index using market value percent change (1997-2017), operator age greater than 65 (2017), average operation size (2017), and future population growth (2020 to 2070). This layer is part of the Texas Land Trends dataset created by the Texas A&M Natural Resources Institute (NRI).
NRI:https://txlandtrends.org/

Major Highways

Major highways were created through condensing Texas Department of Transportation (TxDOT) roadways data layer to only include easily recognizable highways for spatial context to the map.
TXDOT:https://gis-txdot.opendata.arcgis.com/datasets/TXDOT::txdot-roadways/explore?location=31.008846%2C-100.055172%2C7.13

FIGURES 2 & 3

Protected Lands

Protected lands includes a combination of the 2021 Texas Land Trust Council Conservation Lands Inventory (CLI) database and protected areas from the United States Geological Survey (USGS) Protected Areas Database of the United States (PAD-US) 2022. The 2 maps display all protected lands—shown collectively in one color on figure 2 and broken down by manager/owner type in figure 3. This data layer was modified to not include Permanent University Fund lands (approximately 1.4M acres) managed by the Texas General Land Office, School Land Board and lands managed by the Department of Defense (approximately 477K acres).
CLI:https://texaslandtrustcouncil.org/what-we-do/conservation-lands-inventory/
PAD-US:https://www.usgs.gov/programs/gap-analysis-project/science/pad-us-data-overview

FIGURES 2 & 3 CONTINUED

Projected Development

Projected development in 2070 was derived from the Environmental Protection Agency's (EPA) Integrated Climate and Land Use Scenarios (ICLUS v2.1 SSP2). The model used is a middle of the road projection, where social, economic, and technological trends do not shift markedly from historical patterns, resulting in a U.S. population of 455 million people by 2100. Domestic migration trends remain largely consistent with the recent past, however the amenity value of local climate (average precipitation and temperature for summer and winter) is used in this model to influence migration patterns.

EPA:https://www.epa.gov/gcx/iclus-fourth-national-climate-assessment

FIGURE 4

Forestland Priority Conservation Areas

Priority forestlands conservation areas were derived from the Texas A&M Forest Service (TFS), Forest Stewardship Program's Forest Action Plan Report (2020). Forest resource priority areas were identified through a weighted raster overlay suitability analysis including 9 resource richness layers and 3 resource threat layers.

TFS:https://tfsweb.tamu.edu/uploadedFiles/TFSMain/Wildfires_and_Disasters(4)/TexasForestActionPlan.pdf

Grassland Priority Conservation Areas

Priority grasslands conservation areas were created through the combination of the United States Geologic Survey (USGS), National Land Cover Database (NLCD; 2019) land use classes pasture/hay, shrub/scrub, and grassland/herbaceous. The combined "grasslands" data layer was then clipped to only include areas of overlap with functional grassland areas as defined by expert input of The Nature Conservancy (TNC) in Texas.

NLCD:https://www.mrlc.gov/data?

FIGURE 4 CONTINUED

Agricultural Land Priority Conservation Areas

Priority agricultural lands were derived from the American Farmland Trust (AFT), Farms Under Threat program, which identified nationally significant agricultural lands best suited for long-term production of food and other crops. AFT:https://csp-fut.appspot.com/

FIGURE 5

Diminished Stream Flow Priority Conservation Areas

Gage station locations that have moderate or highly diminished stream flow measurements were derived from the Texas Parks and Wildlife Department (TPWD), Texas Environmental Flow Information Toolkit (EFIT). TPWD:https://tpwd.maps.arcgis.com/apps/dashboards/6d8e8676ee26436bad542005e7efbeb1

Freshwater Priority Conservation Areas

The freshwater biodiversity conservation blueprint from The Nature Conservancy (TNC), Texas Water Explorer was used to create freshwater priority conservation areas. This blueprint represents the rivers, streams, and lakes of Texas that constitute the best areas of protection of the state's rich freshwater biodiversity. Each conservation area on the figure reflects: 1) areas where freshwater species of conservation concern persist, and/or 2) examples of all river and stream ecosystem types that remain in the highest condition. Over 200 species are included in this analysis, including fishes, aquatic invertebrates (insects, crustaceans, mussels and snails), aquatic reptiles and amphibians and aquatic plants.
TNC:https://texaswaterexplorer.tnc.org/map.html

Native Fish Priority Conservation Areas

Priority native fish conservation areas were created through identifying where Texas Commission on Environmental Quality (TCEQ) streamline segments of freshwater perennial and tidal streams intersected with Native Fish Conservation Areas derived from the report Texas Native Fish Conservation Areas Network (TNFCAN): Strategic Investments in Restoration and Preservation of Freshwater Fish Diversity.
TCEQ:https://gis-tceq.opendata.arcgis.com/datasets/TCEQ::segments-line/explore?location=31.126448%2C-99.835600%2C7.00
TNFCAN:https://nativefishconservation.org/network/texas/

FIGURE 5 CONTINUED

Watershed Priority Conservation Areas

Priority watershed conservation areas represent areas that have a completed or proposed Texas Commission on Environmental Quality (TCEQ), Watershed Protection Plan (WPP) in place.

TCEQ:https://www.tceq.texas.gov/waterquality/nonpoint-source/mgmt-plan/watershed-pp.html

FIGURE 6

Crucial Habitat Priority Conservation Areas

Priority crucial habitat conservation areas were derived from an aggregated measure of crucial habitat for species and habitats of interest from the Western Association of Fish and Wildlife Agencies (WAFWA), Crucial Habitat Assessment Tool. Crucial habitat describes places that are expected to contain the resources necessary for continued health of fish and wildlife populations or important ecological systems expected to provide high value for a diversity of fish and wildlife. States compiled data and then ranked areas as "crucial habitat" using a relative, six-level prioritization scheme, where 1 represents areas "most crucial," or those areas that most closely meet the definition of crucial habitat and 6 represents "least crucial" areas, or those areas that least closely meet the definition of crucial habitat based on mutually agreed upon definitions. This data layer was modified to display only crucial habitat of ranks 1 and 2.
WAFWA:https://www.wafwachat.org/

Species of Greatest Conservation Need Priority Conservation Areas

Priority conservation areas for Species of Greatest Conservation Need (SGCN) were derived from Texas Parks and Wildlife Department (TPWD), SGCN dataset. Species are ranked using a conservation status system established by NatureServe. NatureServe ranks are based on multiple criteria including range extent, known occurrences, abundance, and threats. This data layer was modified to only includes counties with over 40 SGCN present.
TPWD:https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/nongame/tcap/sgcn.phtml

FIGURE 6 CONTINUED

Wildlife Management Priority Conservation Areas

Priority conservation areas for wildlife management were derived from the Texas Comptroller of Public Account's (CPA) tax valuation dataset for lands appraised as 1-D-1 wildlife management tax valuation (2017), included in the Texas Land Trends dataset created by the Texas A&M Natural Resources Institute (NRI). 1-D-1 appraisal is an open space status (Taxation of Certain Open Space Land) for lands based solely on the primary use of the land with no consideration for the landowner's income or occupation. This data layer was modified to only include school districts with over 10,000 acres of 1-D-1 lands in 2017.

CPA:https://comptroller.texas.gov/

NRI:https://data.txlandtrends.org/

FIGURE 7

Park Priority Conservation Areas

Park priority areas were derived from the Trust for Public Land (TPL), ParkServe database. All populated areas in a city that fall outside of a 10-minute walk of a park were assigned a level of priority, based on a comprehensive index of 6 equally weighted demographic and environmental metrics. These areas are census block groups from which TPL removed unpopulated areas and erased the 10-minute walk service areas. Several metrics were calculated for each block group, normalized relative to each city, and averaged to create the park priority.

TPL:https://www.tpl.org/parkserve/about

Public Access Deficiency Priority Conservation Areas

Areas of conservation priority based on projected park deficiency for year 2050 were based on a park suggested ratio goal by Texas Parks and Wildlife for 21st Century report of 25-55 acres of parks to 1,000 people. The public access deficiency for 2050 was calculated using protected areas with public access from the Protected Areas Database of the United States (PAD-US; 2022), playgrounds and parks from the Trust for Public Land (TPL), ParkServe database (2021), and county level projected populations for 2050 from the Texas Demographic Center (TDC; 2022).

Continued on next page.

FIGURE 7 CONTINUED

Public Access Deficiency Priority Conservation Areas

Public access lands were merged with playgrounds and parks to calculate total acres of public access for each Texas county. From this, the ratio of current park acres per 1,000 people with projected population estimates for 2050 was calculated. Then, the acres needed by county to reach the recommended park ratio goal of 25 to 55 acres of parks per 1,000 people was calculated.

PAD-US:https://www.usgs.gov/programs/gap-analysis-project/science/pad-us-data-overview

TPL:https://www.tpl.org/parkserve/about

TDC:https://demographics.texas.gov/data/tpepp/projections/

STATEWIDE INVESTMENT VALUE

A statewide ecological return on investment was calculated for three scenarios using the following assumptions.

- Investment: $200 million one-time investment
- Average rural land market value: $2,488/acre derived from D-1 and 1-D-1 classified land use acres and market value by school district in 2021 from the Texas Comptroller of Public Accounts tax valuation data.
- Average ecosystem service value: $629/acre derived from the Texas A&M Natural Resources Institute report Texas Ecosystem Services: A Statewide Assessment. https://nri.tamu.edu/publications/research-reports/2022/texas-ecosystem-services-a-statewide-assessment/
- Average conservation easement cost: $871/acre calculated as 35% of statewide average rural land market value ($2,488/acre). Percentage applied is derived from recent conservation easement transactions as reported from the Texas Land Trust Council.

$$\frac{\$/ACRE}{INVESTMENT} = \text{TOTAL ACRES PROTECTED}$$

$$\begin{matrix} \$/ACRE \\ ECOSYSTEM \\ SERVICE \\ VALUE \end{matrix} \times \begin{matrix} TOTAL\ ACRES \\ PROTECTED \end{matrix} = \begin{matrix} TOTAL \\ ECOSYSTEM \\ SERVICES\ VALUE \\ (\$/ANNUALLY) \end{matrix}$$

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