STRATEGIC PLAN

Texas A&M AgriLife Research and Extension Center at El Paso

Texas A&M AgriLife Research

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STRATEGIC PLAN, TEXAS A&M AGRILIFE RESEARCH AND EXTENSION CENTER AT EL PASO

EXECUTIVE SUMMARY

The Texas A&M AgriLife Research Center at El Paso is committed to meeting the needs of community partners in our region, the State of Texas, and beyond. The strategic planning process ensures that we can continue meeting those needs in the future.
We began our strategic planning process by engaging faculty and staff in an analysis of center strengths, weaknesses, opportunities, and threats (SWOT). A series of in-depth questions allowed us to analyze our work from multiple perspectives. We also provided our community partners with a questionnaire to gauge their understanding of our current impact and areas we can improve upon. A careful analysis of faculty, staff, and community partner responses allowed us to identify goals that will guide our work moving forward. We then developed objectives to reach each goal and a way to assess progress over time.

The strategic plan we have created is a living document. We will revisit it annually to reflect on our work, assess impact, and identify growth opportunities. This plan will help ensure that we are utilizing our time and resources in a way that furthers our Center's collective goals. It will also guide our engagement with the community, so the research we conduct continually strives to contribute fresh insight and solutions to regional issues. Our strategic plan will be a part of the annual review process for the Center, providing us and our leadership with a way to measure our success, identify areas for improvement, and fine tune where we are headed.

Our strategic plan includes our Vision, Mission, and Goals and our Strategies and Objectives for meeting those goals. An Action Plan that details the monitoring and communication of our goals, strategies, and objectives is also included.

This document aligns with the 2022 AgriLife Research Strategic Plan and incorporates recommendations provided by internal and external partners as well as the AgriLife Research Center at El Paso's Advisory Board.

For questions about this plan and its contents, please contact the Texas A&M AgriLife Research Center at El Paso, Center Director, Elizabeth (Beth) Racine at (915) 859-9111, or beth.racine@ag.tamu.edu.

ORGANIZATIONAL DESCRIPTION

The Texas A&M AgriLife Research Center at El Paso (the El Paso Center) was established in 1942 and expanded in 1976. Research offices and laboratories are divided into two locations. The main center sits on a 44-acre site at the corner of I-10 East and Loop 375. The secondary location is on a 190-acre site in Socorro, Texas. Facilities include 11 buildings with 65,000 square feet of space including laboratories with extensive analytic equipment, a 200-seat auditorium, classroom, offices, a video conference room and five greenhouses.

Since 1887, Texas A&M AgriLife Research has been an integral part of the Texas A&M University System. AgriLife Research is the state's only agency dedicated to research and technology development in agriculture, natural resources, and life sciences. There are 13 Research and Extension centers across Texas serving the specific research needs of each region for rural and urban citizens.

Scientists at the El Paso Center are developing technologies and methods to improve water-use efficiency, increase water supplies, protect water quality, manage salinity and sodicity in irrigated fields and urban landscapes, diversify cropping pattern to include salt tolerant crops, increase nutrition knowledge, and improve access to healthy food. The Center is internationally recognized for its research in salinity management, reclaimed water use, crop and landscape plants, desalination concentrate, groundwater-surface water management, and evaluation of the economic impacts of technology and policy changes. As of January 2022, the El Paso Center has also added a research program, under the direction of center director, Dr. Beth Racine, dedicated to public health nutrition. It includes studying the impact of policy, educational, and environmental strategies to improve diet quality and calorie intake.

The El Paso Center leads and conducts innovative water, natural resource, environmental, and public health nutrition research to serve the needs of far West Texas and the state. The region is unique in climate; it is situated within the hottest part of the Chihuahuan Desert, has limited water resources and complex institutional jurisdictions. Among the most important needs for agricultural and urban residents in this region is a reliable, adequate, and safe water supply. A border population of over 2 million, rapid growth, competition for existing water, environmental issues, frequent drought, and limited access to fresh, healthy food, underscore the urgency for finding and implementing effective solutions. Research programs at the El Paso Center strive to address these needs.

Scientists at the El Paso Center are leading research in integrated water resources management; water and soil salinity management; watershed hydrology; river operations and aquifer development; district delivery and irrigation efficiency; water value, pricing and water use efficacy; reclaimed water use; urban landscape water conservation; and public health nutrition. These programs are conducted in partnership and with the support of local, state, and federal agencies, community partners, other universities, and public and private organizations.

The Center is currently staffed with two faculty members, eleven research staff (scientists, postdoctoral, technicians, students, and visiting scholars), and seven administrative support staff. The center is currently completing recruitment efforts for one additional faculty position.

Faculty

Public Health Nutrition – Elizabeth (Beth) Racine

- Policy impact
- Education and Environmental Strategies to improve public nutrition

Dr. Beth Racine serves in three roles at Texas A&M AgriLife. First, she is the Director for the AgriLife Research Center at El Paso. Second, she is the Associate Department Head in the Texas A&M Nutrition Department overseeing the Nutrition AgriLife Extension faculty and staff. Third, she is a Professor in the Texas A&M Nutrition Department. Dr. Racine studies food choice and the factors that influence food choice; particularly policies, systems, and environmental influences. She also using her background in food assistance programs to examine the influence of USDA (United States Department of Agriculture) programs like the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children on diet quality and health.

Soil and Water Salinity Management—Girisha K. Ganjegunte

- Salinity Assessment & Management
- On-farm Irrigation Management
- Water Reuse

Dr. Girisha K. Ganjegunte is a Professor of Water Resources and Salinity Management with the Department of Soil and Crop Sciences, Texas A&M University and located at Texas A&M AgriLife Research Center, El Paso, TX. He has more than twenty years of research experience in the areas of salinity management, irrigation water quality and soil carbon sequestration. His research program specializes in salinity assessment and management, beneficial uses of waters with elevated salinity (industrial wastewater, graywater, reclaimed water, brackish groundwater), and on-farm water conservation. Current research includes developing adaptation strategies to potential climate change impacts on water and salinity; developing alternative water supplies for agricultural irrigation; rapid assessment of salinity in agriculture fields and urban landscapes (golf courses) at a high spatial resolution at different scales. Dr. Ganjegunte has trained and mentored over 25 undergraduate, graduate students, postdoctoral scientists, and technicians. In addition to serving as the Chair of the Book committee, he is also serving as an Associate Editor for the Journal of Environmental Quality. Dr. Ganjegunte is the recipient of several awards including Soil and Crop Science Department's 2018 Research Faculty Award; Special Honor award at 2019 ICAR-CSSRI Golden Jubilee International Salinity Conference; Outstanding Young Agricultural Scientist Award by AASIO. He has provided many invited presentations at extension meetings, regional, state, and international scientific conferences. Dr. Ganjegunte received his Ph.D. in Soil Science from Lincoln University, New Zealand. Prior to joining TAMU, Dr. Ganjegunte worked at the University of Wyoming and Tata Energy Research Institute, India.

Research Scientists

Hydrology and Water Research Program – Rocky Talchabhadel

- Water Resources Engineering
- Integrated Water Resources Management
- Other Water Related Issues

Dr. Rocky Talchabhadel is a Research Scientist of Water Resources Engineering at the Texas A&M AgriLife Research Center at El Paso. He received his Ph.D. in Civil and Earth Resources Engineering from Kyoto University, Japan. His expertise includes Hydrology, Climate Change, and Remote Sensing. Dr. Talchabhadel works closely with earth observations and satellite-based estimates. His research program explores innovative science-based solutions for integrated water resources management, employing several machine learning techniques, water system models, climate models, and geospatial models. He investigates water-related issues (including transboundary issues), their cascading impacts, and risk management strategies within a multisector system. Before joining Texas A&M AgriLife, Dr. Talchabhadel worked as a researcher at the Kyoto University Disaster Prevention Research Institute in Japan. Currently, he serves as a task committee member of the American Society of Civil Engineering (ASCE) Remote Sensing Applications for TMDL Modeling and Curve Number Hydrology Committee.

Soil and Water Salinity Management— Vijayasatya Chaganti

- Diversifying Cropping Patterns and Water Use
- Salinity Assessment
- Greenhouse Gas Emissions from Soils

Dr. Vijayasatya Chaganti is a Research Scientist in the Soil and Water Salinity Management research program at the Texas A&M AgriLife research Center at El Paso. He has more than 7 years of experience in doing applied research in soil and water management. His main research interest lies in soil and water quality management and working towards their sustainability by holistically integrating various best management practices. He specializes in field scale soil salinity assessment and management, soil erosion and water quality in agricultural and urban landscapes; regenerative agricultural

practices to improve resilience to climate change; alternative water reuse strategies; biochar and compost use for soil and water quality. Current research includes developing information on diversifying cropping patterns and water use in the Middle Rio Grande Basin; salinity assessment using traditional and electromagnetic induction techniques and management options; greenhouse gas emissions from soils; and using precision agriculture techniques to detect plant abiotic stressors like salinity, water, and nutrient stress. Prior to joining Texas A&M, Dr. Chaganti worked at Ohio State University as a postdoctoral research associate and studied organic cropping systems. Dr. Chaganti received his Ph.D. in Soil and Water Sciences from the University of California, Riverside. He currently serves as a reviewer for several peer reviewed journals and as an editor for the Frontiers in Soil Science journal.

Other Texas A&M University Programs in El Paso

The El Paso Research Center currently hosts and supports Texas A&M University System agencies such as:

- Texas AgriLife Extension, Dairy Marketing Program led by Sandra Pierce
- Texas Engineering Extension Service (TEEX) – Frank M. Tejeda Center led by Carlos Mendez
- Texas AgriLife Extension, Expanded Food and Nutrition Education Program (EFNEP) led by Luz Waters
- Desert Cactus Demonstration Garden and Vegetable Garden led by Master Gardeners and El Paso County Extension Service

In addition, the Texas A&M System provides the following services in El Paso:

- El Paso Extension Service (multiple programs)
- Colonia's Program led by College of Architecture
- Prairie View A&M University 4-H Extension programs

Opportunities for El Paso Center's Partnerships and Collaboration

Departmental Linkages

Through implementation of this strategic plan, the El Paso Research Center faculty will develop greater collaboration with three Texas A&M College of Agriculture & Life Sciences departments on the main campus including, Biological and Agricultural Engineering, Soil and Crop Sciences, and Nutrition.

Linkages with Other A&M Units and Agencies

Linkages are anticipated to be expanded and/or developed with a number of Texas A&M units and agencies including: the Texas Water Resources Institute (TWRI) in research and outreach programs; Blackland Research Center in watershed modeling and informatics; crop physiology research in collaboration with Amarillo Center, Weslaco and Uvalde Centers in irrigation efficiency and border issues; Texas A&M AgriLife Extension Service programs, especially District 6 and El Paso County programs; Texas A&M Engineering Extension Service (TEEX) water treatment certification programs; and with the Tejeda Center in water treatment training and certification as well as irrigation efficiency research and outreach; Colonias Program for health promotion, sanitation and clean water; and Prairie View 4-H & Youth Development Program.

External Institution, Agency and Organization Collaboration

To address complex issues like water resource management, the future of agriculture in Far West Texas, and the rise of diet-related chronic disease the El Paso Center must work in collaboration with many external institutions, agencies, and organizations. The El Paso region needs integrated water resources management. The impact of individual actions such as transfers of water from agriculture to other uses, improvements in water use and canal conveyance efficiency, changes in the quantity and timing of river flows, desalinization or increased use of reclaimed water cannot be adequately examined in isolation. Integration of hydrologic, economic, water quality, and environmental conditions are necessary to provide lasting solutions. This type of comprehensive scientific and policy analysis requires a collaborative approach. The El Paso Center has established extensive partnerships and collaborators in their research. Scientists are working with agencies and institutions, such as the Bureau of Reclamation, U.S. Geological Survey, International Boundary and Water Commission, El Paso Water, New Mexico State University, and University of Texas at El Paso. The El Paso region also needs an integrated effort to minimize the exponential growth of diet-related chronic disease among the local population. Understanding the interdependence of food availability, food cost, food

preparation time costs, cultural preferences, and individual appetite requires interprofessional collaboration. The El Paso Center is developing partnerships and collaborations with agencies and institutions such as the University of Texas at El Paso, El Paso County Economic Development Department, Feeding Texas, La Semilla Food Center, UTHealth El Paso, and Desert Spoon Food Hub.

Unique Features of El Paso Center

The El Paso Research Center serves a region that is unique in climate, water resources, demographics, and institutional jurisdictions, but it also shares and is an excellent example of many issues that will be facing other regions of Texas. One of the most critical issues that needs to be addressed is how to meet growing demands for reliable, safe water supplies for urban and agricultural communities and the ecosystem. Rapid economic growth and frequent and prolonged drought increase the urgency for finding and implementing effective solutions. As the population of Far West Texas grows, there is also a demand for reliable access to affordable and healthy food. Given that El Paso is far from other major cities in the US, ensuring that residents can survive independently is important to community health and food security.

Coexistence of Agricultural and Urban Sectors

El Paso is a rapidly growing city of 900,000 (5th largest in Texas, over 80% of Hispanic origin) in the Chihuahuan Desert, receiving an average of 8" of precipitation per year. Just across the border is Juarez Ciudad with a population of 1.4 million, making this one of the largest border cities in the world. Water is the most important resource needed to sustain the region's economy, population, quality of life and environment. There is tremendous and justified concern over the availability, quality, allocation, and cost of water resources. Both cities rely upon the same two aquifers for their source of water. Agricultural production coexists with the urban development over the last century in El Paso, Ciudad Juarez, and far West Texas. Such coexistence will continue to compete for the limited land and water resources in a semi-arid region, which creates challenges and opportunities for Center scientists to conduct applied research. Center scientists also provide guidelines for policy makers to make science-based decisions on optimized uses of limited natural resources, resilient infrastructure systems, and sustainable development of the region. The El Paso Center is in a unique position to conduct research in partnership with other institutions and agencies, as well as across the U.S./Mexico border, to provide solutions that will benefit the entire region and other areas of Texas. For example, there is potential for significant improvement in urban and agricultural water use efficiency. Irrigated agriculture uses 80% of total surface water supplies from the Rio Grande and most

irrigated agriculture in the area uses low efficiency flood and furrow irrigation. In the urban area, low efficiency irrigation and other outside uses account for 50-60% of total residential water use. However, the answer is not as simple as increasing use efficiency. High and increasing salinity concentrations require knowledge of soils, irrigation technology, careful plant selection, and irrigation management based on research to sustain urban landscapes and agricultural production. The results of joint research and outreach programs in hydrology, irrigation efficiency, soil and water salinity, landscape ecology and watershed management are needed and will benefit El Paso and these results and benefits will be transferrable to many other areas of Texas.

Transboundary Framework

El Paso is located on the border of the United States and Mexico and next to the state line of New Mexico and Texas. Transboundary settings result in institutional and policy challenges in managing the shared ecosystem and natural resources, especially water. The shared surface water from the Rio Grande is allocated by US-MX Convention 1906 and Rio Grande Compact. However, the shared groundwater is regulated under different rules and regulations, i.e., different rules of states in the United States and national regulations in Mexico. The Texas Water Resources Institute and the El Paso Center are currently conducting research on transboundary aquifers in collaboration with water institutes in New Mexico, the U.S. Geological Survey and the International Boundary and Water Commission. El Paso also shares aquifers with New Mexico across the state line and is planning to transfer groundwater from other basins in Far West Texas. Such complex configuration of shared water resources creates opportunities for scientific research, technical innovation, and institutional reform.

Border Economics and Cultural Settings

El Paso is the largest metro area along the Texas-Mexico border which provides a business-friendly operating environment while also offering a great living experience. It represents one of the largest manufacturing centers in North America and is recognized as globally competitive, due to its unique quality of possessing the largest bilingual and bi-cultural (80% of Hispanic origin) workforce in the Western Hemisphere. El Paso continues to experience positive economic growth by attracting new businesses and helping existing companies to grow, such as call center company TransPerfect who announced in 2022 that they will be opening a new location in El Paso in 2023. That venture alone would bring 400 jobs to the city. El Paso County also supports small businesses through initiatives like their Healthy Food Financing Initiative (HFFI). HFFI offers grants and low-interest loans to food retail and infrastructure projects committed to increasing healthy and affordable food options for underserved residents.

As the city of El Paso continues to create new employment opportunities in 21st century industries, maintain a great quality of life and facilitate business growth at the local and international levels, water providers are seeking alternative sources of water, in particular, transfers of water from irrigated agriculture, wastewater reuse (potable and non-potable direct uses), desalinization of brackish water, conservation and importing water from west Texas ranch aquifers. There are substantial and unanswered technical and policy questions about water availability, use efficiency, hydrologic, environmental, and economic impacts of alternative sources of water and changes in use, and sustainability of water resources and economic growth. High and increasing salinity, deterioration of water quality, and protection of human health are also major concerns. The jurisdictional institutions and issues of three states and two countries compound these management challenges and the need for collaboration.

One threat to El Paso and Far West Texas is the high rates of diet-related chronic disease. In some El Paso communities the obesity rate is as high as 58%, compared to 32% for the US average. These are the communities with the highest concentration of immigrants, poverty, and Latino ethnicity. The diabetes rate in El Paso and neighboring Hudspeth County are quite high; 15% and 19% respectively compared to 9% for the US average. High rates of obesity and diabetes lead to a reduction in the eligible work force. a high cost of medical services, and an increase in pre-mature deaths.

MISSION, VISION, AND STRATEGIC PRIORITIES

Mission

Create, learn, and share knowledge about arid ecosystems, natural resource management, and nutrition to promote economic advancement, healthy residents, and sustainable development in Far West Texas.

Vision

Healthy lives and livelihoods improved through producing affordable and healthy food to meet dietary needs while managing natural resources in Far West Texas.

Strategic Priorities of Texas A&M AgriLife Research

Strategic priorities are areas that Texas A&M AgriLife Research will emphasize over the coming years to make measurable progress toward enhancing the resilience of agricultural systems and ensuring an abundant supply of high-quality, nutritious foods for our citizens. These are described in detail in the agency strategic plan. Texas A&M AgriLife Research and Extension center strategic priorities, such as those of the center at El Paso, align with those of AgriLife Research.

Strategic Priority One: Leading-Edge Research and Innovations

Discover new innovations, technologies, and science-based solutions to enhance agricultural and ecological systems and the life sciences.

Strategic Priority Two: Sustainable Production Systems

Provide the translational research necessary to develop and produce high-quality, safe, and sustainable food and fiber systems with local, national, and global impacts.

Strategic Priority Three: Economic Strength

Enhance the efficiency, profitability, and resiliency of agriculture, natural resources, and food systems in the state of Texas and around the world.

Strategic Priority Four: Healthy Living

Discover, disseminate, and facilitate the adoption of scientific evidence at the intersection of nutrition, human health, and agriculture.

Synergistic Interactions Among Priorities

These four research priority areas interact synergistically to deliver healthy living to Texans. Innovative research is the foundation of this strategy, which empowers the nexus between agriculture and human health by cultivating science-based solutions to develop sustainable, profitable, and resilient agriculture that provides affordable, high-quality, nutritious food.

Strategic Priorities of the Center at Elpaso

Strategic priority one – Leading-edge research and innovations

Discover new innovations, technologies, and science-based solutions to enhance agricultural and ecological systems and the life sciences.

Goals & Objectives

The El Paso Research Center will develop technologies related to natural resource management in agricultural and urban settings.

- Continue to develop precision technologies to mitigate salinity and ensure land productivity.
- Continue to develop effective cropping systems for water-scarce and high-salinity arid regions.
- Continue to develop technologies and practices to enhance the value of rural and urban water use, reuse, and alternative water sources.

The El Paso Research Center will engage in innovative public health nutrition research to better understand food choice.

- Engage with scientific communities, local coalitions, and food service providers to identify food choice information.
- Partner with scientific communities, local coalitions, and food service providers to identify funding, conduct research, and disseminate knowledge gained to the local community, the scientific community, and research partners.
- Study the impact of policy, systems, environmental, and/or educational interventions on food choice.

Strategic priority two – Sustainable production systems

Provide the translational research necessary to develop and produce high-quality, safe, and sustainable food and fiber systems with local, national, and global impacts.

Goals & Objectives

The El Paso Research Center will strengthen agricultural production with water use efficiency and disease control.

- Continue to develop best cropping systems management for a better economic return by increasing crop yields and improving water use efficiency.
- Continue to develop small-scale production practices to supply local markets with fresh vegetables and fruits during extended growing season.

The El Paso Research Center will research the feasibility of implementing controlled environment agriculture in El Paso.

- Engage with local collaboratives and scientific communities to learn about controlled environment agriculture options.
- Partner with local collaboratives and scientific communities to identify funding, conduct research, and disseminate findings to determine if methods of controlled environment agriculture could be successfully implemented in the El Paso region.

Strategic priority three – Economic strength

Enhance the efficiency, profitability, and resiliency of agriculture, natural resources, and food systems in Texas and the world.

Goals & Objectives

The El Paso Research Center will conduct research targeted at identifying crops that can provide economic strength to the El Paso region.

- Engage with local collaboratives and scientific communities to identify crops that may be successfully grown in the El Paso region.
- Partner with local collaboratives and scientific communities to identify funding, conduct research, and disseminate findings with the goal of identifying crops that can grow successfully in the El Paso region.

The El Paso Research Center will conduct research to better understand individual food spending that can lead to better financial resource management skills.

- Engage with local collaboratives and scientific communities with a shared goal of promoting healthy eating and the prevention of diet-related chronic disease.
- Partner with local collaboratives with a shared goal of promoting healthy eating and the prevention of diet-related chronic disease to identify funding sources, conduct food spending assessment and research, and dissemination of assessment and research findings.
- Identify or develop policy, systems, environmental, and/or educational interventions with the goal of improving food acquisition financial management.

The El Paso Research Center will work with community partners to support local food systems with the goal of increasing the economic strength of the Far West Texas Region in the following ways:

- Engage in local food and agriculture collaboratives with a shared goals of supporting local food systems.
- Assist and partner with local food and agriculture collaboratives to seek funding and learning opportunities with the goal of developing and supporting a stronger local food system.

Stretegic priority four – Healthy living

Discover, disseminate, and facilitate the adoption of scientific evidence at the intersection of nutrition, human health, and agriculture.

Goals & Objectives

The El Paso Research Center will engage in research that intersects nutrition, human health, and agriculture in the following ways:

- Build relationships with local health care systems to develop nutrition intervention research projects with the goal of improving health measures.
- Identify funding sources that will support the local agricultural community and the El Paso Research Center to grow nutritious foods to serve the El Paso community.
- Work with local organizations to identify nutrition promotion interventions with a goal of increasing the intake of healthy foods.

Monitoring and evaluation of the strategic plan

As we move forward, on an annual basis we will address the following questions at an annual strategic plan evaluation meeting in early February of each year to determine how we are making progress and ways to redirect our work to ensure successful implementation of our goals and milestones.

1. Are goals and milestones being achieved? If they are, then acknowledge, reward, and communicate the progress. If not, then consider the following questions.
2. Do personnel have adequate resources (money, equipment, facilities, training, etc.) to achieve the goals?

3. Do the goals and objectives remain realistic and relevant to the regional needs?
4. Should specific goals be changed?
5. What were the successes and challenges encountered in the previous year while attempting to achieve these goals?

Communicating the strategic plan

This strategic plan will be widely communicated including through use of the following approaches:

1. The complete strategic planning document will be distributed to all Center faculty and staff and AgriLife leaders.
2. Vision, mission, and goals will be posted throughout the Center and the strategic plan will be available on the Center website.
3. The plan will be shared with advisory council members and community partners.

APPENDIX: TEXAS AGRICULTURE, NATURAL RESOURCES, THE FUTURE

Agriculture

By 2050, the U.S. and world population are expected to increase by 30%, and global real incomes per capita are expected to double. Population and income growth translate into higher demand for both staple products and high-valued foods, such as more animal and plant proteins, fruits, and vegetables. Higher real incomes also mean a growing demand for livestock and feed for livestock. As a result, agricultural productivity has increased dramatically over the years. Today's farmers produce 262% more food with 2% fewer inputs than in 1950. A major component of this increase in agricultural productivity is due to investments in public agricultural research with a benefit-cost ratio of 32, which means that every dollar spent on public agricultural research and extension returns 32 dollars to society. Therefore, large benefits exist for investments in U.S. public agricultural research.

Rapid agricultural productivity increases, relative to gains in other food sectors of the U.S. economy, have translated into falling real prices of food consumed at home. For example, in 1948-2018, the share of U.S. household income spent on food at home declined from 22.3% to 6.4%, while total food consumption increased. With Americans spending 6.4% of their income on food, the other 93.6% is available for spending on a wide range of other goods and services, including recreation, housing, transportation, education, and health care. Therefore, the long-term rise of civilization and living standards worldwide largely tells a story about increasing agricultural productivity. The U.S. is the largest exporter of agricultural products. Since 95% of the world's population lives outside the U.S., the possibilities and opportunities to continue feeding the world are endless.

Agriculture has long been a mainstay of the Texas economy, and the success of Texas agriculture has paved the way for the development of new industries and sustained the diversification of our economy.

The food and fiber systems' contribution to the Texas gross domestic product (GDP) was valued at $145.8 billion in 2017. This represented 9.1% of the state's total economic activity. The top ten commodities in market value are cattle, cotton, milk, broilers, greenhouse, sorghum, wheat, fruits, vegetables, and eggs (Figure 3).

Additionally, agriculture-related activities such as hunting, fishing, and recreation, among others, are worth over $2 billion.

Cattle	$12.3 billion
Broilers	$2.9 billion
Cotton	$2.6 billion
Milk	$2.1 billion
Corn	$1.1 billion
Greenhouse	$840 million
Fruits and Vegetables	$629 million
Eggs	$500 million
Sorghum	$490 million
Wheat	$276 million

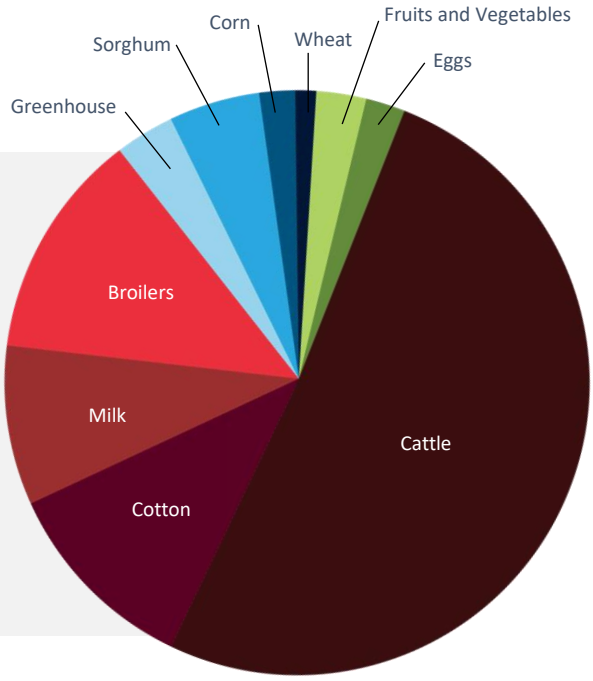

Figure 3. Texas top 10 commodities in terms of market value

Texas is the top state in the nation for producing crude oil, natural gas, and wind-based energy, which provide significant competitive advantages. In 2020, Texas accounted for 43% of the nation's crude oil production and 26% of its marketed natural gas production. Texas also has abundant renewable energy resources. It is first in the nation in wind-generated electricity and a leader in biomass-based renewable energy. With many sunny days across vast distances, Texas is also a leader in solar energy potential. Ranking second in the nation in both population and economy, Texas consumes a large share of the nation's energy. Therefore, as U.S. and world economies grow, two main variables sustain such growth — energy and food — and Texas is a key player in both. Integrating and taking advantage of the synergies of both industries will contribute greatly to the continued growth of the Texas and U.S. economies.

Natural Resources

Texas's natural resources are expansive, with nearly 172 million acres of landmass. The state is home to more than 142 mammal species as well as 615 bird species, of which half are migratory.

Freshwater lakes, ponds, and reservoirs cover about 1.2 million Texas acres. This includes nearly 185,000 miles of river, more than 350 miles of coast along the Gulf of Mexico, and 1,254 miles along the Rio Grande bordering Mexico. Texas waters house more than 250 freshwater fish species and 1,500 saltwater species.

Within this natural ecosystem, 141 million acres — more than 80% of the state's total acreage — consist of privately owned working lands and more than 60,000 working landowners. Texas working lands are privately owned farms, ranches, and forests producing agricultural products. This includes 25.8 million acres of cropland, 105.8 million acres of grazingland, 8 million acres of timber, 5.3 million acres of wildlife management, and more than 780,000 acres of other working lands.

At the same time, from 1997 to 2017, Texas lost approximately 2.2 million acres of working lands converted for nonagricultural uses. Of those acres, 1.2 million were converted in the last five years.

The Future

Texas is becoming an urban state and is home to four of the top 10 most populous cities in the country (Houston, San Antonio, Dallas, and Austin) and 69 of the top 780 cities. The Census Bureau estimates that Texas has three of the ten fastest-growing counties in the country (Hays, Comal and Kendall) and almost a quarter of the top 100 fastest-growing counties. Although Texas has a large rural population, almost 4.5 million, it only accounts for about 15% of the total, which means that around 25 million people live in urban areas.

The COVID-19 global pandemic pushed the world several years prematurely into cyberspace and wreaked havoc on the global food supply chain, causing tremendous decreases in food security. Texas was no exception. COVID-19 exposed Texans' poor health status regarding obesity, hypertension, diabetes, heart diseases, and other chronic diseases related to diet and nutrition. COVID-19 also revealed the need to examine food production and distribution systems, uncovering the need for a more

agile food supply system that provides nutritious, affordable, and accessible food to consumers while financially supporting our farmers, ranchers, and agricultural workers, even when there are multifactored disruptions at one time throughout the supply chain.

We are keenly aware that hunger, specifically undernutrition, is one of our most important global issues. Both a cause and a symptom of poverty, it can ultimately lead to conflict, mass migrations, and the rise of terrorism, all of which can impact Texans. We believe that we can help alleviate human suffering associated with hunger and poverty through agricultural science and, in that way, help prevent these outcomes while building a better world for present and future generations. With proper investment today, AgriLife Research will set the foundations of the infrastructure necessary to ensure food security for future generations. Over-nourishment presents a double-burden paradox that affects nutrition and increases the risk of chronic diseases. Texas agriculture and AgriLife Research are uniquely positioned to partner to improve public nutrition and health by providing a healthier, more nutritious, and abundant food supply.

As Texas agriculture grows, it has a positive multiplier effect throughout the economy. For every dollar of agricultural production in Texas, another $2.19 is generated by other industries in the state to support this additional output. The interconnected nature of Texas agriculture to other sectors of the economy — and the everchanging relationships across these sectors — make it imperative that AgriLife Research is positioned to anticipate and respond to critical needs and emerging challenges.

AgriLife Research's roots are firmly embedded in production agriculture and natural resources. We seek to expand the agency's focus to apply the power of fundamental life sciences to solve real-world issues. Discoveries in genetics, crop and animal management systems, and links between poor human nutrition and chronic diseases are accelerating our impacts on sustainable food and fiber supply chains. Our approach integrates basic and applied research to create, as stated in our vision, "healthy lives and livelihoods improved through abundant, affordable, and high-quality food and agricultural products in Texas and the world."