STRATEGIC PLAN

Texas A&M AgriLife Research and Extension Center at Corpus Christi

Texas A&M AgriLife Research

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STRATEGIC PLAN, TEXAS A&M AGRILIFE RESEARCH AND EXTENSION CENTER AT CORPUS CHRISTI

Center background

The Texas A&M AgriLife Research and Extension Center at Corpus Christi was officially opened in February 1974, and formally dedicated in May 1974.
The **c**enter is **administrated by Texas A&M AgriLife Research and is** responsible for the research of satellite station laboratories at Beeville and Flour Bluff. Faculty and staff located at the **c**enter and **s**atellite **s**tations research problems facing South Texas including agricultural economics, animal science, crop physiology, digital agriculture, entomology, family and consumer health, forage agronomy, mariculture, rangeland management, soil and crop sciences, and youth development.
With a vast network of 18 county Extension offices and some 50 professional educators, spanning from Corpus Christi to Brenham, the science-based programs, tools and resources provided by AgriLife Extension are available to every resident in our district.

Vision

Excel in the creation of novel technologies in plant and animal agriculture, aquaculture and natural resources to benefit stakeholders in the Costal Bend region of Texas and beyond.

Mission

Lead the implementation of new knowledge and technology that benefits the economies of the agricultural industry, sustains and enhances the environment and natural resources and contributes to development of new leaders in agriculture.

Priorities of Texas A&M AgriLife Research

Strategic priorities are areas that 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.

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

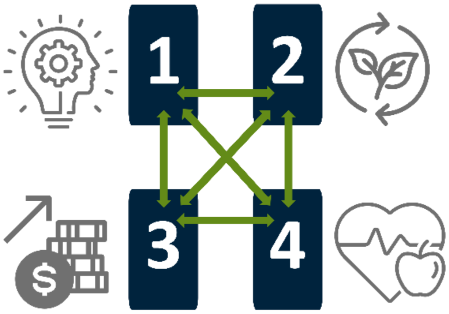
Enhance the efficiency, profitability, and resiliency of agriculture, natural resources, and food systems in the state of Texas and around the world.

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.



ALIGNING WITH AGRILIFE RESEARCH STRATEGIC PRIORITIES

Strategic Priority 1 - Discover new innovations, technologies, and science-based solutions to enhance agricultural and ecological systems, and the life sciences

Goal 1.1. Develop remote sensing tools to characterize crop performance as affected by biotic and abiotic stresses.

- Action 1.1.1. Expand existing collaboration across Texas A&M AgriLife Research centers to develop an efficient UAS-based High-Throughput phenotyping (HTP) system (wheat breeding, peanut breeding, corn breeding, rice breeding, cotton breeding, and energy cane breeding programs).
- Action 1.1.2. Develop web-based data portal for automated data processing, feature generation, and feature extraction system to improve the data processing efficiency
- Action 1.1.3. Analyze sensors data, interpret images, develop visualization and communication tools (data management Software).
- Action 1.1.4. Use growth analysis techniques to identify crop parameters responsible for resilient crop productivity and automate the growth parameter extraction for multiple plots.
- Action 1.1.5. Promote collaborative research and development efforts with corporate partners.

Goal 1.1 Milestones and Deliverables

1. Within one year, test and “debug” web-based UAS data processing and data management platform
2. Within three years, utilize the data processing system to evaluate the performance of genotypes of several crops
3. Within two-year, secure funding to initiate a centralized data processing unit to support several breeding and research programs for UAS-based HTP

Goal 1.2. Develop remote sensing tools to characterize grasslands as affected by biotic and abiotic stresses, including management practices.

- Action 1.2.1. Strengthen existing collaboration with TAMU-Corpus Christi faculty with grant submissions.
- Action 1.2.2. Analyze the correlation between ground truth and UAS-derived data collection methods.
- Action 1.2.3. Scale plot level algorithms to satellite level to facilitate development of pasture level tools.
- Action 1.2.4. Promote collaborative research and development efforts with corporate partners

Goal 1.2 Milestones and Deliverables

1. Within one year, reconvene meeting of the UAS Forage/Range Team renamed to the South Texas Grasslands Team
2. Within two years, refine algorithms to accurately estimate herbage mass and other forage crop parameters
3. Within three years, scale plot level parameters to greater land areas
4. Within five years, deploy tools to aid in decision making at the pasture/land management unit level

Goal 1.3. Develop data driven tools for precision crop management systems

- Action 1.3.1. Strengthen existing collaborations with several departments (example computer engineering, Institute of Data science) and Universities across Texas A&M system to develop in-season crop management and yield prediction systems using remote sensing data (both UAS and satellite), Digital Twins (DT), and Artificial Intelligence (AI)
- Action 1.3.2. Establish Test Beds at three different cotton growing environments (Corpus Christi, central Texas, and Lubbock) and collect high-resolution satellite imagery as well as UAS data
- Action 1.3.3. Develop user-friendly web-based in-season crop management decision support system (DSS)
- Action 1.3.4. Promote collaborative research and development efforts with corporate partners.

Goal 1.3 Milestones and Deliverables

1. Within one year, develop web-based DSS with the capability for in-season forecasting of canopy features, management decisions, and yield
2. Within one year, develop automated transfer of satellite data to the DSS system
3. Within two years, evaluate and deploy web-based DSS as a prototype with capability to receive satellite data and develop in-season forecasting automatically
4. Within three years, assess the profitability of using DSS with respect to crop management and marketing strategy.
5. Within three years secure funding to strength the capability of this system across states

Goal 1.4. Develop state-of-the-art tools for genotyping and phenotyping species relevant to Texas aquaculture

- Action 1.4.1. Develop high- and low-density genotyping arrays for genotyping Eastern oyster and a low-density array for red drum
- Action 1.4.2. Investigate the potential for high-throughput phenotyping of difficult-to-measure traits such as meat yield using computer vision and machine learning strategies.
- Action 1.4.3. Apply novel simulation techniques to assess strategies for genomic improvement of aquaculture species

Goal 1.4 Milestones and Deliverables

1. Within one to three years, secure funding for pilot projects and understand industry needs
2. Within five years, deploy commercially available tools for addressing industry breeding goals

Strategic Priority 2 - Provide the translational research necessary to develop and produce high-quality, safe, and sustainable food and fiber systems with local, national, and global impacts

Goal 2.1. Identify primary components of seasonal progressive stress environments and their interaction with corn genetics and crop developmental stages in vulnerable hybrids that respond with a loss of kernel integrity which directly increases mycotoxin content (aflatoxin, fumonisin) across Texas corn production regions.

- Action 2.1.1. Continue screening multiple public and commercial corn hybrids at South and North Texas locations for vulnerability to loss of kernel integrity (LOKI) and assess ongoing risk through collaboration with public scientists and commercial companies
- Action 2.1.2. Conduct field trials of LOKI-susceptible public and commercial hybrids to assess primary seasonal environmental factors and how they interact with crop developmental stage to produce LOKI and associated fungal colonization
- Action 2.1.3. Promote interaction with public scientists and commercial seed company representatives to assist in efforts to most effectively screen or field identify their current and experimental corn hybrids for vulnerability to LOKI

Goal 2.1 Milestones and Deliverables

1. Within 1-2 years publish information in peer-reviewed journals
2. Ongoing sharing of information through public presentations to clientele like producers, commercial enterprise, producer boards, and other research scientists
3. Within 2-3 years, have a more reproducible field screening methodology for public and commercial deployment in primary areas of South Texas and the North Texas High Plains.

Goal 2.2. Accelerate the development of satellite based in-season prescription management systems.

- Action 2.2.1. Team-up with Texas A&M University-Corpus Christi, Texas A&M University-Kingsville, AgriLife-Research-Temple and AgriLife-Extension
- Action 2.2.2. Correlate ground and/or UAS data with corresponding satellite signals to develop artificial intelligence models of plant growth and yield.

- Action 2.2.3. Develop economic analyses to assess profitability and cost/benefit of tools, technologies, and systems derived from actions 3.1.2.
- Action 2.2.4. Strengthen and leverage collaborative research and development efforts with AgriLife-Extension and corporate partners.

Goal 2.2 Milestones and Deliverables

1. Within one year, assemble team with TAMU-CC, TAMU-K, TAMAR-Temple and TAMAE.
2. Within three years, develop, test and "debug" artificial intelligence in-season management models
3. Within five years, develop and deploy model to TAMAR, AgriLife Scientists and to corporate partners

Goal 2.3. Evaluate collected johnsongrass specimens as potential survival reservoirs for specific pathogens and characterize those populations as potential inoculum sources that could or do initiate diseases in commercial grain and forage sorghum fields.

- Action 2.3.1. Strategic collections of johnsongrass with known susceptibility or resistance to known pathogens will be evaluated to determine if they could logically function as survival reservoirs and inoculum sources for disease occurrence in commercial grain sorghum
- Action 2.3.2. Determine variability in pathogen susceptibility and diversity between distal and proximal johnsongrass populations and relate those differences to other inherent similarities and differences
- Action 2.3.3 Evaluate differences in phenotype, variance in reproductive maturity, and other factors to assess how that might interact with johnsongrass population integrity, diversity, seasonal pathogen activity, and disease severity.

Goal 2.3 Milestones and Deliverables

1. Within one year, publish peer-reviewed articles based on core group johnsongrass pathogen responses
2. Within 1-2 years, alternate funding will be pursued through grant applications to appropriate funding agencies

Goal 2.4. Fast-track genetic progress in crop improvement through automated high-throughput phenotyping systems

- Action 2.4.1. Expand existing collaboration with AgriLife cotton, wheat, corn, and sorghum breeders to understand breeding objectives and priorities.
- Action 2.4.2. Expand data collection and analytic capacity for artificial intelligence and statistical approaches to extract biologically relevant information.
- Action 2.4.3. Develop machine learning models to appraise crop health, crop performance yield and quality using crop characteristics obtained from remote sensing data.
- Action 2.4.4. Strengthen and leverage collaborative research and development efforts with corporate partners.

Goal 2.4 Milestones and Deliverables

1. Within one-two years, secure funding, assemble team with AgriLife breeders and set research priorities.
2. Within three years, develop, test and “debug” high-throughput phenotyping software
3. Within five years, develop and deploy software to AgriLife breeders and to corporate partners

Goal 2.5. Assessment of crop health using remote sensing images.

- Action 2.5.1. Expand existing collaboration with AgriLife plant pathologies and breeders to stablish breeding objectives and priorities.
- Action 2.5.2. Establish data collection and analytic capacity for artificial intelligence and statistical approaches to extract crop health relevant information.
- Action 2.5.3. Develop machine learning models for the early detection of diseases using crop characteristics obtained from remote sensing data.

Goal 2.5 Milestones and Deliverables:

1. Within one-two years, assemble team with AgriLife plant pathologist and breeders and set research priorities.
2. Within three years, develop, test and “debug” Artificial intelligence disease models
3. Within five years, develop and deploy model to AgriLife Scientists and to corporate partners

Goal 2.6. Increase knowledge of fitness traits of Brahman-influenced cattle in the Texas Gulf Coast region for genetic improvement and sustainability.

- Action 2.6.1. Establish a new herd of beef cattle to study breeds adaptable to the subtropical environment of the gulf coast of Texas. These cattle will be obtained from the germplasm evaluation project (GPE) of the United States Department of Agriculture Agricultural Research Service and consist of the breeds of Beefmaster, Brangus, Santa Gertrudis and Brahman.
- Action 2.6.2. Implement intensive phenotyping (i.e., digital agriculture technologies), analytical capability, and statistical approaches to study and improve grazing and heat tolerance traits.
- Action 2.6.3. Build collaborations within the beef cattle systems and genetics teams of Texas A&M AgriLife Research and develop efforts with breeders and breed association partners.

Goal 2.6 Milestones and Deliverables

1. Within one-two years, obtain and start breeding cattle from which intensive phenotypes can be collected with digital agriculture technologies.
2. Within three years, develop statistical-genetic approaches for understanding phenotypes and breeding value estimations.
3. Within five years, develop and deploy new traits and breeding values for use in genetic improvement programs of Texas cattle.

Strategic Priority 3 - Enhance the efficiency, profitability, and resiliency of agriculture, natural resources, and food systems in the state of Texas and the world

Goal 3.1. Develop a genomics-based selective breeding program for Eastern oyster in Texas.

- Action 1.3.1. Develop breeding program infrastructure (trained personnel, data management systems, standard operating procedures)
- Action 1.3.2. Expand the capacity of the Flour Bluff facility to facilitate state-of-the-art oyster breeding and production
- Action 1.3.3. Cultivate relationships with industry partners to facilitate technology transfer and uptake of improved seed
- Action 1.3.4. Explore long-term funding opportunities for an oyster breeding program to serve the industry in Texas and the wider Gulf of Mexico

3.1 Milestones and Deliverables

1. Within one to two years, form a base population for long-term breeding
2. Within three years, develop long term funding and industry involvement for breeding program
3. Within five years, consistently demonstrate measurable genetic progress for the breeding program

Goal 3.2. Explore the feasibility for domesticating new species for Texas aquaculture.

- Action 3.2.1. Identify promising aquaculture species based on commercial value and feasibility of domestication/production
- Action 3.2.2. Work with regulatory partners to determine bottlenecks to permitting for commercial production
- Action 3.2.3. Partner with economists to understand market potential for new species
- Action 3.2.4. Perform trials to measure key traits and feasibility of genetic improvement

Goal 3.2 Milestones and Deliverables

1. Within one to two years, identify candidate species and secure pilot funding for initial assessments
2. Within three to four years, secure funding for measuring trait values and economic potential
3. Within five years, establish feasibility of aquaculture production based on biology/production/economics

Goal 3.3. Monitor and mitigate threats from insect-derived threats to crops, focusing on large-acreage systems.

- Current: Action 3.3.2. Identify reliant and stable pest management approaches that mitigate threats from established and invasive insect pests region-wide.
- Should be: Action 3.3.2. Identify resilient and stable pest management approaches that mitigate threats from established and invasive insect pests region-wide.

Milestones and Deliverables:

1. Within one to two years, augment databases with special attention to measuring IPM benefits of natural enemies of pest insects and insect pollinators.
2. Within three years, develop models that evaluate insect pest risk, and deploy models with pest risk forecasting features for authentication in large-acreage cropping systems of the region.
3. Within five years, adapt models that evaluate insect pest risk to other large-acreage cropping systems.

Strategic Priority 4 - Promote research to connect agriculture to human health

Goal 4.1. Improve and execute field screening methodologies to assess aflatoxin and fumonisin (mycotoxin) risk of corn inbreds and hybrids as influenced by biotic and abiotic stresses.

- Action 4.1.1. Continue collaborative research with Texas A&M AgriLife corn breeder in Lubbock to evaluate elite hybrids for susceptibility and resistance to aflatoxin and fumonisin as caused by Aspergillus flavus and Fusarium verticillioides, respectively, in South Texas stress environments in the field.

- Action 4.1.2. In collaboration with Lubbock corn breeder, expose corn hybrids to tightly managed (scheduled irrigation) in South Texas field environments to assess response to biotic (primarily insect) and abiotic (heat) stress.

Goal 4.1 Milestones and Deliverables

- Within 1-2 years, probable co-author in inbred line releases with Lubbock corn breeder Wenwei Xu. This is based on previous year and ongoing field assessments in South Texas and other Texas environments.

		Crops	Animal Sc.	Mariculture	Total
Strategy one	Basic Research, innovations	2	0	2	4
Strategy two	Sustainable Production Systems	5	1	0	6
Strategy three	Economic Strength	1	0	2	3
Strategy four	Nutrition and Human Health	1	0	0	1
Center Totals		9	1	4	14

Figure 1. summary Texas A&M AgriLife Research and Extension Center at Corpus Christi

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

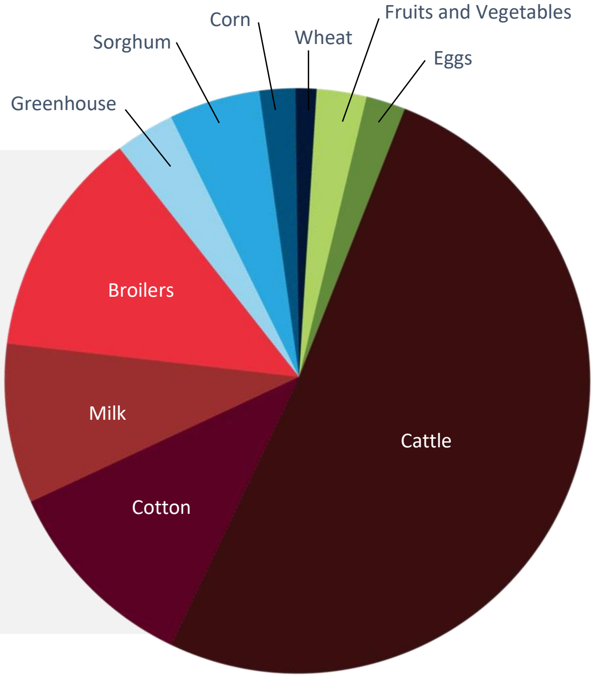


Figure 2. Texas top 10 commodities in terms of market value

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."