A Report For

The Future of Rural Texas: A Texas Tribune Symposium

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Texas Rural Funders Collaborative

7

Challenges to Rural Texas Natural Resources

Provided by
Texas A&M Natural
Resources Institute

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Executive Summary

Although rural working lands contribute significantly to Texas, rural communities are impacted by external pressures, including rapid population growth, urban sprawl, and increased demands on land and water resources compounded by cuts in federal aid programs and services ultimately contributing to increased strain on critical natural resources.

By utilizing both expert input and geospatial analyses to identify and assess 17 major categories of needs and challenges impacting rural communities, we can visually predict potential scenarios across Texas and will be able to determine areas that could be affected the greatest by quantifying opportunity costs. In analyzing these trends surrounding rural counties, this report introduces the first working definition of rural versus urban—a potentially far-reaching catalyst for other problem-driven solutions.

From a natural resource perspective, some of the identified challenges included loss of agricultural and open space lands, multiple aspects of water and watershed management, mitigating for energy-related impacts while promoting continued and sustainable energy development, and proper and efficient waste management. Recommendations leveraging opportunities and enhancing the sustainability of rural communities dependent on the above factors include solutions for state and local decision-makers and help inform policies and programs geared towards conserving vital landscapes.

Assessing data and grouping critically marked challenges enabled us to recognize the emergence of three major themes—working lands, water and energy—and to develop the beginnings of smart, viable strategies to address current and projected challenges looking at the largest intergenerational transfer of working lands, reliable water supplies and management and offsetting the burden of energy development.

Introduction

Rural lands in Texas make up the majority of its mass, playing a vital role in both the state's economy, along with providing various ecological benefits, also referred to as ecosystem services. Public benefits derived from these predominantly privately-owned rural lands (i.e., farms, ranches, forests; hereafter, *working lands*) not only include clean air and water, fish and wildlife habitat, and recreation opportunities, but also support the state's agricultural economy which accounted for approximately $23B of the state's GDP in 2017 (Texas Land Trends 2014; USDA 2018). Although rural working lands contribute significantly to the state, they and their communities are impacted by external pressures, including rapid population growth, urban sprawl, and increased demands on land and water resources. Some examples of these external pressures include the nearly doubling of the state's population by 2050 (Lund et al. 2017), budget reductions of rural community federal program budgets, and water quality challenges due to drought and increased consumer demands (EPA 2016).

In July 2017, a group of funders convened to consider how they might bring additional attention and resources to areas of rural Texas. The Texas Rural Funders Collaborative (TRFC) is made up of private, community and health-conversion foundations and collectively believe that the future of Texas depends upon the success of all its communities, to include rural areas. In the short term, the TRFC hopes to build awareness and bring resources to the challenges facing rural people and places through education of rural community needs and the identification of place-based assets to allow an approach that adds value. To that end, the TRFC is compiling efforts into a research report on rural Texas with five sections:

- Introduction to rural Texas prepared by Texas 2036.
- Listening tour results on broadband access by Connected Nation.
- Statewide survey results conducted by Strategic Research Associates.
- Status assessment of natural resources by the Texas A&M Natural Resources Institute.
- Landscape analysis developed by the Boston Consulting Group.

Results and discussions from these studies will provide relevant, long-term, ready-to-use strategies and actionable information for public and private organizations. The research report described above will be presented at the Texas Tribune Symposium—"The Future of Rural"—to be held at Texas A&M University in College Station on November 12-13, 2018. The section providing an overview and status of natural resources issues and challenges, as prepared by the Texas A&M Natural Resources Institute, will be presented at the symposium.

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Goals and Objectives

The Texas A&M Natural Resources Institute collaborated with the TRFC to accomplish the following goals and objectives:

- *Rural Advisory Group Workshop*—Host a workshop with rural community leaders (hereafter Rural Advisory Group) to better understand respective rural community needs and specific challenges they are facing.
- *County Leader Survey*—Develop and execute an online survey targeting rural county community leaders, namely County Judges, County Commissioners, and members of Regional Council of Governments, to better inform future program.
- *Geospatial Trends*—Compile geospatial information to better understand drivers influencing changing rural landscapes across rural communities, based on identified needs and challenges from the workshop and survey.

Methodology

A two-pronged approach was implemented to determine rural needs and challenges. First, a brief survey encompassing rural water, land management, natural resources, and general needs and challenges, along with the benefits and values of living in rural communities was developed and shared with county leaders from May to August 2018. In addition, participation in two Rural Advisory Group meetings/workshops served to gather information for the study. The Rural Advisory Group workshops were used to define high-priority issues facing rural communities ranging from federal budget cuts and increasing land and water resource demands to land-use changes and energy development pressures, among others. Second, based on county leaders' expressed needs and challenges, geospatial analyses were conducted to illustrate regional and general trends for rural counties across the state. Relevant geospatial datasets exploring issues identified in surveys were gathered that included variables not limited to: land-use, land and water resources, human population trends, health and social services, transportation, and energy development/delivery. From these datasets, we created a geospatial database summarizing data by ecological region, distance to population centers, county population size and other key parameters derived from surveys. Finally, summary maps and state-wide trends were developed and provided in the report.

The benefits of a combined approach, utilizing both expert input and geospatial analyses to assess the needs and challenges impacting rural communities, is the ability to not only visually predict potential scenarios across the state given external pressures will increase, but to also potentially determine areas which may be affected the greatest. Collectively, we developed rural working lands draft recommendations for state and local decision-makers to help inform policies and programs geared towards conserving these vital rural landscapes.

Survey Development and Analysis

A brief survey was developed to determine rural county needs and challenges. Because this was an exploratory study, open-ended questions encompassing rural water, land management, natural resources, and general needs and challenges, along with the benefits and values of living in rural communities, were asked of county leaders in both a written and online survey (*n*=131). Each survey respondent listed their county's top needs and challenges. Based on their similarity, responses were divided into the following 17 major categories: Care, Education, Employment, Funding, General, Government, Growth, Industry (agricultural), Industry (non-agricultural), Infrastructure, Land, Natural Resources, Tourism, Transportation, Water, Weather/Natural Disaster, and Wildlife. Each major category was further divided into sub-categories, and these were divided into sub-sub-categories, as necessary, also based on the way responses were similar or dissimilar. If responses were too dissimilar within a major category, these were placed under the sub-category "Other." The process was repeated until all responses (*n*=1,574) were categorized into major and all sub-category types. To quantify qualitative responses, each response was marked with both a tally and by county. Some responses mentioned more than one category and/or sub-category, and these were categorized and tallied accordingly. The county name would then assist with geospatially locating an expressed item. To respect and protect the confidentiality of survey respondents, data and maps are presented in aggregate form.

A summary of major categories, their corresponding sub-categories and tallies are provided in Table 1. A representation of total responses in map form encompasses these regions (Figure 1). For purposes of the summary pie charts, categories comprised only of the mentioned name of the major category or the sub-category, were omitted because these did not offer detail as to the nature of the need or challenge (i.e., one-word responses listing "water," a major category, or "roads," a sub-category within infrastructure). Also omitted from the summary pie charts were the sub-categories "other," since these did not form a cohesive sub-category, but rather were comprised of responses that fell within the same major category but were not like responses in the other sub-categories. Please note that although some sub-categories were omitted from the figures and tables for the sake of cohesiveness (i.e., "other" sub-categories, one-word responses representing categories or sub-categories, and those that did not fall within the top 10), each item expressed by county leaders still represents a significant county need, as the survey asked county leaders to express their county's top three needs and challenges.

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Table 1. Tally by major topic category with sub-category descriptions from county leader survey, 2018.

Major Category/Sub-categories	Tally (*n*)
Water	492
Water resources; infrastructure; quality management; groundwater; surface water; water treatment/systems; wastewater disposal; supply/availability; reservoirs; conservation; rights; drainage; recreation; marine resources; water sales; and other	
Natural Resources	220
Soil conservation; rangelands; grasses; trees; brush; forests; air; wind energy; natural resource management; preservation; pollution; quarries; mining; coal; renewable energy; oil; gas; disposal wells; damages funding; parks and recreation; solar energy; fracking technology; energy infrastructure; invasive species; and other	
Funding	128
State funding; taxes; unfunded mandates; revenue; general budget; need money for…; economic development; funding categories; and other	
Industry (Agricultural)	97
Dairy farms; cattle; poultry; wine industry; horticulture; preserving; diversifications; tourism; aging landowners; economic sustainability; production; improve industry; farm management; farm income; crops; sustainable alternatives; ranching practices; livestock; pasture land; grazing management; and other	
Infrastructure	97
Roads; bridges; capital infrastructure; utilities; septic systems; and other	
Land	93
Agricultural land; preserve land; land rights; oil drilling; authority; storm water impacts; land use; overgrazing; trash dumping; erosion; land leases, and other	
Growth	79
Strategic plan; urban, rural; population growth; staff; encroachment; development; county ordinance authority; subdivisions; zoning; land development regulations; and other	
Wildlife	73
Invasive species; wildlife protection; wildlife management; hunting; wildlife and livestock; birds; predators; wildlife conservation; and disease	
Education	71
Agriculture-related; wildlife; natural resource; small landowner; new landowner; willingness to learn; safety; training/retraining; vocational;	

Government	37
Mandates; unfunded mandates; law enforcement; jail; crime; public records; regulations; authority; staff needs; collaboration; taxing; volunteer firefighters; and other.	
Weather/Natural Disaster	35
Wildfire; wildfire prevention; flooding; disaster declaration	
Care	28
Mental health care; indigent care; general health care	
General	27
Number of people; community relations; retail services; public awareness; nutrition; and other	
Tourism	26
Increase; ecotourism; birding; and other	
Transportation	21
Public transportation; high speed rail; railroad; and traffic	
Industry (Non-Agricultural)	12
More industry; ordinances for wrecking yards; and low water, low environmental impact enterprises	

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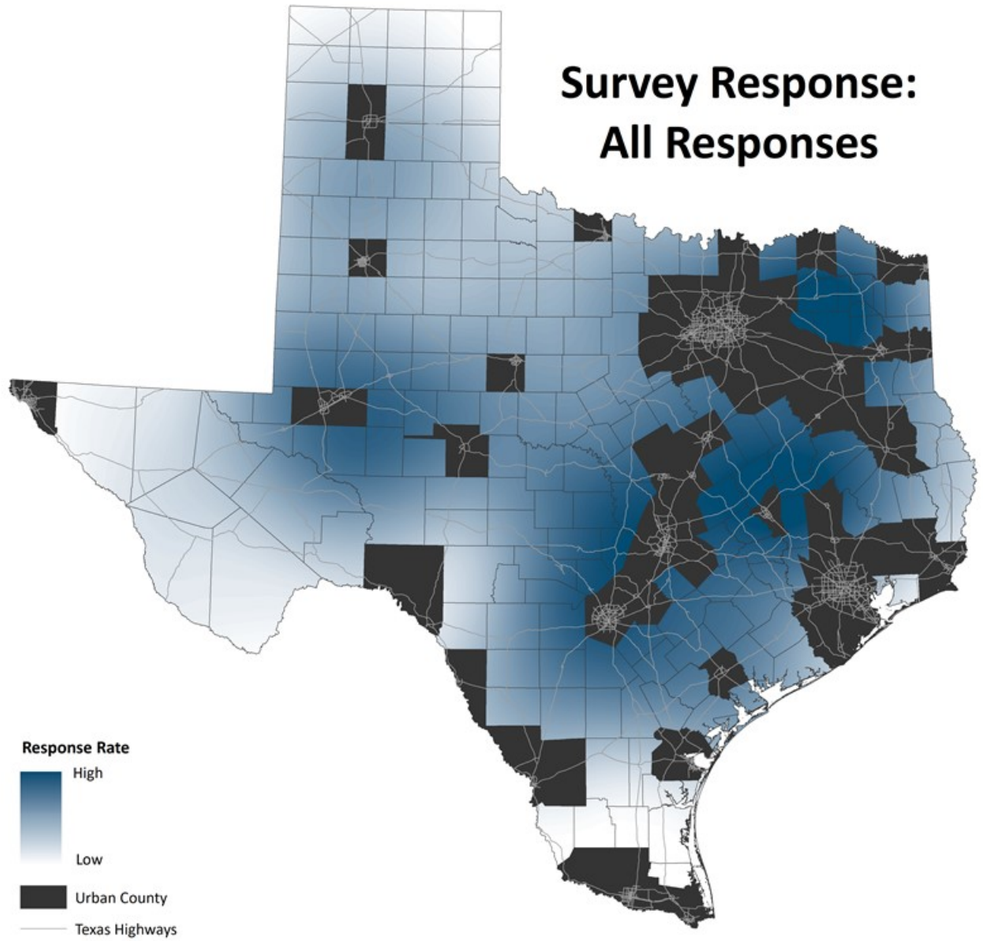

Figure 1. Survey responses (*n*=1,574) from county leaders, 2018.

Part I: Survey Results

Our findings suggest that each rural county is unique, yet they share basic needs and challenges (Table 1, Figure 1). These are impacted by various factors, such as demographic population shifts, to include births and deaths, aging landowners, movement from rural areas to urban centers and vice versa and economic factors. Here we describe basic findings from our county leader survey, which illustrate the impacts of these "push and pull" factors. County leaders from rural communities across the state expressed 17 major categories of needs and challenges. The focus of this project was to describe rural needs and challenges with respect to (1) land, (2) natural resources, and (3) water topics to ultimately inform future programming and needed resources. Each major category pertaining to these three topic areas will be discussed, from most to least mentioned by county leaders (i.e., water, natural resources, funding, industry – agricultural, infrastructure, land, growth, wildlife, education, employment, government, weather/natural disaster, general, tourism, transportation, industry – non-agricultural). Each of these categories and their corresponding sub-topics both influence and are influenced by the other major categories. For example, water availability and supply impacts agriculture, natural resources, wildlife, and growth, to name a few, and water availability and supply is influenced by agriculture (i.e., water quantity, quality, etc.), growth (i.e., meeting increasing population needs, small communities do not have the tax base to afford water treatment/systems), funding, industry, and government. In terms of meeting rural community needs, all major categories serve as factors influencing a county community's quality of life and success, thus, each factor can be used to define a county's uniqueness. The combination of factors influencing counties is helpful in guiding funding choices understanding there is no "one size fits all" solution.

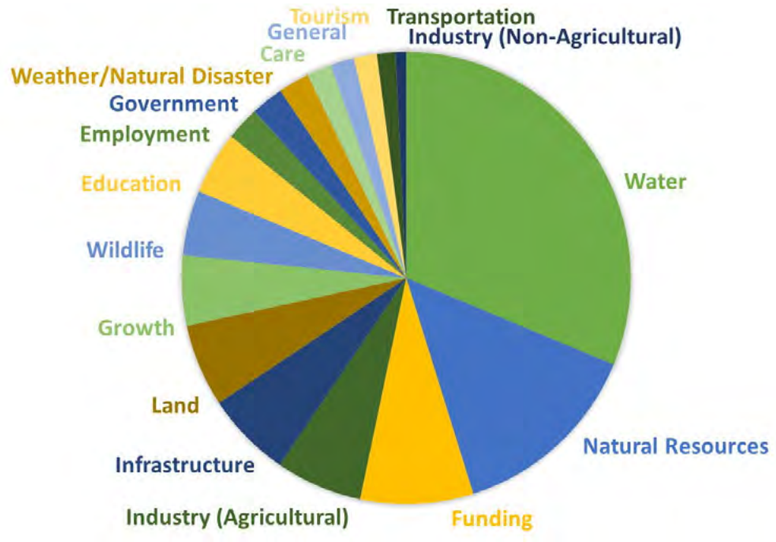

Figure 2. Major categories (*n*=17) of rural needs and challenges as expressed by county leaders from most mentioned to least mentioned, 2018.

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Water

Water was the most common category among county leaders (*n*=492; Figure 3) and encompassed rural, municipal, and subdivision needs and challenges. Subtopics included: conservation, drainage, groundwater, infrastructure, marine resources, quality management, recreation, reservoirs, rights, supply/availability, surface water, wastewater disposal, water resources, water sales, water treatment/systems, and other needs/concerns. With few exceptions, collectively, water was a concern for most county leaders. County leaders' top three* needs and challenges centered on *Supply/Availability*, *General Infrastructure*, and *Water Treatment/Systems*, ordered from greatest to least and described below:

* More than three categories listed because of equal *n* values.

- *Supply, Availability: Drought*—County leaders looked to meeting long-term water needs during periods of drought, and considered refillable water sources, drought management, and even flood management following a drought.
- *Supply Availability, Planning for Future Needs*—County leaders were concerned with managing and meeting water needs during growth periods that occur with increased and/or rapid development, increasing population size and with the increasing pressure these variables place on groundwater. Also of concern were managing public water availability and access to public water, such as drinking water for all communities. Subdivisions were mentioned in terms of their demands on current water supplies, particularly for new subdivisions, along with water distribution in rural subdivisions.
- *Supply, Availability: Infrastructure*—Infrastructure for water needs of growing populations was a concern. Maintaining pipelines for water use and infrastructure to deliver water in general also was a concern. Conservation dam maintenance was mentioned by county leaders as well.
- *Water Treatment/Systems*—County leaders mentioned the need for funding to improve water treatment/systems, including infrastructure improvements such as delivery lines and processing water quantity, and to create more systems in general (for everyone), including new areas, to provide clean water on a water system. With respect to sewers, county leaders asked for more sewer systems and related infrastructure, along with meeting the sewage needs of cities, small towns and rural areas. Water treatment plants and refurbishment were a concern, along with water reclamation and septic and associated environmental concerns.

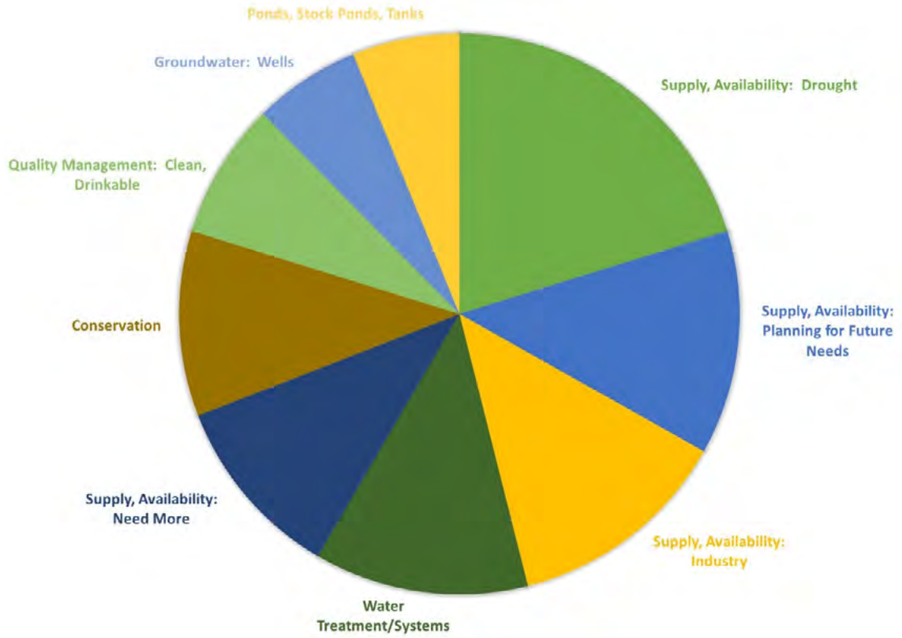

Figure 3. Top 10 water needs and challenges expressed by county leaders, 2018.

Natural Resources

Natural resources were the second most pressing need and challenge for county leaders (*n*=220; Figure 4). Subtopics included: air, brush, coal, damages funding, disposal wells, energy infrastructure, forests, fracking technology, gas, grasses, invasive species, mining, natural resource management, oil, parks and recreation, pollution, preservation, quarries, rangelands, renewable energy, soil conservation, solar energy, trees, wind energy, and other. County leaders' three* most pressing needs and challenges were *Soil Conservation*, *Brush Management*, *Rangelands*, and *Grasses*.

*More than three categories listed because of equal *n* values.

- *Soil Conservation*—County leaders listed soil quality, soil testing, soil health and fertility, soil water retention, and soil erosion as their major challenges. Code enforcement to protect soil and imparting a better understanding of soil management and soil health in general, were also mentioned as needs.
- *Brush Management*—Brush management was a concern as it related to encroachment on rangelands and influenced cattle management. County leaders sought funding for brush control/management.
- *Rangelands*—Native rangeland health was a challenge for county leaders. Conservation, management, and protection were listed. This included protection from overgrazing, controlling pasture weeds, brush encroachment of rangelands, forages, grasses and a need for reseeding programs.
- *Grasses*—Grasses form a specific need and challenge for counties. Apart from palatable grasses for livestock, county leader concerns centered around re-establishing native grasses (i.e., how-to-plant and be successful with native grasses), educating on the value of native grasses, managing grasses on pastures, and controlling/managing weeds, such as spurs and goat heads.

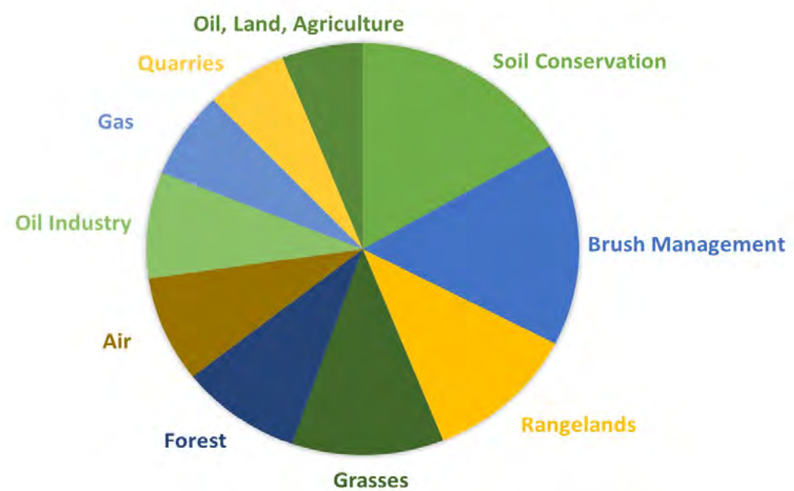

Figure 4. Top 10 natural resource needs and challenges expressed by county leaders, 2018.

Funding

Funding was the third most common challenge and need for county leaders (*n*=128; Figure 5). County leader responses included the following subtopics: economic development, funding categories, general budget, revenue, state funding, taxes, unfunded mandates and other. Much like water and natural resources, each county had funding needs. The top three county funding needs and challenges were *Funds for Road Infrastructure*, *Funds for Housing*, and *Tax Base*.

- *Need Money for: Road Infrastructure*—Road infrastructure was a near all-encompassing need and challenge impacting many other major categories, such as natural resources, industry (agricultural and non-agricultural), growth, land, weather/natural disaster, care, and tourism, among others. Maintenance costs, materials and equipment costs for roads, along with paying for an increasing number of roads were listed concerns and needs by county leaders.
- *Need Money for: Housing*—Some counties reference a lack of housing and lodging. Affordable housing for low-income individuals and for workers were also stated concerns.
- *Tax Base*—Taxing impacts all county communities. Responses ranged from a low tax base and/or a poor tax base, to needing growth in tax base. Property taxes were a concern encompassing not having the ability to pay property taxes, more affordable property taxes, to county leaders mentioning some entities not having to pay into property taxes (e.g., federal land holdings).

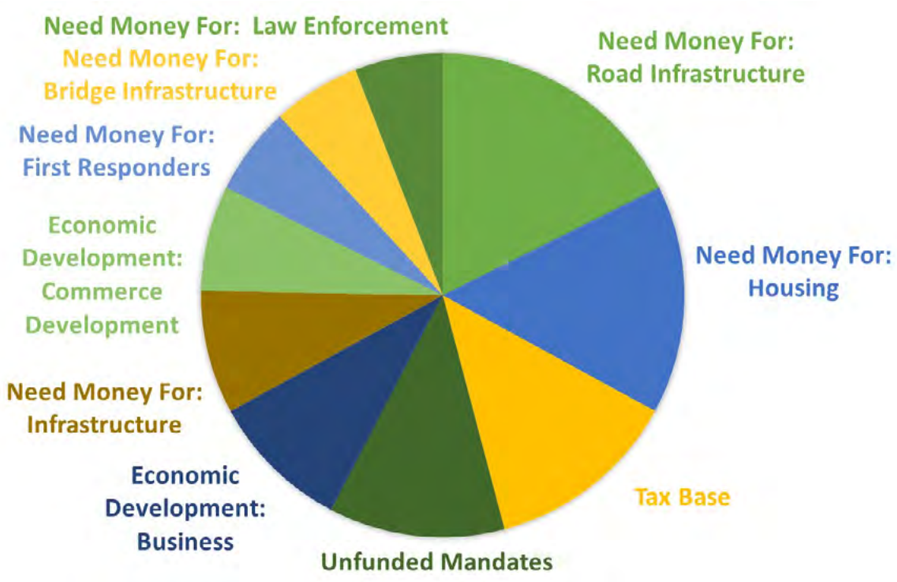

Figure 5. Top 10 funding needs and challenges expressed by county leaders, 2018.

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Agriculture

The agricultural industry was the fourth most common challenge mentioned by county leaders (*n*=97; Figure 6). Subtopics derived from responses included: aging landowners, cattle, crops, dairy farms, diversifications, economic sustainability, farm income, farm management, grazing management, horticulture, improve industry, livestock, pasture land, poultry, preserving, production, ranching practices, sustainable alternatives, tourism, wine industry, and other. The top three* most pressing needs and challenges for county leaders were *Ranching/Livestock*, *Ag Diversification*, *Ag Economic Sustainability*, *Ranching/Grazing Management*, and *Farming/Sustainable Alternatives*.

* More than three categories listed because of equal *n* values.

- *Ranching: Livestock*—County leaders shared that expanding livestock production was a challenge, along with livestock depredation, using livestock as a management tool, loose livestock, the livestock-wildlife interface, and stocking rates.
- *Agriculture: Diversification*—Diversifying current production methods for improving profit was a challenge for county leaders and rural landowners. They specifically mentioned incorporating agricultural production in urban areas, alternative enterprises (outside of lands used for hunting), and progressive practices.
- *Agriculture: Economic Sustainability*—County leaders noted it was more difficult to make a profitable living off the land. The current agricultural economy created a need associated with the desire to find crops that are more profitable and the challenge associated with number of acres to obtain sustainability.
- *Ranching: Grazing Management*—Proper grazing techniques, overgrazing, and rotational grazing, along with the expense of growing and establishing sustainable grasses were challenges for county leaders.
- *Farming: Sustainable Alternatives*—County leaders are looking for alternatives, from more small-acreage-friendly specialty crops, water efficient alternative crops and sustainable non-irrigated agriculture to drought resistant, more tolerant marketable commodities.

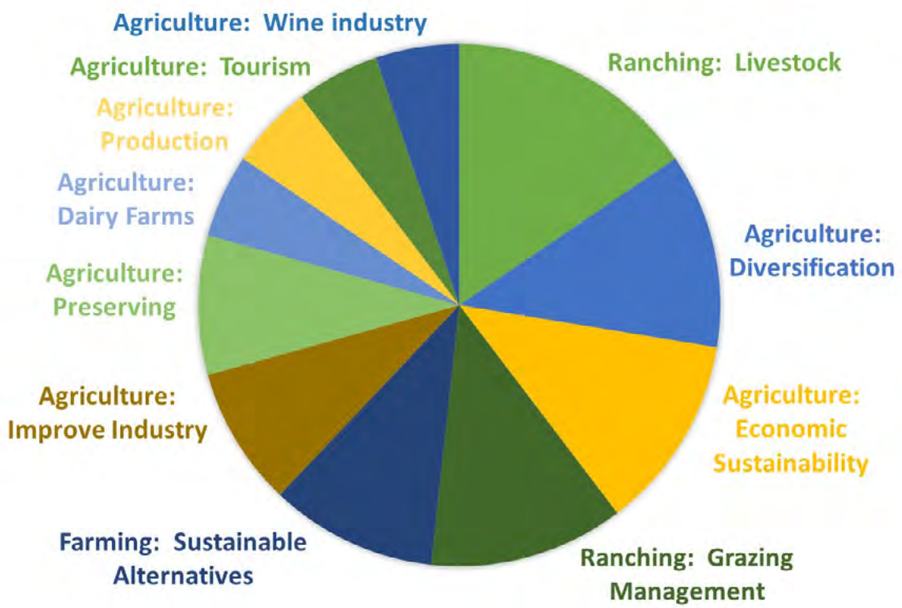

Figure 6. Top 10 agricultural industry needs and challenges expressed by county leaders, 2018.

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County Infrastructure

Infrastructure was the fifth most shared concern among county leaders (*n*=97, Figure 7). The top challenging subtopics included bridges, capital infrastructure, roads, septic systems, utilities and other. Of these, the top three needs for county leaders were *Roads/Improvement and Repair*, *Capital Infrastructure/Jails*, and *Utilities*.

- *Roads: Improvement and Repair*—County leaders expressed concern for road improvement and repair, which influences many major categories. Challenges included difficulties in sugar sand areas, aging paved roads, particularly in subdivisions, the impacts of rock trucking on roads, and the need for road improvements and repair in rural areas.
- *Capital Infrastructure: Jail*—Overcrowded jails were a challenge for county leaders, and they look to the possibility for larger jails and building/renovating current jails. Also mentioned was state control over jails.
- *Utilities*—Upgrading technology and broadband internet was a common need among county leaders, along with the enforcement of burying cables.

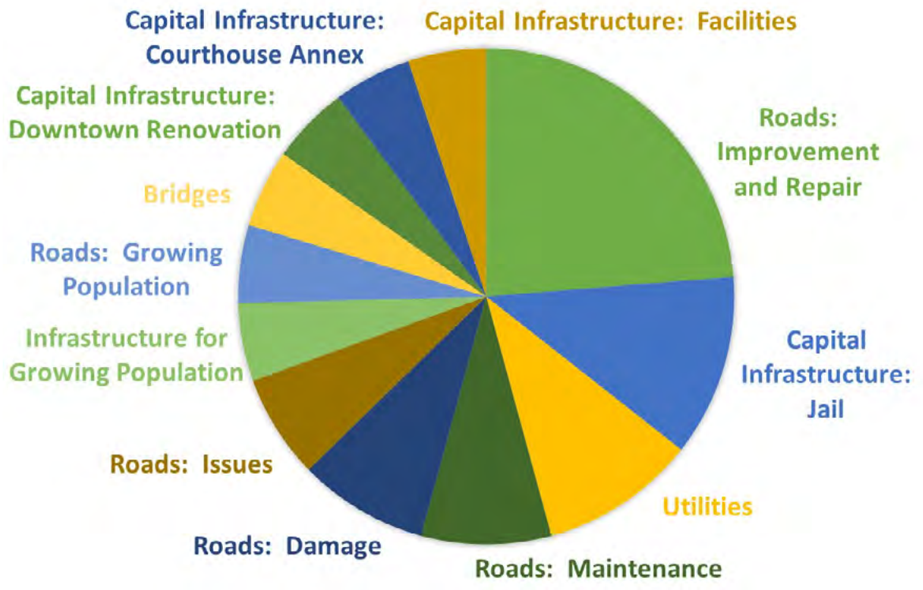

Figure 7. Top 10 infrastructure needs and challenges expressed by county leaders, 2018.

Land Uses

Land was the sixth most common need and challenge for county leaders (*n*=93, Figure 8). Subtopics focused on: agricultural land, authority, erosion, land leases, land rights, land use, oil drilling, overgrazing, preserve land, storm water impacts, trash dumping, and other. Of these, county leaders' top three needs and challenges were *Preserve Land/Fragmentation*, *Trash Dumping*, and *Land Use*.

- *Preserve Land: Fragmentation*—Land fragmentation was a concern for county leaders. Their comments revolved around forestland fragmentation into smaller tracts and subdivisions, stopping land fragmentation and challenges associated with urban encroachment.
- *Trash Dumping*—Trash dumping was a challenge for county leaders. Controlling waste, accumulations of junk and trash, illegal dumping, waste disposal, solid waste management and green landfills were the most common needs for county leaders, along with clearing abandoned structures in municipal areas.
- *Land Use*—County leaders had various needs and challenges associated with land use. Authority was a challenge, such as lacking authority to regulate incompatible land uses. Litter and dust control were other challenges. A rapidly growing population compared with a decrease in agricultural land use also was a challenge. Tied to this was the loss of farmland and keeping land in agricultural use. Lake land use, available land for development, and land development for oil were also challenges. In addition, educational opportunities for new landowners, who may not be familiar with land lease agreements, thus, influencing leased grazing land income for cattle raisers were mentioned.

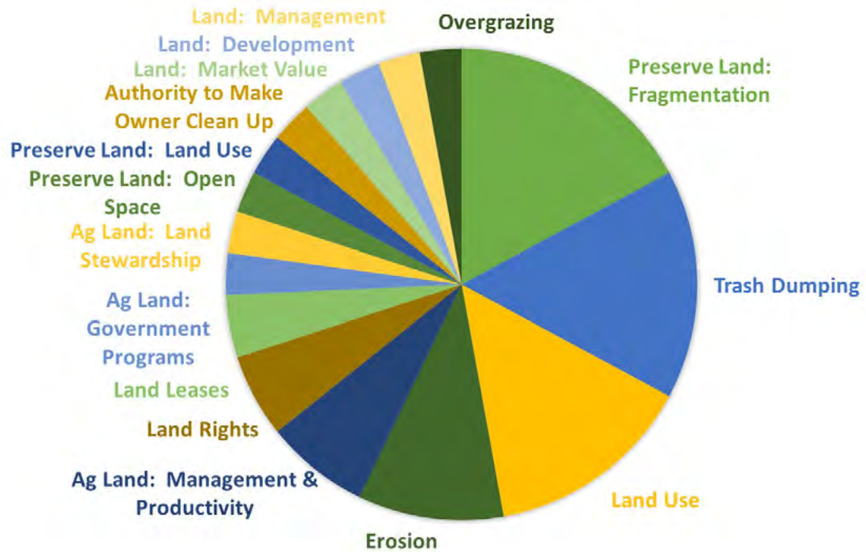

Figure 8. Top 10 land needs and challenges expressed by county leaders, 2018.

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Population Growth

Growth was the seventh common challenge among county leaders (*n*=79, Figure 9). Subtopics centered around: county ordinance authority, development, encroachment, land development regulations, population growth, staff, strategic plan, subdivisions, urban vs. rural, zoning, and other. Of these, the top three* growth needs and challenges for county leaders were *Spatial Growth/Zoning*, *Population Growth*, *Spatial Growth/Subdivision*, and *Spatial Growth/Land Development Regulation*.

* More than three categories listed because of equal *n* values.

- *Spatial growth: Zoning*—Zoning was a need/challenge for county leaders often associated with obtaining more control over growth and development, such as county leaders expressing a lack of ordinance authority and a need for local zoning. Rezoning agricultural land, commercial zoning, control over permitting of solid waste disposal and zoning land for oilfield waste were mentioned. Zoning management and improvements to vaguely written zoning laws were expressed challenges by county leaders.
- *Population Growth*—Adapting to a rapidly growing population was a challenge for county leaders. Lacking authority to regulate population density was also a challenge. From a natural resource perspective, ecological conservation under a growing population model was a challenge, along with urban heat island (urban areas that are significantly warmer than surrounding rural areas due to human activity) mitigation.
- *Spatial Growth*: Subdivision—Growth is a challenge for some county leaders. This includes existing rules and regulations governing growth and the need to develop new rules, for example those involving subdivisions specifically. Controlling subdivision growth was a challenge (i.e., reviewing and inspecting new subdivisions) as it pertained to residential developments, their potential for landscape impacts, and using farmland for housing additions.
- Spatial Growth: Land Development Regulations—Similarly, land development regulations were a challenge for county leaders. These encompassed greater landscape areas than subdivisions, such as managing and guiding development type from urban sprawl onto adjacent counties. The challenge of guiding growth to protect green space from development was expressed by county leaders. County leaders also mentioned being land-locked in terms of growth and lack of land use regulations.

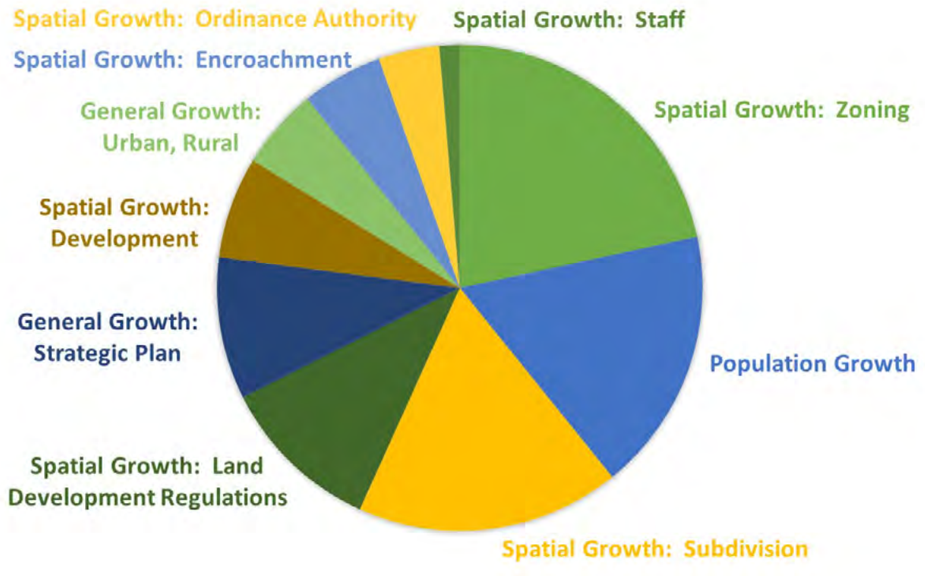

Figure 9. Top 10 growth needs and challenges expressed by county leaders, 2018.

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Wildlife

Wildlife was the eighth most common challenge among county leaders (*n*=73, Figure 10). Responses include the following subtopics: birds, disease, hunting, invasive species, predators, wildlife and livestock, wildlife conservation, wildlife management, and wildlife protection. The top three most common county needs and challenges were *Feral Hogs*, *Wildlife Management/Habitat*, and *Predators*.

- *Feral hogs*—Feral hogs were a challenge for county leaders. Their main concerns were in controlling the population, associated hog damage, and their rapid increase, along with preventing water pollution associated with feral hogs. Eradication also was mentioned by county leaders.
- *Wildlife Management: Habitat*—Land development encroachment was a concern among county leaders because it resulted in displaced wildlife. Managing properties and fence lines for improved wildlife movement were needs and challenges among county leaders, to include maintaining adequate wild spaces and urban wildlife.
- *Predators*—Predator management was a need for county leaders, this included controlling hogs, coyotes, and vultures, and the impacts of predators on livestock.

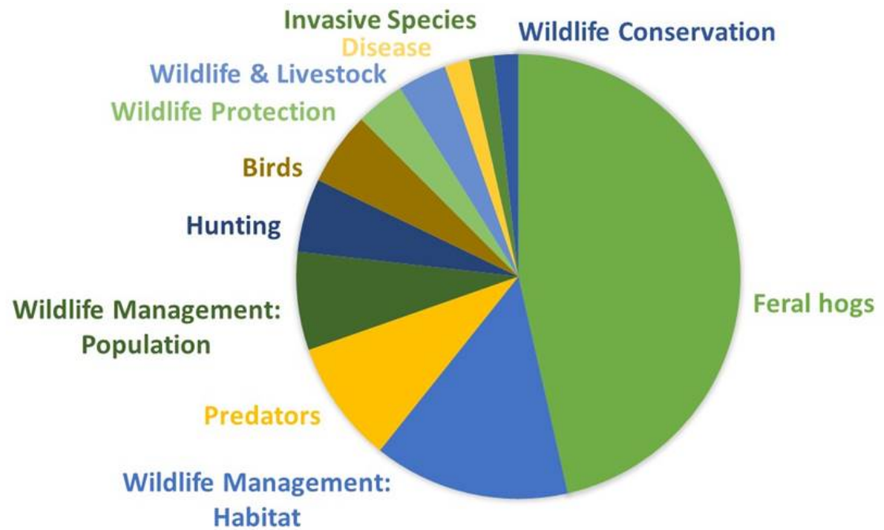

Figure 10. Top 10 wildlife needs and challenges expressed by county leaders, 2018.

Education

Education was the ninth most common need for county leaders (*n*=71; Figure 11). Responses included the following subtopics: agriculture-related, energy sector, gardening, natural resource, new landowner, safety, small landowner, training/retraining, vocational, wildlife, willingness to learn, and other. The three* most common needs/challenges among county leaders were *Vocational Programs*, *Agricultural Literacy*, *Youth Development*, and *County Agent.*

***More than three categories listed because of equal *n* values.

- *Vocational Programs*—Vocational training and programs were a need for county leaders hoping to increase and develop more vocational programs, including providing more cooking, sewing and youth programs associated with agricultural education. Their unified goal was to train their future work force for better-paying jobs. They also sought assistance with family community health and 4-H programming.
- *Agricultural Literacy*—Agricultural use and agricultural literacy communication were needs and challenges mentioned by county leaders.
- *Youth Development*—County leaders were looking for ways to encourage youth to be self-reliant and service-oriented, thus, improving community success. Increasing youth program activities, access, availability, and attendance were important to county leaders.
- *County Agent*—Some county leaders felt they needed an additional county extension agent and advancement opportunities. They also suggested county extension agents may benefit from social media training and from improved marketing techniques for county extension programs. There was also an expressed need for more 4-H leaders.

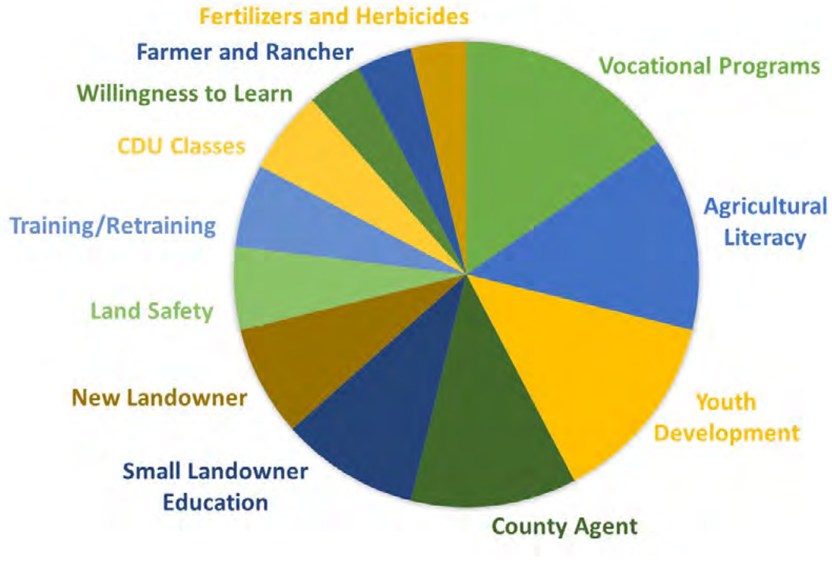

Figure 11. Top 10 education needs and challenges expressed by county leaders, 2018.

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Employment

Employment was the tenth most common challenge among county leaders (*n*=38, Figure 12). The main subtopics were long-term sustainable jobs, more jobs, wages, workers, and other. The top three county needs and challenges were *More Jobs*, *Workers*, and *Wages*.

- *More jobs*—County leaders voiced concern over lack of jobs, including the oil industry moving westward and the lack of oil and gas job openings. Job creation was the unified goal of county leaders.
- *Workers*—County leaders expressed the need for a well-trained and skilled workforce. They were also interested in the career readiness of disadvantaged workers.
- *Wages*—Lack of good paying jobs and jobs that offer livable wages were a challenge for county leaders. They reported wages were not comparable with the private sector for law enforcement and infrastructure-related positions, and for AgriLife Extension agent; this impacted turnover rates.

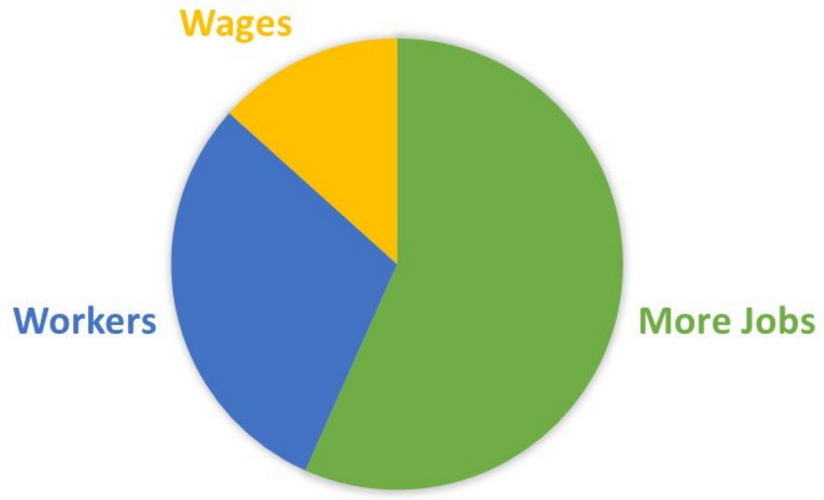


Figure 12. Top employment needs and challenges expressed by county leaders, 2018.

Government

Government provided both a need and challenge for county leaders (*n*=37, Figure 13). Subtopics derived from responses included: authority, collaboration, crime, jail, law enforcement, mandates, public records, regulations, staff needs, taxing, unfunded mandates, volunteer firefighters, and other. The top three needs/challenges for county leaders were *Law Enforcement*, *Crime*, and *Authority*.

- *Law Enforcement*—County leaders expressed a need for more law enforcement for public safety and the ability to move people through incarceration more quickly.
- *Crime*—Rising crime and drug rates, along with drug control were needs and challenges mentioned by county leaders.
- *Authority*—County leaders expressed they lack regulative and enforcement authority and their need for more authority to avoid being exploited.

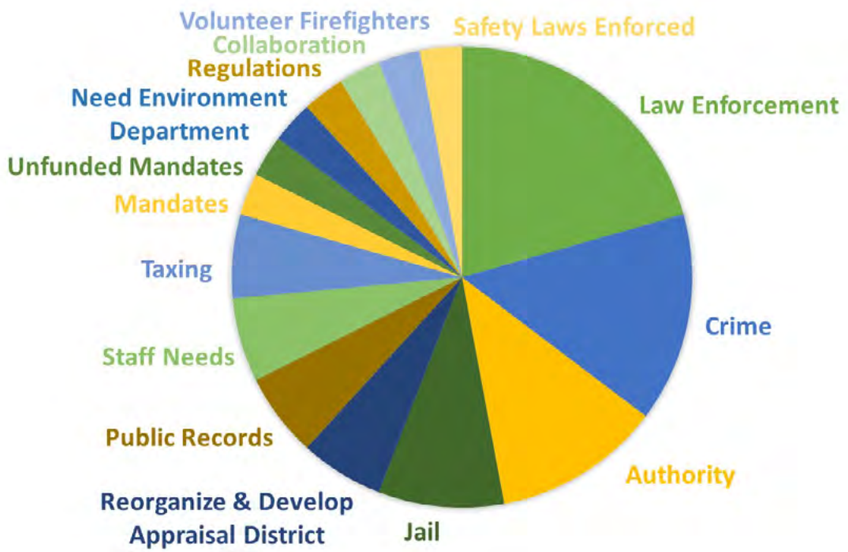


Figure 13. Top 10 government needs and challenges expressed by county leaders, 2018.

Challenges to Rural Texas Natural Resources

Weather/Natural Disaster

Weather/Natural Disaster was a challenge for county leaders (n=35, Figure 14). Subtopics included disaster declaration, flooding, wildfire, and wildfire prevention. County leader's top three* needs and challenges were *Flooding/Drainage*, *Flooding/Control*, *Wildfire Prevention*, *Flooding/Damage to Roads*.

* More than three categories listed because of equal *n* values.

- *Flooding: Drainage*—Flooding was the primary concern and need for county leaders. Drainage off right of way and drainage zoning were topics county leaders mentioned along with mitigation and buyouts.
- *Flooding: Control*—Regional flood control was the main need/challenge for county leaders with respect to flooding control.
- *Wildfire Prevention*—Planning, brush management, and improved fire equipment were expressed needs and challenges. Limited fire control capacity was also a need/challenge.
- *Flooding: Damage to Roads*—Flooding damage to roads by rivers was a concern for county leaders.

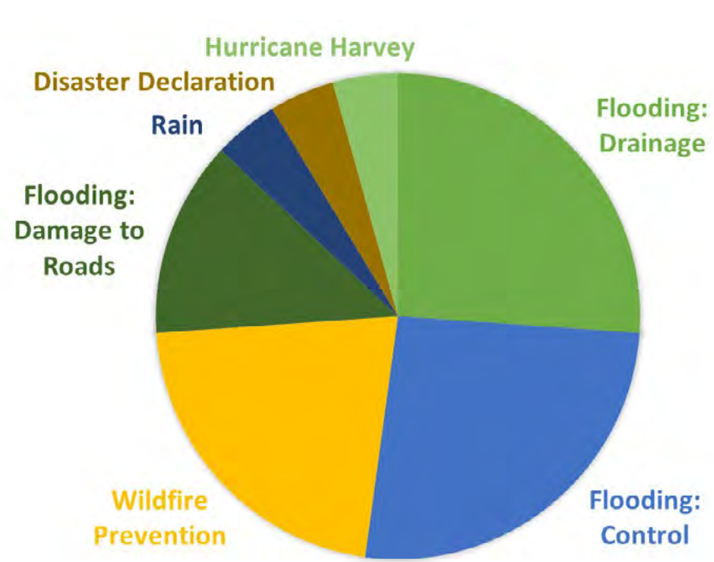


Figure 14. Top 10 weather, natural disaster needs and challenges expressed by county leaders, 2018.

Other

Five major categories received less than 30 responses each (*n*=30, Figure 15). Although this does not detract from their relative importance, for purposes of this report, these major categories were grouped together. The five major categories with corresponding subtopics were *Care* (Subtopics: mental health care, indigent care, and general health care), *General* (Subtopics: number of people, community relations, count culture, retail services, public awareness, nutrition, and other), *Tourism* (Subtopics: increase, ecotourism, birding, and other), *Transportation* (Subtopics: public transportation, high speed rail, railroad, and traffic), and *Industry, Non-Agricultural* (Subtopics: more industry, ordinances for wrecking yards, and low water, and low environmental impact enterprises). The top three needs and challenges among the five categories were *Care/General Health Care*, *Care/Indigent Care*, and *Care/ Mental Health Care*.

- *Care: General Health Care*—Diabetes, access to emergency medical care and general health care were among county leader concerns. General health in the county was the primary concern.
- *Care: Indigent Care*—Providing medical care and services for the homeless and socioeconomically disadvantaged was a need for county leaders.
- *Care: Mental Health Care*—Mental health programs and drug abuse, addiction and rehabilitation programs were a need/challenge for county leaders.

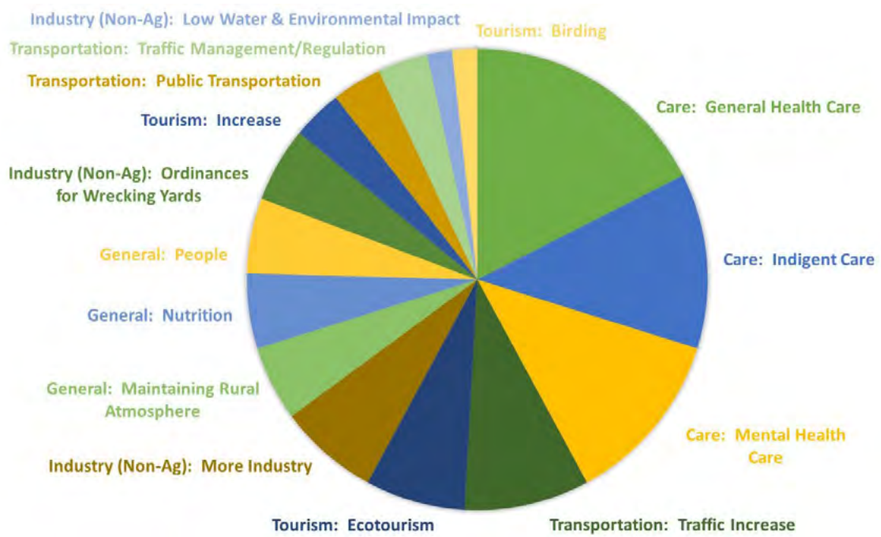


Figure 15. Top 3 rural needs and challenges for the 5 least mentioned categories (*n*<30) – Care, General, Tourism, Transportation, Industry – Non-Agricultural, 2018.

Challenges to Rural Texas Natural Resources

Part II: Geospatial Analyses

Based on survey responses from county leaders, a geospatial analysis was conducted to illustrate general and regional trends for rural counties across the state. Relevant geospatial datasets exploring natural resource issues identified in surveys were gathered and included, but not limited to, land, water (quality, quantity, and flooding), waste management, and energy/transportation. In analyzing these trends and issues surrounding rural counties, it required a working definition of rural versus urban to enable us to categorize counties. The following maps for this section of the report exclude urban counties, defined as counties with (1) population centers >50,000 and/or (2) having an urban (i.e., cover type classification) footprint of > 50% of total county area (Figure 16). By 2070, Texas is expected to reach a total population of about 50 million people (Figure 17; TWDB 2016). While urban centers may carry the bulk of this expected increase, rising populations can have far-reaching affects across the state. Growing urban centers eventually encroach into the rural communities that surround them, as illustrated by the top 25 growing counties in Texas (Figure 18). As Texas populations continues to grow, rural counties and working lands (i.e., farms, ranches, and forestlands) will encounter profound impacts and challenges that will require proactive, informed, and innovative solutions.

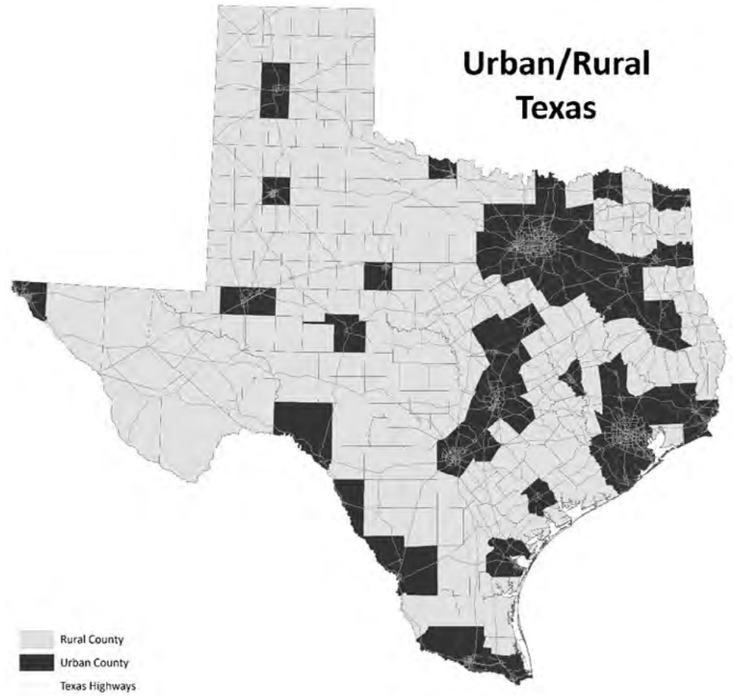


Figure 16. Rural Texas counties based on state demographer data (i.e., population density, urban footprint >50%), 2018.

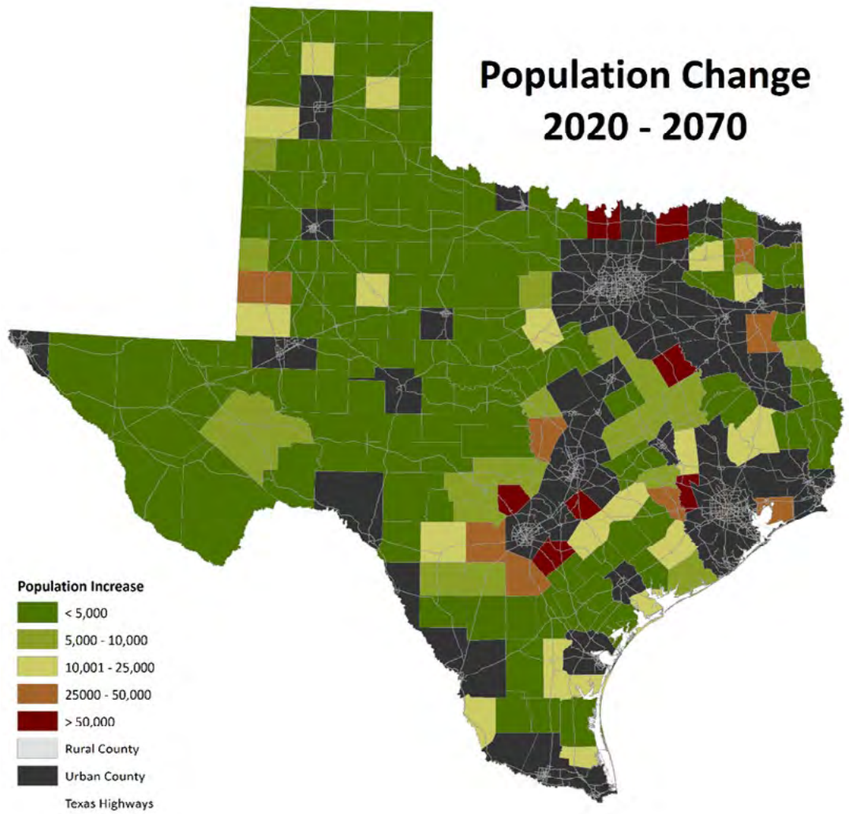


Figure 17. Estimated future population increase between 2020-2070 by county Texas Water Development Board, State Water Plan data, 2017.

Challenges to Rural Texas Natural Resources

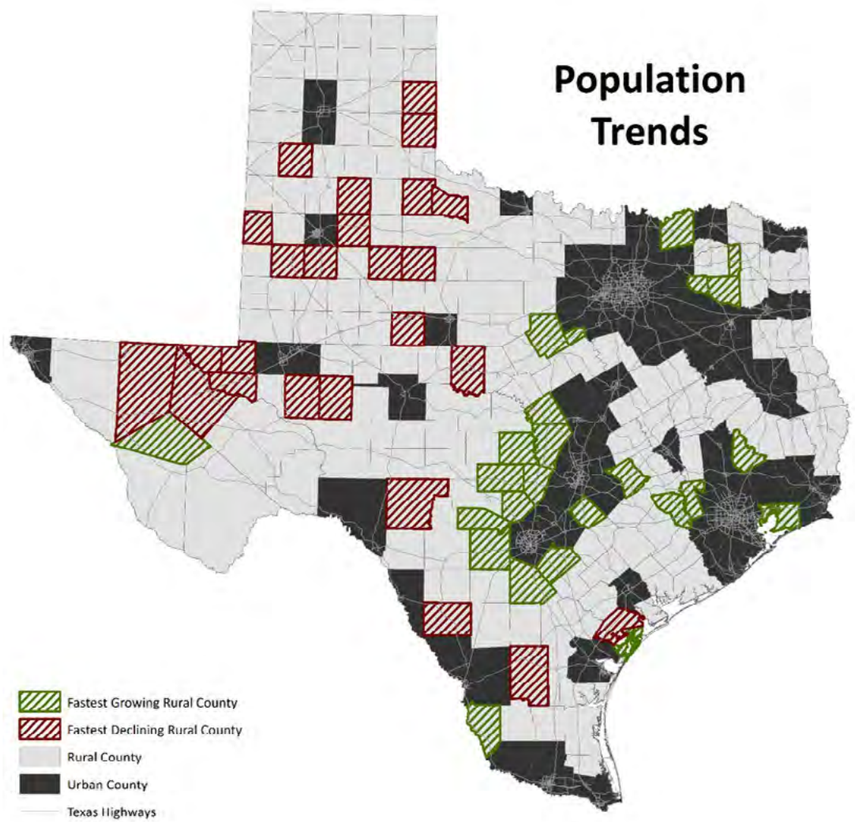


Figure 18. Top 25 fastest growing and declining rural counties based on population data from U.S. Census Bureau, 1997-2012.

Working Lands

Texas is comprised of 142 million acres of private farms, ranches and forests, leading the nation in land area devoted to privately-owned *working lands*. These working lands account for 83% of the state's entire land area and provide substantial economic, environmental, and recreational resources that benefit many Texans. Working lands are increasingly threatened by suburbanization, rural development, and ownership fragmentation, all primarily driven by rapid population growth. These threats result in a fundamental change in the Texas landscape that has implications for rural economies, national and food security, and conservation of water, wildlife, and other natural resources.

The *Texas Land Trends* state-wide report (http://txlandtrends.org/) is conducted every five years, following the availability of the U.S. Department of Agriculture National Agricultural Statistics Service's Census of Agriculture data, and serves to describe the status and recent changes in land use, ownership size, and land values of privately-owned working lands. For this study, we analyzed several *Texas Land Trends* datasets (Figures 19-21) to determine a "Land Risk Index" (Figure 22) across rural counties in Texas. Increases in land market values indicate rising demand for land, often because of large population increases (Figure 19). In addition, an aging landowner base throughout the state (average 60 years old in 2012, Figure 20), indicates Texas is on the verge of the largest intergenerational land transfer and potential change in land use to date. Together, average farm size, market value change, future population growth, and landowner age were combined in determining our "Land Risk Index". Our analysis reveals that increases in population density in urban centers may influence private, rural ownerships and subsequent changes to current land uses in Texas due to increased needs for development, resulting in urban sprawl outside city limits. This trend is illustrated in our "Land Risk Index" map (Figure 22).

Survey responses from county leaders across the state further validate this threat to rural working lands in Texas, as high responses for conservation and fragmentation concerns were found among similar areas that were identified as "high risk" in our analysis. For example, Caldwell County lies just east of the I-35 corridor, along the outskirts of major transportation corridors and urban hubs including Austin and San Antonio. Our analysis identified this county as "high" for land risk with major expected future population growth (over 50k increase by 2070), small average farm sizes (191 acres), large changes in land market value (200% increase since 1997), and an aging majority landowner base (655 landowners over 65 years old, 40% of total). In contrast, Jeff Davis County, on the other hand, lies in far west Texas, considerably distant from any major urban center. Our analysis using *Texas Land Trends* data identifies Jeff Davis as "low" for land risk with no expected future population increase, large average farm sizes (14,936 acres), relatively minor changes in land market value (95% increase since 1997), and an average number of aging landowners (30 landowners over 65 years, 35% of total).

Challenges to Rural Texas Natural Resources

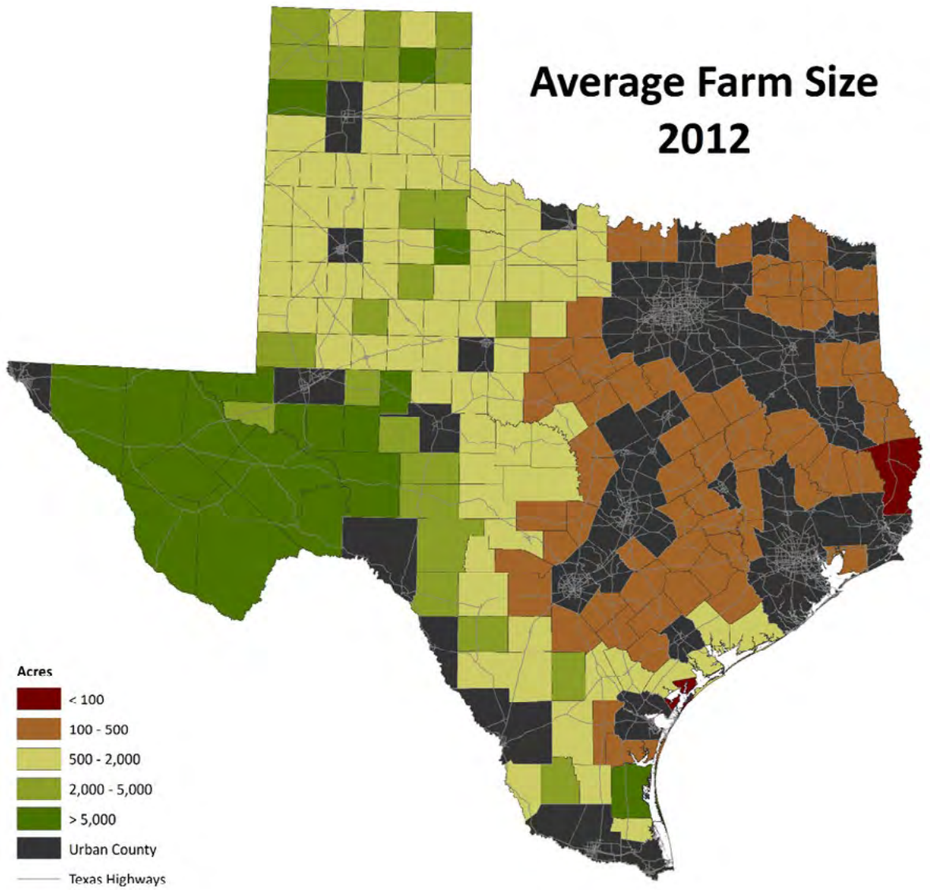


Figure 19. Average farm size in acres based on Census of Agriculture ownership size data, 2012.

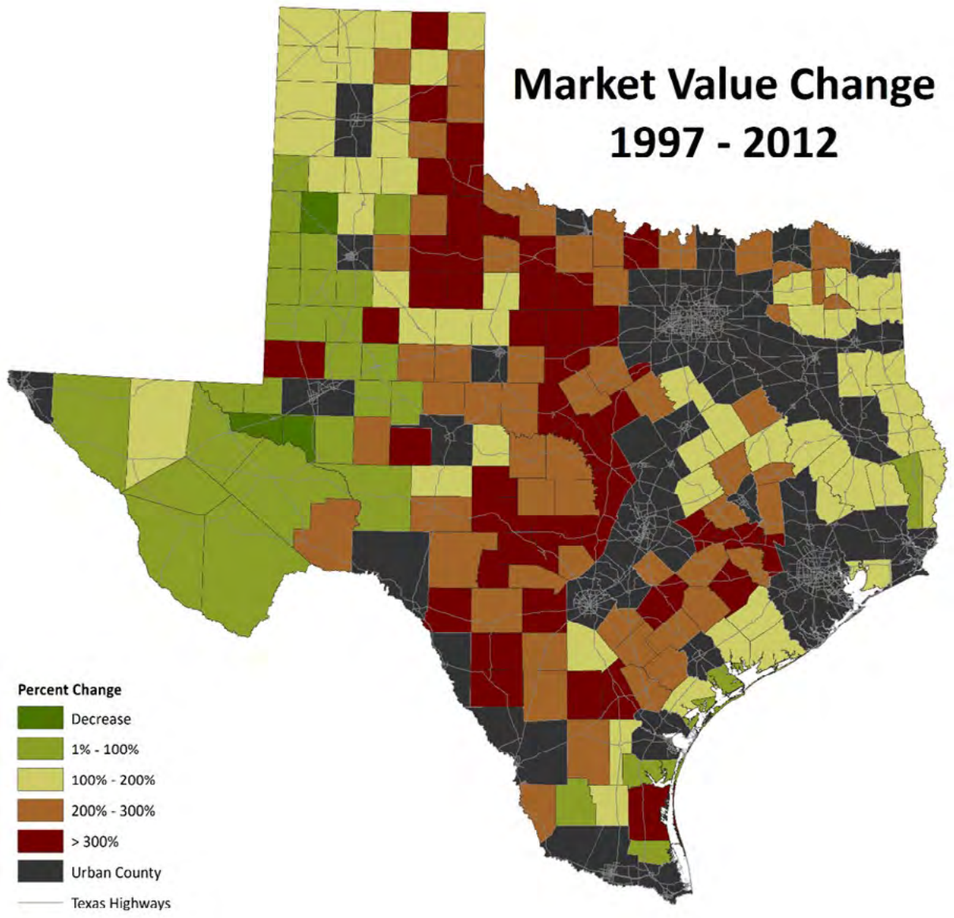


Figure 20. Percent change in land market value between 1997-2012 based on Texas Comptroller of Public Accounts land use data.

Challenges to Rural Texas Natural Resources

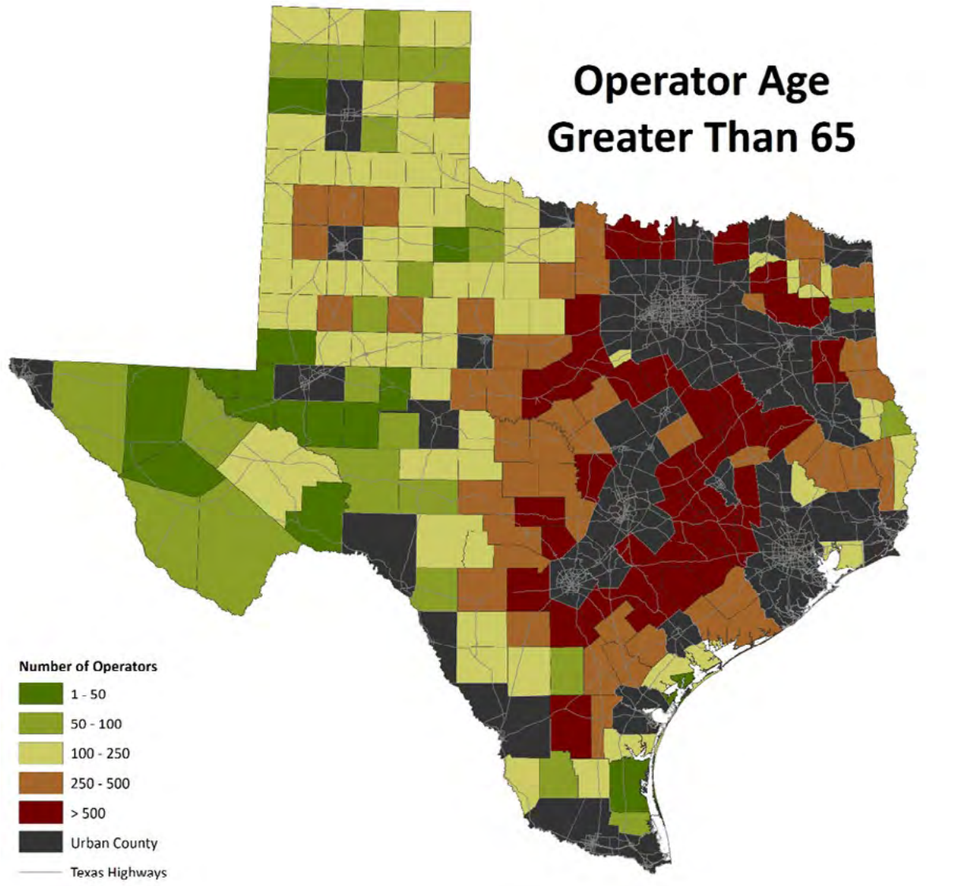


Figure 21. Number of operators greater than 65 years old by county based on Census of Agriculture land ownership data, 2012.

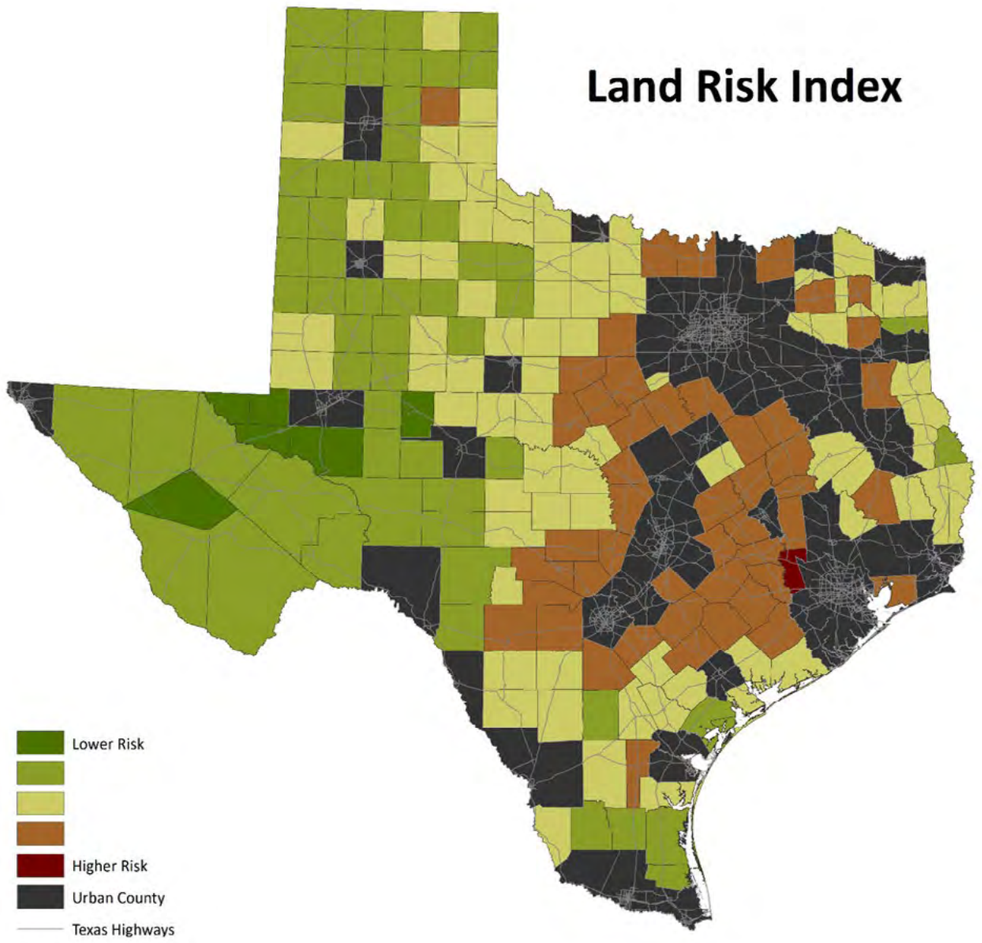


Figure 22. Land fragmentation risk index by county, 2018.

Challenges to Rural Texas Natural Resources

Energy

Texas is the clear leader in energy production in the U.S., ranking first in crude oil well numbers and production, natural gas wells and production, wind turbines and wind energy capacity, and fifth in the nation for solar energy capacity (EIA 2018; SEIA et al. 2018). As energy production continues to grow in Texas, the demand for infrastructure and resources grows with it, further stressing the rural communities that support these industries.

For this study, we analyzed trends in energy industries and production across the state. Results indicate a significant increase in oil and gas well production over the past decade (Figures 23-24). Lampasas County, for example, has seen an increase of over 2,000 oil and gas wells since 2008. Similar trends were seen throughout north and west Texas. In addition, wind energy production increased its footprint across the state as well, doubling the number of producing turbines statewide since 2008 (Figure 23). In the Texas panhandle, Oldham County has seen an increase of over 250 wind turbines over the last decade (2008-2018). Several South Texas counties have recently seen a dramatic rise in the number of turbines as well. Willacy County, for example, has produced over 300 turbines in the last eight years, starting with zero turbines in 2010. Survey responses from county leaders further validate these findings (Figure 25). Areas with growing energy infrastructure were also highlighted by survey responses concerned with rising market values and energy production needs (Figure 26).

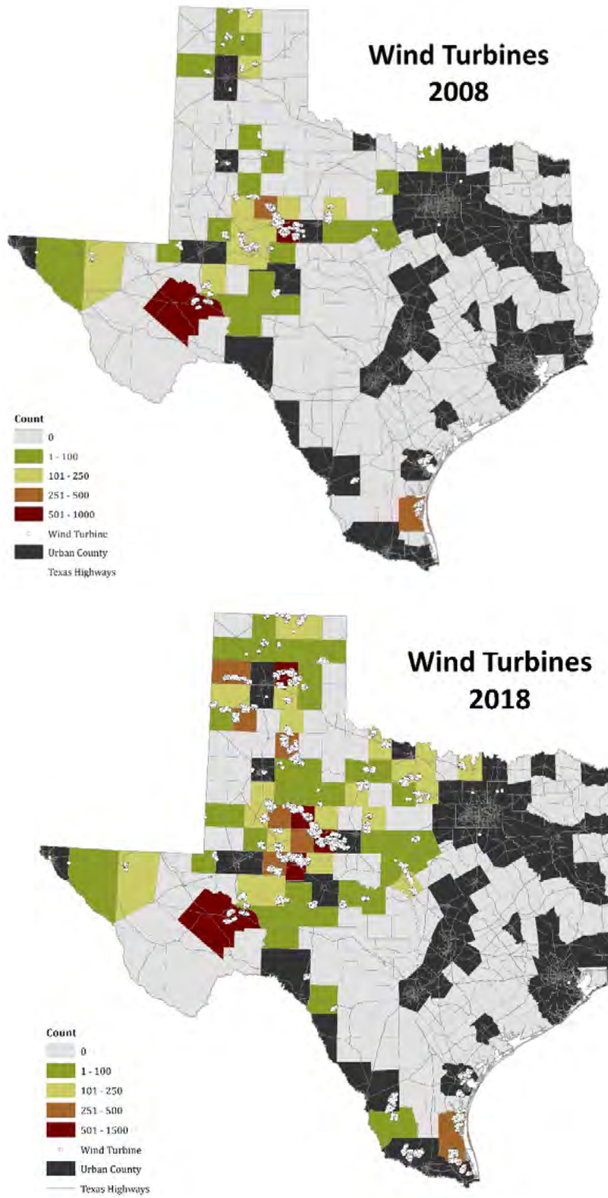


Figure 23. Wind turbine locations, 2008 and 2018.

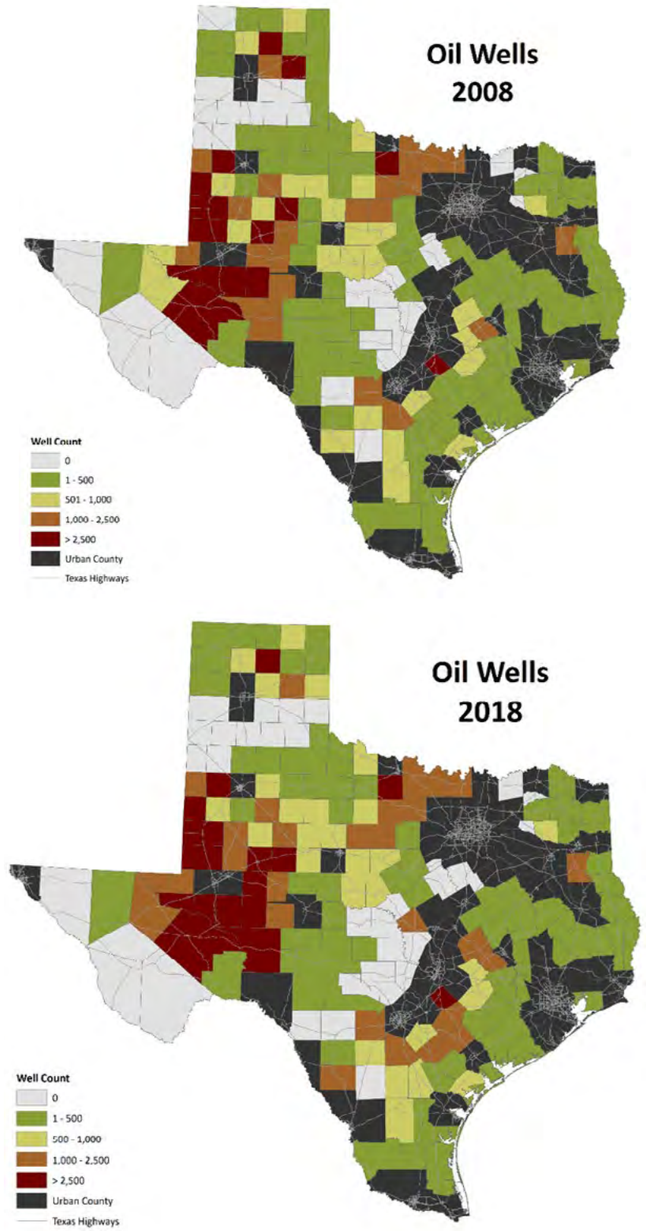


Figure 24. Number of oil wells by county, 2008 and 2018.

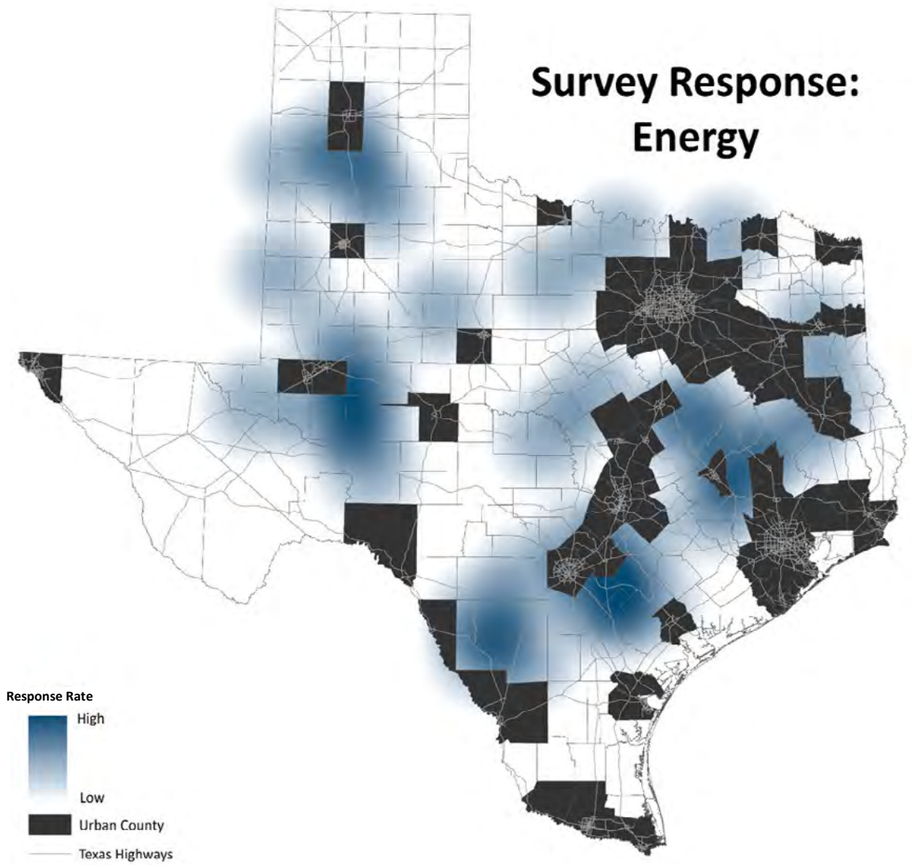


Figure 25. Survey responses from county leaders for energy needs and challenges, 2018.
dark counties are considered urban

Challenges to Rural Texas Natural Resources

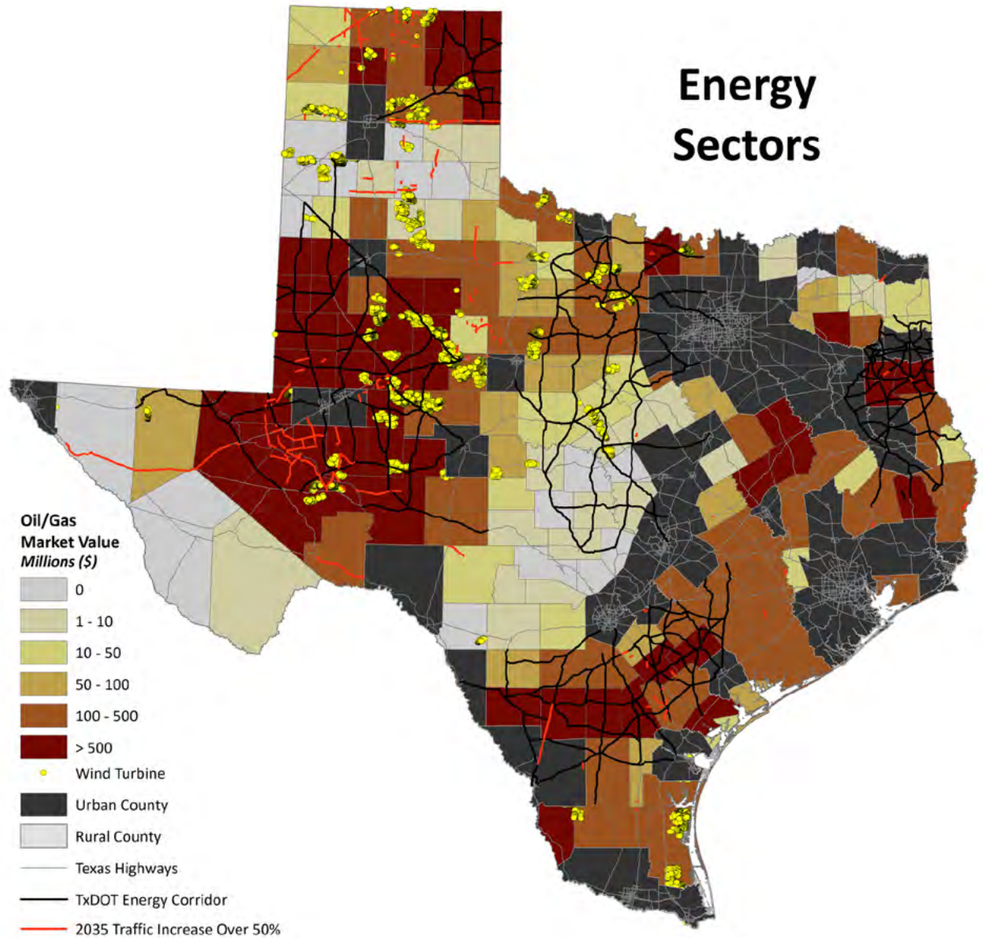


Figure 26. Oil and gas lease market value, current wind turbine locations, current energy sector transportation corridors, and expected future traffic increase over 50%, 2035.

Water

Water Availability

The 2017 State Water Plan for Texas (hereafter *water plan*), developed by the Texas Water Development Board (TWDB), illustrates several water challenges facing Texas in the future. The water plan looks at current water availability, or the maximum volume of raw water that could be withdrawn from a given source, as well as projected water availability through 2070. Surface water is projected to decline by 3% and groundwater by almost 20%, while the state's water needs are expected to grow from about 4.7 million acre-feet in 2020 to about 8.8 million acre-feet by 2070. In addition, municipal water needs are projected to surpass irrigation demand within the next 50 years.

Stream impairment can also greatly impact water availability due to bacteria, dissolved oxygen, pH, temperature, or impaired fish communities. Under the Clean Water Act, Section 303 (d) states that water sources that fall below standards are restricted in available daily water supply. Impaired waterbodies are present across the state (Figure 27), which can significantly reduce overall water availability. Outside of major urban areas, future water availability needs are highlighted throughout the Texas Panhandle, coastal agricultural counties, and rural counties along the urban fringe (Figure 28). Our analysis mirrors trends found among survey response data from county leaders concerned with water availability in Texas (Figure 29).

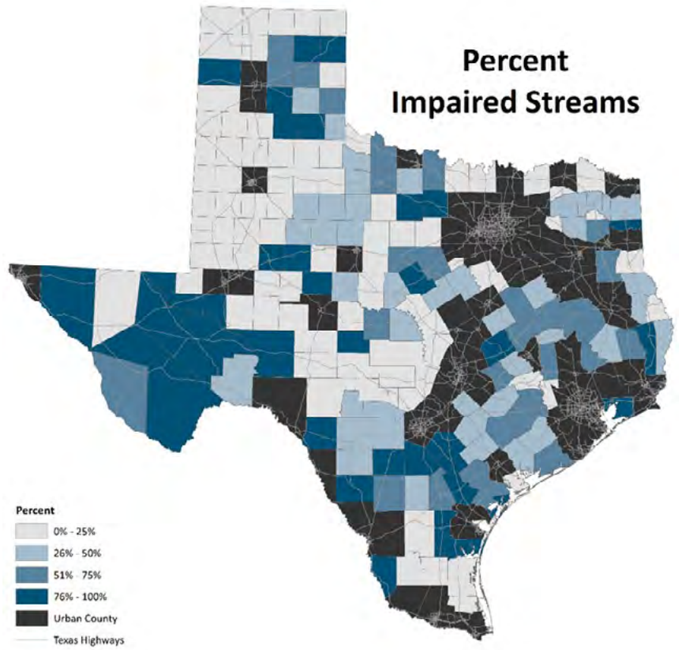


Figure 27. Impaired streams (% of impaired/total stream), 2018.

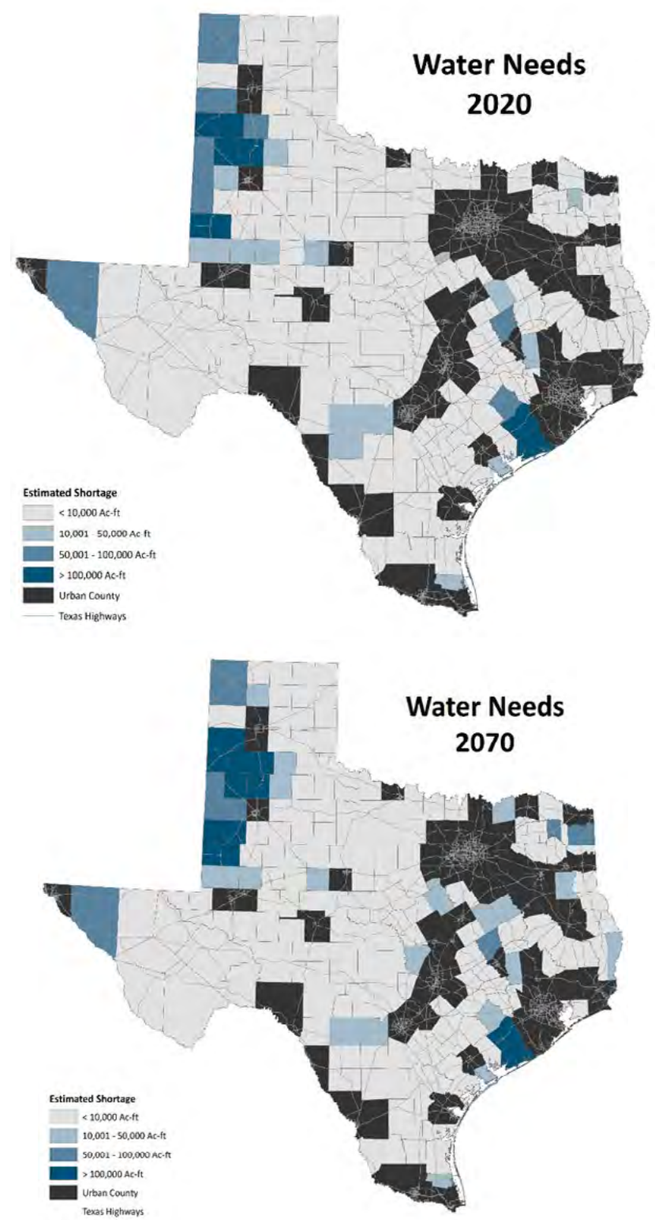


Figure 28. Projected future water needs in 2020 and 2070 from the Texas State Water Plan, 2017.

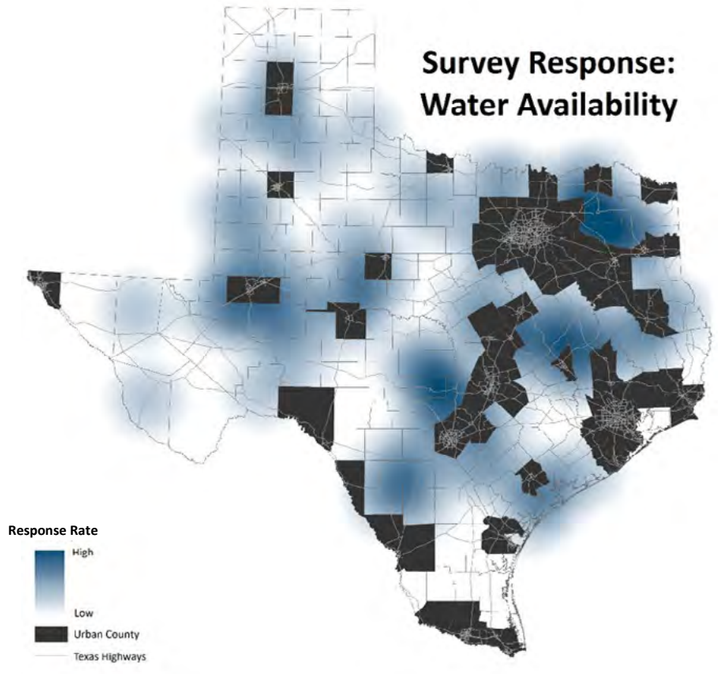


Figure 29. Survey responses from county leaders for water availability and challenges, 2018.
dark counties are considered urban

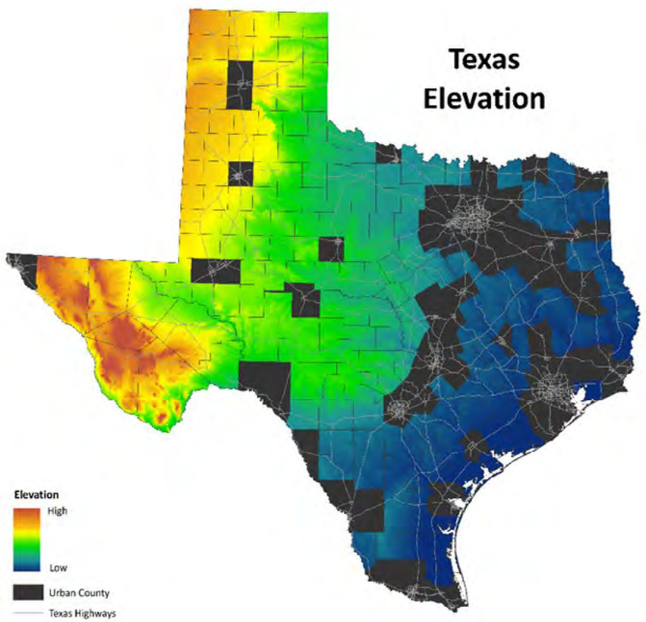
Challenges to Rural Texas Natural Resources

Flooding

As seen in recent years, flooding impacts Texas in several ways, and represents another area of concern for rural counties. Whether flooding homes and roads, or drowning crops and stranding livestock, flooding in Texas poses a substantial threat across the state. In general, Texas experiences two different types of flooding. Heavy rainfall in a short period of time creating flash flooding, which typically occur 1-6 hours after a heavy rainfall event, are normally short-lived, and are most frequent in regions of the state with steep terrain and rocky soil. Flash floods can dramatically impact communities and their native landscapes, as seen in the catastrophic floods along the Blanco River in 2015.

In contrast, surface/riverine flooding are generally slower developing and longer-lasting flood events. This type of flooding occurs following prolonged periods of rain that cause rivers to swell out of their banks and inundate surrounding areas. Flood waters can remain for many days to weeks, as seen in the flooding resulting from Hurricane Harvey in 2017.

Types of flooding concern vary by region within the state of Texas, according to characteristics of the natural landscape. Areas in the Texas Hill Country and along the Balcones Escarpment are more prone to flash flooding due to soil types and elevation changes (Figures 30-34). East Texas and coastal regions with characteristically lower elevations, flatter terrain, and larger rivers are often more prone to surface/riverine flooding (Figure 30). For this study, we analyzed several flood data sets to determine a “Flood Risk Index” among rural counties in Texas. Together, flash flood warnings and percent of flooding soils provided a snapshot of flood hazards across the state. The resulting “Flood Hazard Index” map highlights counties with large potential for flooding. Survey responses from county leaders reveal concerns in similar areas as our final analysis; counties with high risk for flood hazard also expressed high concern for flooding and flood mitigation (Figure 34).



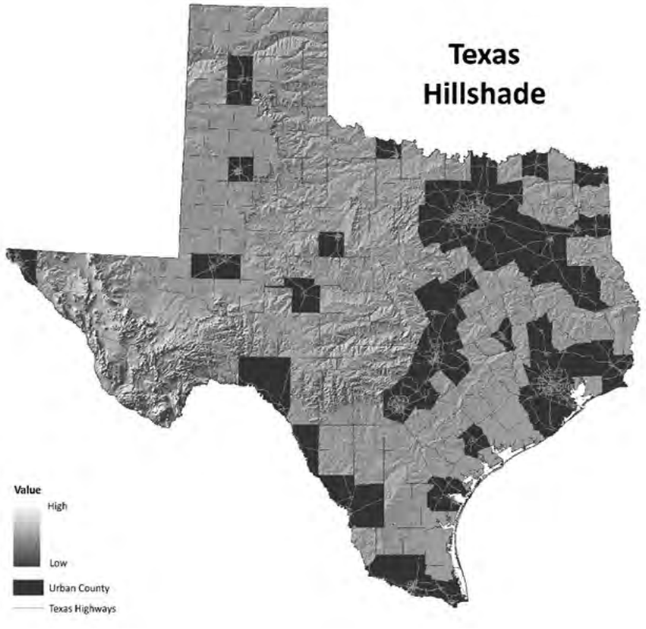


Figure 30. Texas elevation and hillshade derived from the National Elevation Dataset, 2018.

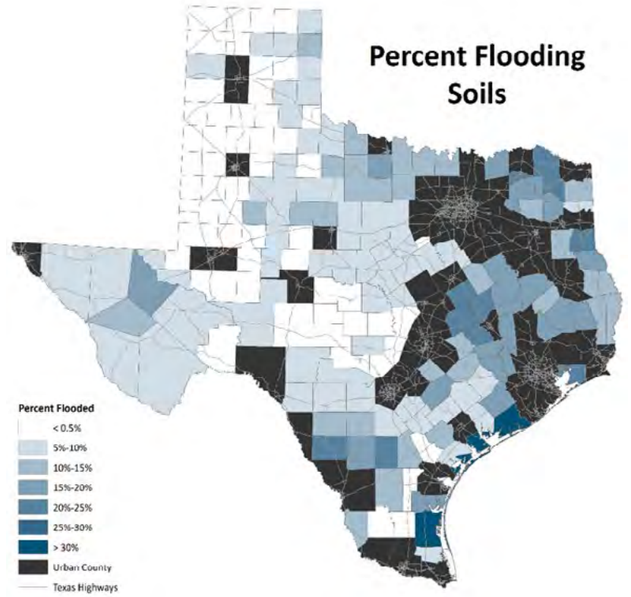


Figure 31. Percent of county with soils prone to flooding, 2018.

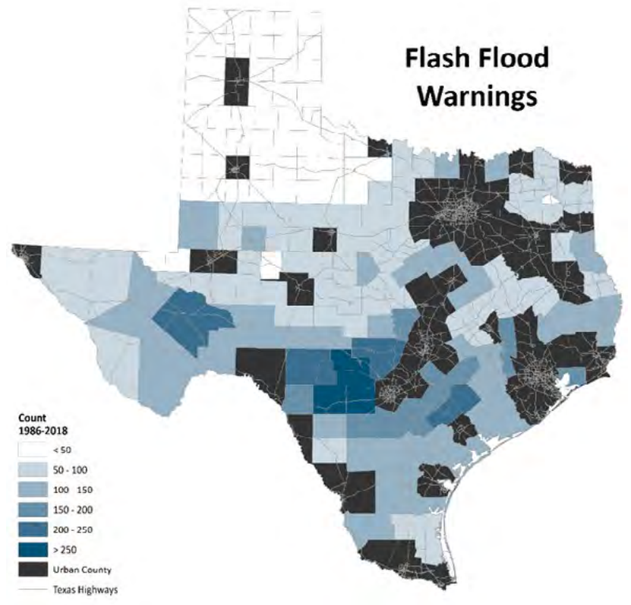


Figure 32. Number of flash flood warnings by county, 1986-2018.

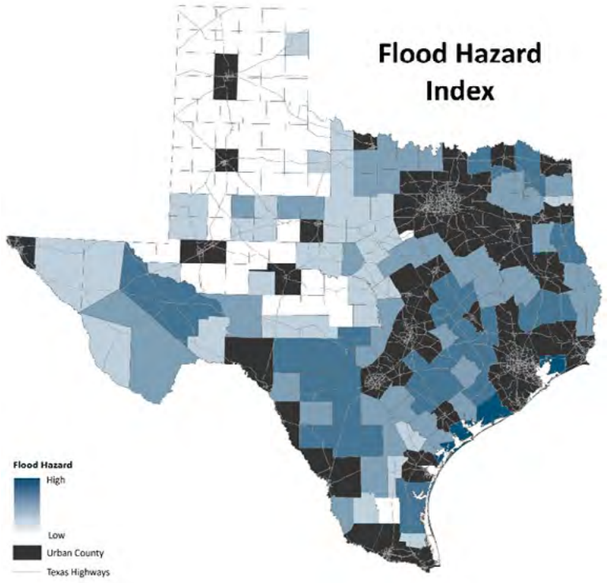


Figure 33. Flood hazard index derived from percent of flood-prone soils and flash flood warnings, 2018.

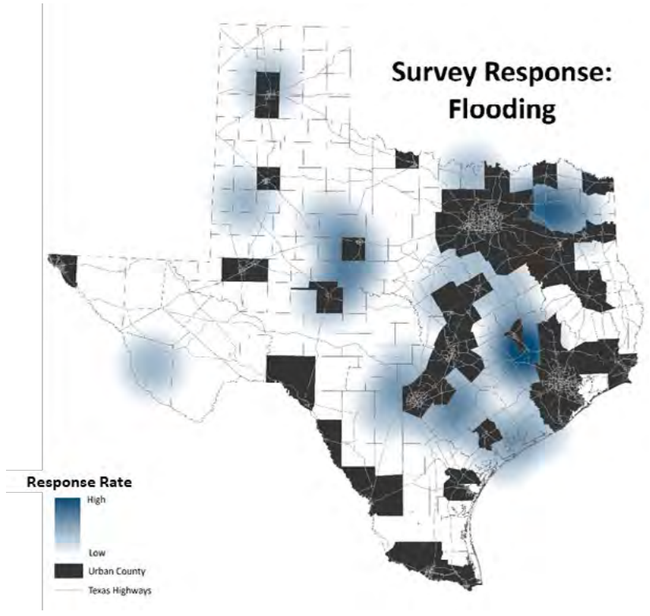


Figure 34. Survey responses for county leaders for flooding needs and challenges, 2018.
dark counties are considered urban

Industrial Waste

Reducing or eliminating industrial waste is a concern among county leaders for many rural communities in Texas. In addition, common waste disposal (e.g., tires, mattresses, etc.) also was an identified need. For the former type of waste, the Texas Commission on Environmental Quality (TCEQ) has several programs in place to help remediate industrial and hazardous waste throughout the state. For this study, we mapped TCEQ cleanup programs by county to highlight areas of the state with high contamination rates/potential future risks due to industrial and hazardous waste issues (Figure 35). The industrial site program totals were the collective actions stemming from seven TCEQ cleanup or remediation programs. These programs include (1) superfund cleanup sites, (2) wastewater outfalls, (3) brownfield remediation sites, (4) industrial and hazardous waste (IHW) corrective action sites, (5) innocent owner program sites, (6) volunteer cleanup sites, and finally (7) Leaky Petroleum Tanks program areas. These programs, while very beneficial, also highlight areas of concern. As expected, most industrial and hazardous waste cleanup programs can be found in urban counties and surrounding rural counties. Survey responses from county leaders support the regional concern over industrial waste management and mitigation (Figure 36).

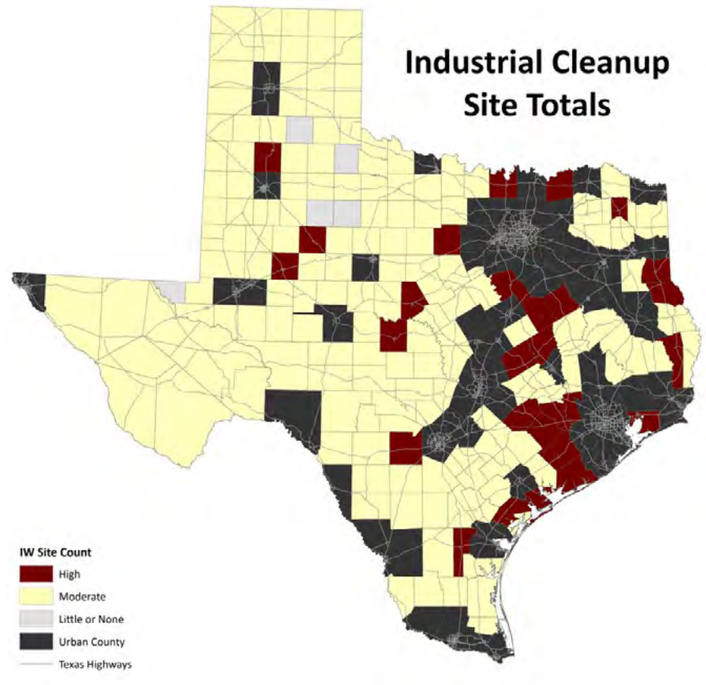


Figure 35. Number of industrial cleanup sites by county, 2018.

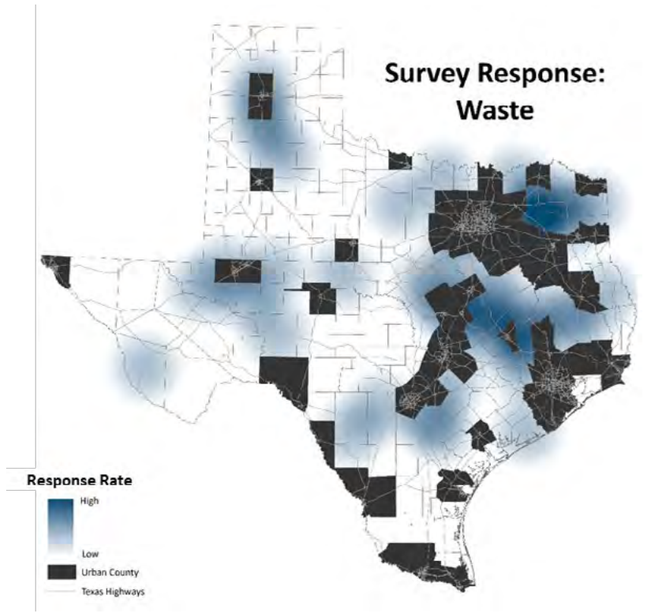


Figure 36. Survey responses from county leaders for waste management needs and challenges, 2018.
dark counties are considered urban

Challenges to Rural Texas Natural Resources

Recommendations and Conclusions

Results from the county leaders survey and geospatial analyses identified key themes in sustaining the viability of rural communities. From a natural resource perspective, some of these issues included loss of agricultural and open space lands, multiple aspects of water and watershed management, mitigating for energy-related impacts while promoting continued and sustainable energy development, and proper and efficient waste management. One important aspect of the rural advisory group meeting was to identify best practices or success stories from workshop participants related to addressing these county concerns. Though not a comprehensive list, these recommendations offer a starting point for leveraging opportunities and enhancing rural communities long-term. Recommendations from the rural advisory group are grouped by key themes.

Working Lands

A critical aspect to strengthening rural counties and communities is maintaining *rural land*. With the largest intergenerational transfer of working lands anticipated in the next decade, the challenge in maintaining agricultural and open spaces will likely increase in rural counties, as new owners are often faced with financial burden and/or lack of knowledge in maintaining working operations will be pressured to sell all or portions of their land for other land uses (e.g., development). Some incentives and strategies to consider into the future include the following:

- Tax valuations to minimize the economic burden to private landowners (e.g., 1-D or 1-D-1 tax valuations) and ultimately conserve working lands. More recent variations of tax valuations include managing for wildlife (which is growing significantly in the state, nearly 5M acres have been enrolled since 1997; consideration for other ecological benefits should be explored (e.g., water benefits/recharge zones, open space).
- Increased conservation easement funding, particularly for the Texas Farm and Ranch Land Conservation Program managed by Texas Parks and Wildlife Department (TPWD), is recommend. Local and state funding sources serves as matching dollar to leverage federal conservation easement programs (e.g., Natural Resource Conservation Service's Agricultural Conservation Easement Program, U.S. Department of Defense's Readiness and Environmental Protection Integration, etc.).
- Eminent domain reform is needed that balances the equitability between private landowners and industry to ultimately promote the continued conservation of open spaces and strategic energy development that serves to minimize impacts.
- New landowner education programs to assist and improve their stewardship roles is recommended, along with an increased awareness of the public benefits of private lands to all citizens. Another recommendation from a workshop participant was pursuing investment opportunities for public recreational land purchases and/or leases.
- Promote the increased use of Joint Land Use Studies funded by the U.S. Department of Defense's Office of Economic Adjustment for rural communities with neighboring military installations. These studies serve to assist local communities in addressing challenges with changing land uses while protecting the military's mission and economic benefits to the local community.

Water

Water was the primary factor and concern for rural county leaders across the entire state. The issues with water and watershed management were diverse, ranging from flood management strategies to

ensuring safe and reliable water supplies for rural communities with burgeoning populations, particularly those neighboring urban counties. Some examples of innovative strategies to address flooding concerns and improve water supply and quality included the following:

Water Availability/Quality

- The Tarrant Regional Water District's George W. Shannon Wetlands Water Reuse Project (http://www.trwd.com/water-supply/wetlands/) is a functional water supply alternative for the district's rapidly growing service area. The 2,000-acre wetlands naturally filter water from the Trinity River and pumps it back into Richland-Chambers Reservoir, where it is then reused with customer cities in North Texas. The first of its kind wetland system also provides additive benefits like wildlife habitat for migrating waterfowl.
- Expand use of land conservation strategies that serve to protect and improve water supplies is recommended. An example project where urban citizens invest in the protection of rural lands is the Edwards Aquifer Protection Program, a City of San Antonio program that uses a local sales tax to collect funding to purchase sensitive properties or conservation easements located over the Edwards Aquifer (https://www.sanantonio.gov/EdwardsAquifer/). Similar strategies where cities can invest in neighboring rural communities should be explored.

Flooding

- Recent flooding events have illustrated the need for updated flood plain maps. Challenges for counties include either the need for updated rainfall data/new flood plain boundaries where maps currently exist, or the development of flood maps in counties that currently do not have any in place. Such information helps determine where homes can be built, insurance costs, and sites for flood control projects. Long-term benefits include minimizing the risk of flood damages to personnel property and human safety risks.
- The Salt Bayou Restoration Plan works to restore marsh habitat, dunes, and beaches to protect infrastructure for the Port of Beaumont with a diverse set of partners: local government (city, county), Ducks Unlimited, TPWD, U.S. Fish and Wildlife Service, port authorities and others. Through the restoration of natural infrastructure (e.g., dunes, channel improvements, beach stabilization), property and community safety can be improved.

Energy

The energy sector is an important contributor to the state's economy; however, accelerated energy development can also place an increased burden on rural lands and their communities, ranging from traffic/safety concerns, demands on road infrastructure, and housing demands/shortages, to name a few. It was recommended that rural communities seek opportunities and partnerships between stakeholders (e.g., energy sector, landowners, county government) which can facilitate vital input into energy development strategies, proactively voicing rural county needs. The following is an example of this type of engagement:

- The Permian Road Safety Coalition (http://www.permianroadsafety.org/) is a public-private partnership formed to address safety and roads related to increased energy development activity in West Texas. The coalition works to address these issues ranging from leveraging member companies' collective intellectual expertise to advance best practices for their fleets in the region to addressing strategic road safety challenges in select locations by working with local government and stakeholders.

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