STRATEGIC PLAN

Texas A&M AgriLife Research and Extension Center at Dallas

TEXAS A&M AGRILIFE RESEARCH

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STRATEGIC PLAN: TEXAS A&M AGRILIFE RESEARCH AND EXTENSION CENTER AT DALLAS

About

More than 80 percent of Texas' residents live in urban environments. The Texas A&M AgriLife Research and Extension Center at Dallas, located in the heart of the Dallas–Fort Worth Metroplex, is the sole urban regional center of its kind among 13 managed by Texas A&M AgriLife. The center at Dallas is dedicated to increasing the sustainability of urban living through its internationally recognized research and outreach initiatives. The center's programs address the preservation and wise use of critical resources through the development of urban food production through controlled environment systems, water efficient turfgrasses, technologies for low impact development, stormwater management, water conservation, and healthy human living. The center partners with national, state, and local governmental bodies, schools, international corporations, commodity groups, regional businesses, non-profit organizations, private companies, and citizens to deliver world-class research and outreach that advance sustainable living in urban Texas, the U.S., and the world.

Mission

Our mission at the Center at Dallas is to promote sustainable urban agriculture, water and land resource management, and healthy living through innovative research and science-based solutions.

We strive to develop and apply cutting-edge technologies that enhance the resilience of agriculture in the face of biotic and abiotic stress, improve microclimate control systems for efficient food production, develop resource management practices to be better stewards of our water and lands, and improve the health of Texans.

We are dedicated to meeting the challenges of land, labor, and climate change within the food, energy, and water nexus, with a forward-thinking and responsive approach that addresses the needs of our stakeholders, collaborators, and the community. We work in close partnership with The Texas A&M University System, government agencies, international organizations, and private enterprises to drive progress and bring solutions to stakeholders.

We believe in supporting the personal and professional growth of all our employees, and in promoting translational and applied research -through education to students and the wider community. Our goal is to contribute to a healthier, more sustainable future for all.

Goal

Enhance the lives of Texas by integrating innovative technologies, optimizing productivity, and promoting sustainability with a focus on urban agriculture, water and land resource management, and healthy living.

STRATEGIC PRIORITIES AND DALLAS ACTIVITIES

The Texas A&M AgriLife Research and Extension Center at Dallas's research activities align with the strategic priorities of Texas A&M AgriLife Research.

Synergistic Interactions Between Priorities

These four research priority areas interact synergistically to deliver healthy living to Texans (Figure 1). Innovative research is the foundation of this strategy, which operates at the nexus among agriculture, environmental and human health by cultivating science-based solutions to develop sustainable, profitable, and resilient agriculture and horticultural systems that provide affordable, high-quality, nutritious food and improve quality of life.
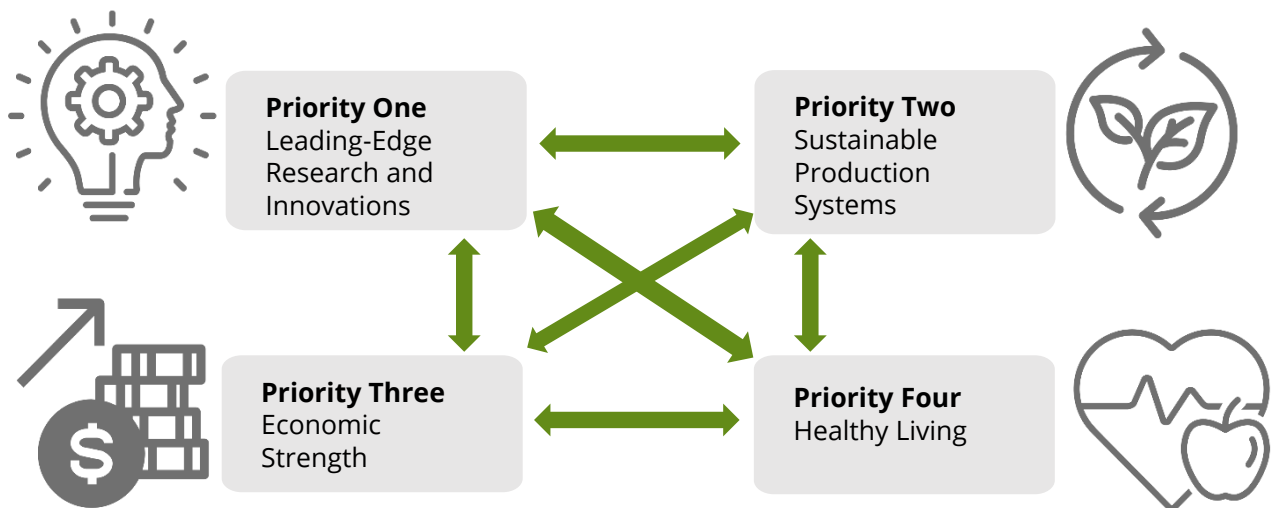

Figure 1. Synergistic interactions among our four research priority areas

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 and Milestones

The Center at Dallas will work with other Texas A&M AgriLife units and its federal, state, and international collaborators to strengthen its research capabilities in the following areas:

- – Controlled environment agriculture (CEA)
- – Artificial intelligence, robotics and "big data" analytics
- – Turfgrass and horticulture breeding
- – Plant immunity and integrated pest management
- – Greenhouse and field research
- – Water and land resource management
- – Healthy living

The Center at Dallas will strengthen its research infrastructure as follows:

- Construction of 12,000 sq. ft. state-of-the-art CEA research greenhouse complex
- Renovation of 25,000 sq. ft. Healthy Living Building
- Renovation of Turfgrass Research Building
- Strategic investments in next-gen production equipment including drones, sensors, and robots
- Addition of field infrastructure including hoop houses and high tunnels
- Assessment and renovation/replacement of existing greenhouse infrastructure
- Strengthening of business and facilities support staff by the addition of three recent new hires: an administrator, a greenhouse manager, and a business associate.
- Strategic hires in Urban Ag:
  - o CEA Entomology (ongoing)
  - o CEA Breeding (ongoing)
  - o CEA Horticultural Physiology
  - o CEA Microbiome
  - o Plant Genomics
  - o Plant Phenomics
  - o Computational Biologist
  - o Turfgrass Extension Agronomist
  - o Water and Urban Resilience
  - o Plant Pathologist

The Center at Dallas will strengthen the capabilities of its faculty and support staff by encouraging the following:

- Active recruitment efforts, including addition of graduate student fellowships
- Participation in inter- and multidisciplinary collaborative research project proposal writing workshops and courses
- Participation in project implementation, management, and reporting workshops
- Engagement with The Texas A&M University System Sponsored Research Services procedures, AgriLife Administrative Services, Intellectual Property and Commercialization office, and the office of Corporate Engagement and Research Support

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 and Milestones

The Center at Dallas will continue the development and dissemination of translatable, internationally recognized research aimed at enhancing sustainable food production in both controlled environments and open field systems and developing resource-use-efficient and stress-tolerant turfgrasses by:

- Investing in state-of-the-art greenhouse infrastructure (facilities, equipment, intelligent environmental control systems)
- Adding strategic programs within the urban agriculture pillar with faculty hires in CEA horticulture, turfgrass and agronomy
- Integrating with existing or emerging programs within Texas A&M University and Texas A&M AgriLife Research and Extension in the areas of CRISPR technology and gene editing, gene discovery, soil and plant health, AI and robotics, food safety and nutrition

- Maintaining and expanding collaborative linkages with partners at the local, state, federal and international levels
- Expanding linkages within CEA and turfgrass industries to develop public-private partnerships to drive technology and innovation
- Engaging in community education programs, especially in food deserts or areas with limited food access

STRATEGIC PRIORITY THREE – ECONOMIC STRENGTH

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

Goals and Milestones

Investigators at the center at Dallas will continue and expand crucial and strategic research in CEA including hydroponics, vertical and indoor farming, greenhouses, and high tunnels. Research will:
- focus on CEA engineering, breeding, entomology and crop physiology, plant immunity, plant genomics, turfgrass breeding and water and land resource management
- lead to dissemination and advances in resource-use-efficient, healthy, and profitable food systems
- surveillance and control of devastating plant pest and diseases
- breed more resilient, sustainable turfgrass cultivars
- breed nutritious fruits and vegetables with water, nutrient and light use efficiency

## STRATEGIC PRIORITY FOUR – HEALTHY LIVING

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

Goals and Milestones

- The urban horticulture team will advance research aimed at improving fruit and vegetable production and quality, eliminating pests and diseases, and increasing resource efficiency through controlled environment agriculture. This will lead to increased healthy food systems and availability in urban environments.
- The turfgrass breeding team will continue to develop new cultivars aimed at increasing water use efficiency and heat tolerance. As the top urban agricultural

product in urban areas, turfgrass is key to cooling cityscapes and enhancing the health of Texans.

- The water and land resource team leads the nation in developing water use management strategies, increasing sustainability and ensuring water availability for the next generation of Texans.
- The healthy living team, in collaboration with the Texas A&M AgriLife Institute for Advancing Health Through Agriculture will enhance the effectiveness of community and healthy behavior interventions by developing, adapting, and evaluating healthy living programs for various populations using community-informed approaches. The healthy living team will develop strategies to disseminate and sustain novel, evidence-based healthy living programs tailored to various populations and settings.
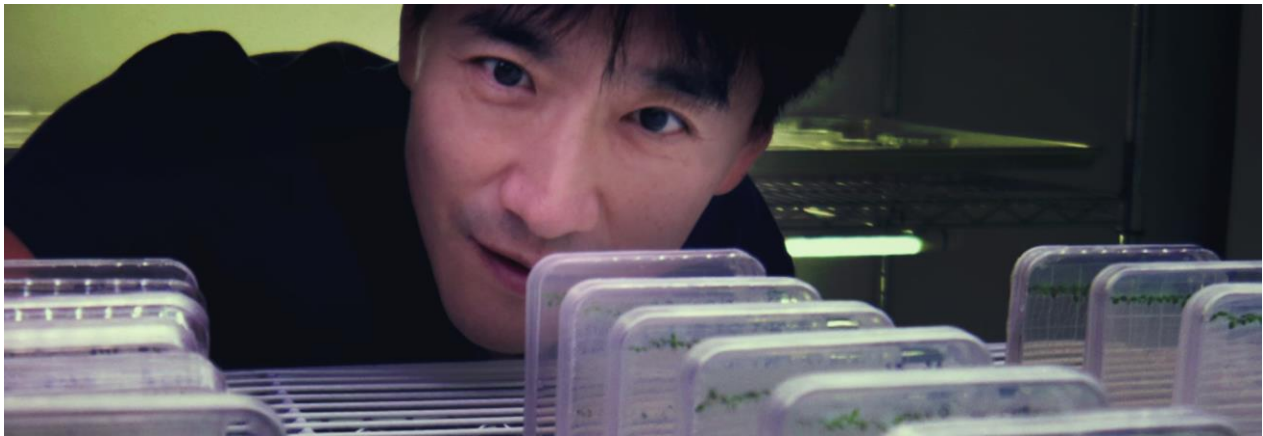
APPENDIX: TEXAS AGRICULTURE, NATURAL RESOURCES, THE FUTURE

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.

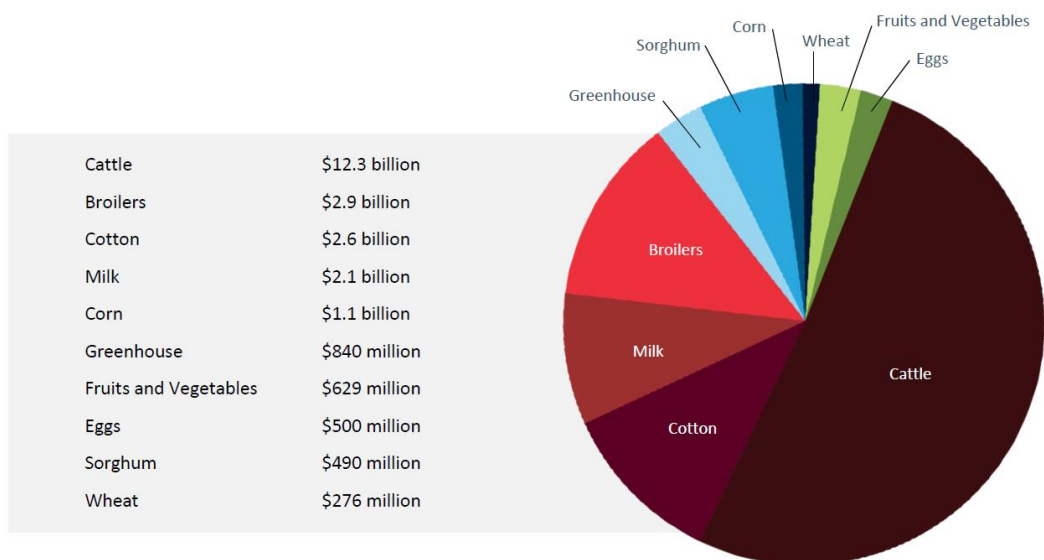|	
Cattle	$12.3 billion
Broilers	$2.9 billion
Cotton	$2.6 billion
Milk	$2.1 billion
Corn	$1.1 billion
Greenhouse	$840 million
Fruits and Vegetables	$629 million
Eggs	$500 million
Sorghum	$490 million
Wheat	$276 million

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

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.

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 grazing land, 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."