TEXAS A&M AGRILIFE RESEARCH STRATEGIC PLAN

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Texas A&M AgriLife Research Strategic Plan

Strategic Priorities Task Force 6: Our Charge

Texas A&M AgriLife Research assembled a task force to complete an aspirational strategic plan for the agency. The task force was also responsible for reviewing AgriLife Research's vision and mission statements, and to propose strategic research priorities that elevate the agency's impacts for all Texans and beyond.

The goal of Texas A&M AgriLife Research is to become the most recognized national authority in agriculture. The agency aspires to develop resilient agricultural systems that provide affordable, high-quality, and nutritious food while protecting natural resources and strengthening communities and their agricultural-based economies.

Following in-depth discussions, comprehensive constituent engagement, and an analysis of strengths, weaknesses, opportunities and threats (SWOT), the task force recommends implementing an adaptive strategic planning process to achieve these goals.

Internal and External Surveys

A subcommittee was formed to develop a questionnaire and conduct internal and external surveys of the strengths, weaknesses, opportunities, and threats (SWOT) of Texas A&M AgriLife-Research for consideration in an adaptative strategic planning process. Stakeholders and faculty members were involved in the survey. A total of approximately 360 faculty and research staff responded to the internal survey and 250 persons responded the external survey. A report of the surveys will be produced by August 31, 2021.

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Adaptive Strategic Planning

Adaptive strategic planning is a process that applies integrated core values to responses to varying opportunities and challenges. This process enables innovation, creativity, scientific excellence and public service through inclusive leadership and teamwork.

Adaptive strategic planning can improve Texas A&M AgriLife Research's established research procedures and strategies. This can be accomplished by modifying traditional research management tactics and learning to adapt more intuitively, taking advantage of the input of an exceptional agricultural faculty and staff.

Effective adaptive strategic planning requires mechanisms that promote innovative ideas that are evaluated in an iterative process, leading to continuous improvements in action plans and delivered outcomes.

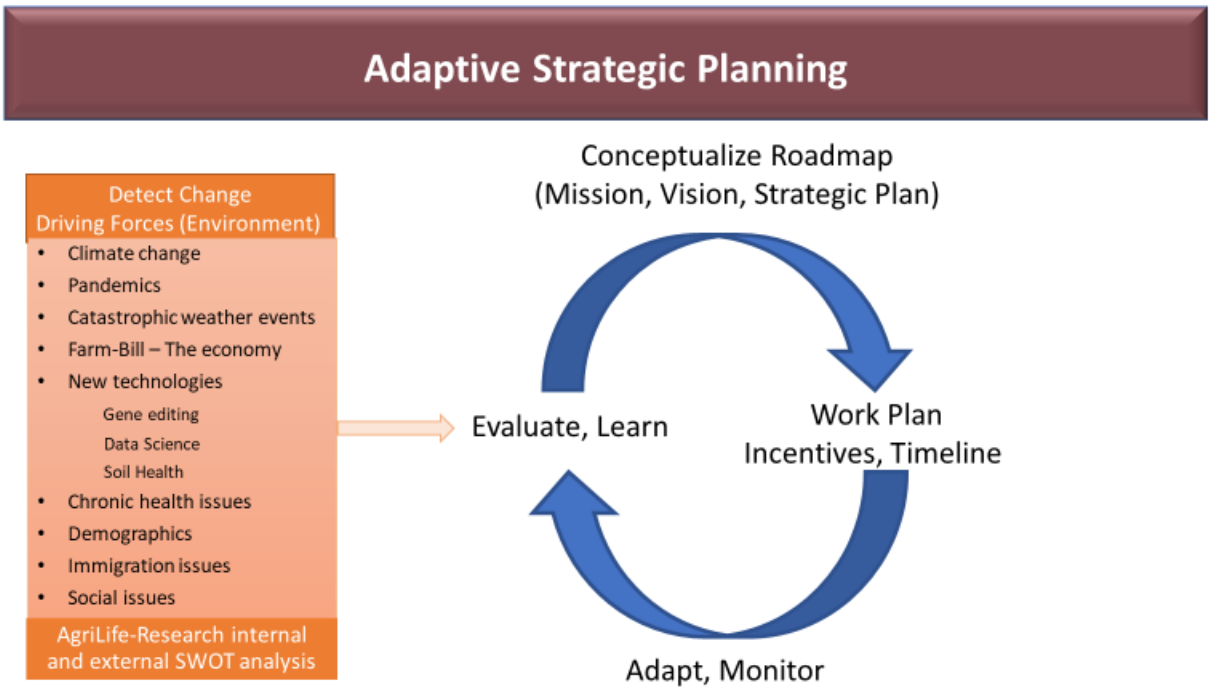


Figure 1. Dynamics and mechanisms of the proposed adaptive strategic plan

An adaptive strategic plan evaluates and responds to new relevant information with implications for Texas A&M AgriLife Research's portfolio (Figure 1). Our proposed mechanism will:

- Invite innovative ideas and proposals for critical evaluation of potential outcomes and impacts using transparent metrics of success

- Develop action plans and define objectives, timetables, and incentives for meritorious proposals

- Adapt, monitor, and evaluate progress in gains made by Texas A&M AgriLife Research's research portfolio arising from strategic shifts in the plan

- Detect changes, learn, survey, and explore the environment to identify and gauge driving forces and new technologies

The adaptive strategic plan will use a defined process, carried out by a small independent and critical group of Texas A&M AgriLife Research leaders, to rapidly advance meritorious ideas through the evaluation and refinement processes for presentation to decision-makers.

Structural Recommendations:

- Form a Strategic Planning Committee (SPC).

- To be efficient and proactive, the SPC will consist of a Chairperson and a small number of thought leaders, all appointed by the Vice-Chancellor.

- The Chairperson will be the convener of the SPC and have the responsibility to manage committee operations.

- The SPC will review the strategic plan developed by the Task Force and consider refreshing the plan on an annual basis, and as situations arise, for Texas A&M AgriLife Research to move easily in another direction.

- The SPC will invite, encourage, and nurture ideas that are broad and involve significant components of Texas A&M AgriLife Research through internal and external stakeholder engagement.

- The SPC will provide resources to facilitate white paper concept development in a timely way. To generate new ideas and to move into new directions, the SPC will gather interested parties, retain expert consultants, and fund workshops and symposia to distill new ideas into action plans. The Chairperson must be proactive in soliciting ideas and organizing appropriate venues to actively encourage and engage broad discussions among faculty, the Council of Resident Directors (CORD), Department Heads, and Institute and Center Directors.

- The SPC will entertain proposals involving complex/multidisciplinary research opportunities that reach beyond a single administrative unit. The SPC will focus on novel research-oriented activities and operational innovations. The Vice Chancellor will determine if funds are available to pursue these activities.

- SPC will develop its criteria for evaluating the strategic significance of an idea, identifying relevant capabilities and deficiencies inherent in proposals, and provide a financial analysis for the Vice Chancellor's final decisions. Criteria and assessment methods will be made transparent to all members of Texas A&M AgriLife Research.

- The SPC will provide Texas A&M AgriLife Research leadership with prioritized proposal white papers.

Background and Introduction

Our Roadmap

Vision
Healthy lives and livelihoods improved through abundant, affordable, and high-quality food and agricultural products in Texas and the world.

Mission
Create, learn, and share knowledge about agriculture and the life sciences that nourishes health, strengthens communities, protects natural resources, and supports economies.

Core Values
Leadership, respect, loyalty, integrity, scientific excellence, creativity, innovation, inclusiveness, agility, facilitating teamwork, accessible, responsive, and exemplary public service.

These values reinforce Texas A&M AgriLife Research's commitment to delivering cutting-edge scientific tools and innovative solutions for Texas producers, industry members, and both urban and rural communities to support the nourishment and well-being of all people. These efforts lead to the stability and continual enhancement of our state's agroecosystems and natural resources, further ensuring the economic competitiveness and excellence of agriculture and human health.

Strategic Research Priorities

Texas A&M AgriLife Research is working to find innovative solutions that will create *adaptive agricultural systems* — systems that can meet the demand of a growing population, changing climate, fluctuating economic conditions, unpredictable geopolitical environments, declining resources, and public health crises. Our strategic research plan aims at making fundamental scientific discoveries and applying them to create new technologies that will enhance the sustainability and resilience of adaptive agricultural systems. These efforts provide the translational research necessary for the development and production of high-quality, safe, and sustainable food and fiber systems with local, national, and global impact. These agile systems can meet the needs not only of food and fiber, but also of clean water and air, functional landscapes, improved health and well-being, and the sustainability of resources for generations to come. This strategic plan includes the discovery, dissemination, and adoption of evidence-based research focused on the intersection of nutrition, human health, and agriculture.

In 2021, the Institute for Advancing Health through Agriculture (IHA) was established to advance science at the intersection of the core priority areas described below. 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. After reviewing the vision and mission, evaluating the competitive advantages, and considering the context of the obstacles to sustainable systems, the following four broad priority areas became clear:

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

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

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

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

These four research priority areas interact synergistically to deliver healthy living to Texas citizens (Figure 2). 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.

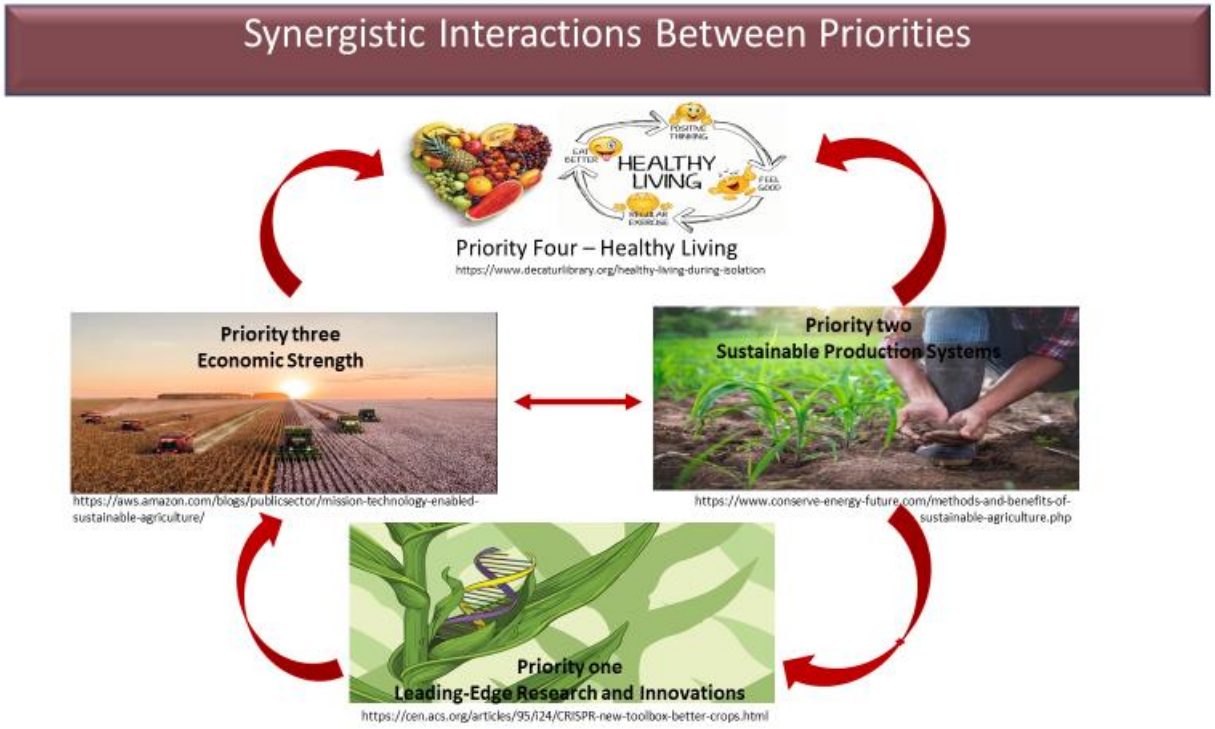


Figure 2. Synergistic interactions between our four research priorities areas

Texas Agriculture

By 2050, the U.S. and world population are expected to increase by 30 percent and global real incomes per capita are expected to double. Population and income growth translate into a 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. Agricultural productivity has increased dramatically over the years. Today's farmers produce 262 percent more food with 2 percent fewer inputs as compared to 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 cost benefits exist for investments in U.S. public agricultural research.

Rapid agricultural productivity increases, relative to increases in other food sectors of the U.S. economy, have translated into falling real prices of food consumed at home. For example, from 1948 – 2018, the share of U.S. household income spent on food at home declined from 22.3 to 6.4 percent, while total consumption of food increased. With Americans spending 6.4 percent of their income on food, the other 93.6 percent 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 throughout the world largely tells a story about increasing agricultural productivity. The U.S. is the largest exporter of agricultural products. Since 95 percent of the world population lives outside the United States, 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 terms of market value are cattle, cotton, milk, broilers, greenhouse, sorghum, wheat, fruits, and vegetables, and eggs (Figure 3). Additionally, agriculture related activities such as hunting, fishing and recreation, among others is worth over $2 billion.

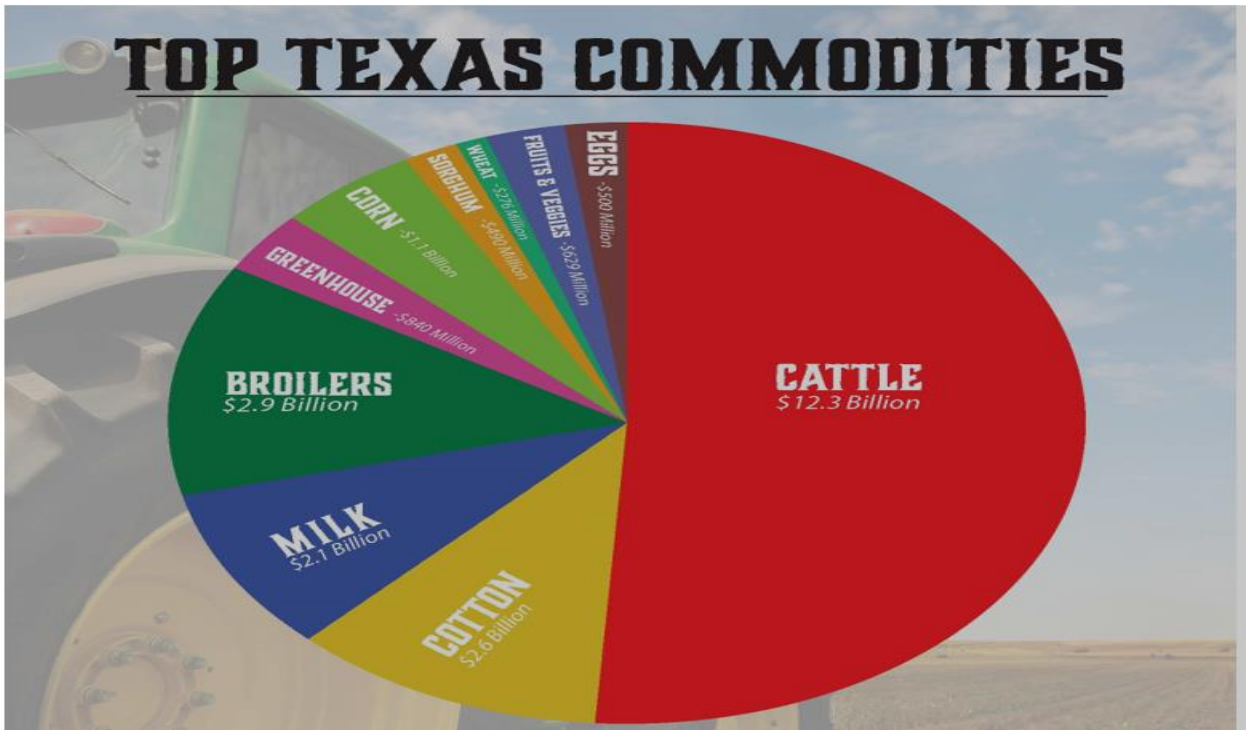


Figure 3. Texas top ten commodities in terms of market value.
(https://www.texasagriculture.gov/About/TexasAgStats.aspx)

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 a significant number of 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.

Texas is becoming an urban state as it has 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 percent of the total, which means that around 25 million people live in urban areas.

The COVID-19 global pandemic cause by the SARS-CoV-2 virus pushed the world several years prematurely into cyberspace and wreaked havoc on the global food supply chain, causing tremendous decreases in food security and Texas was no exception. COVID-19 exposed Texas citizens' poor health

status in terms of obesity, hypertension, diabetes, heart diseases, and other chronic diseases related to diet and nutrition. COVID-19 also exposed the need to examine food production and distribution systems, uncovering the necessity of 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 multi-factorial disruptions at one time throughout the supply chain.

We are keenly aware that hunger, specifically undernutrition, is one of the most important global issues of our time. It is both a cause and a symptom of poverty, and 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, Texas A&M 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 Texas A&M 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 Texas A&M AgriLife Research is positioned to anticipate and respond to critical needs and emerging challenges.

Texas A&M AgriLife Research's roots are firmly embedded in production agriculture and natural resources. We seek to expand the focus of the agency 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 is to integrate basic and applied research to create **"healthy lives and livelihoods improved through abundant, affordable, and high-quality food and agricultural products in Texas, and the world".**

Texas A&M AgriLife-Research,

Our Competitive Advantages

Texas A&M AgriLife Research is the leading research and technology development agency in Texas for agriculture, natural resources, and the life sciences. Since 2017, Texas A&M AgriLife Research has been ranked #1 by the National Science Foundation among its peers regarding federal funding in agricultural sciences and natural resources conservation. Texas Agriculture is supported by Texas A&M AgriLife Research's fifteen departments, thirteen Research and Extension centers, and eight institutes fully staffed with approximately 417 academic faculty and 210 support Research Scientists and post-docs.

In addition, Texas A&M AgriLife Research manages several state-of-the-art core research facilities, such as:

- AgriLife Genomics & Bioinformatics Service, which provides support to researchers on nucleic acid sequencing and genotyping;
- Texas A&M Institute for Genomic Medicine, where animal models can be used to address chronic diseases;
- Biomolecular Nuclear Magnetic Resonance Laboratory, which focuses on modern spectrometry to study biological macromolecules and subatomic particles;
- National Center for Electron Beam Research facility which engages with the food industry and with NASA to examine how non-ionizing irradiation can be used to enhance the safety and shelf-stability of foods; and
- Multi-Crop Transformation Facility where modern plant genetics can be studied in cell culture and then stimulate those cells to develop whole rooted plants for testing in the field.

The research carried out by AgriLife scientists is applicable to a variety of systems, providing solutions to agriculture- and life-science-related challenges at the state, national, and international levels.

Texas is geographically and climatically diverse. The state, therefore, provides a platform for Texas A&M AgriLife Research scientists to develop solutions relevant to a vast array of global agricultural issues. Variations in precipitation and humidity, elevation, salinity, soil textures, solar radiation, and average daily temperatures across Texas make statewide research relevant to most of the world's ecosystems and overall global issues. Diverse sources of funding enable Texas A&M AgriLife Research to research agriculture-related matters of importance to Texas, the nation, and many other countries, as well. A sample of the many possible researchable areas include:

- Improving the efficiency of food production while conserving soil, water, and natural resources
- Genetic improvements of plants and animals
- Developing novel food processing technologies
- Pathogen and pest control strategies

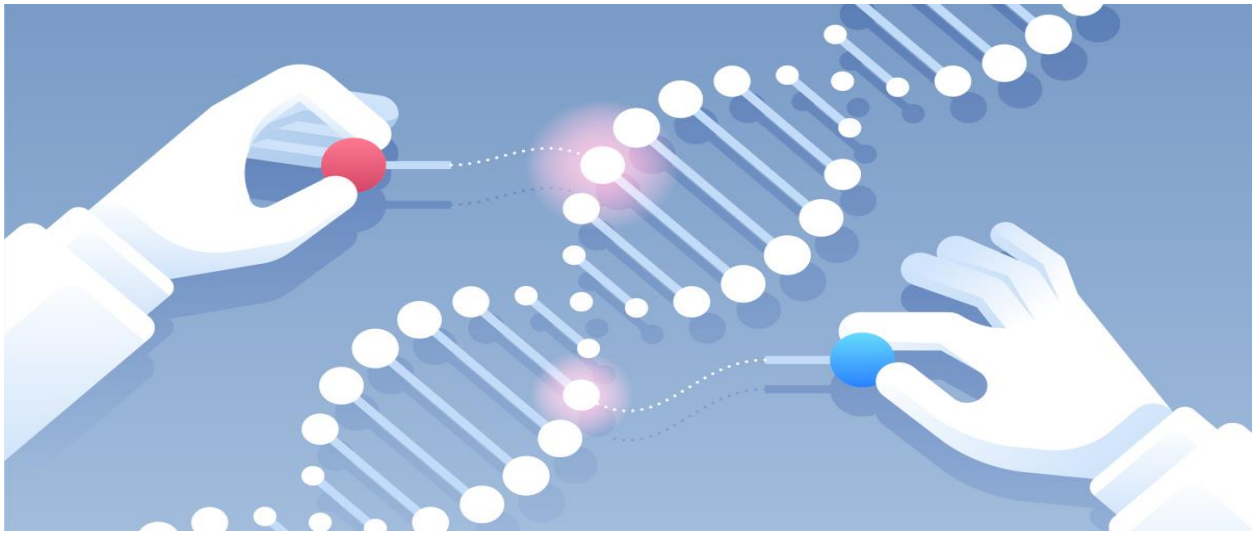
- Bioenergy
- Zoonotic diseases
- Animal and human nutrition
- Production economics
- Trade
- Effects of climate change on all the above
- Policies to help mitigate the effects of climate change

Through enduring investments in research, Texas A&M AgriLife Research has accumulated growing volumes of data from genomics, phenomics, phenotyping to livestock, field crops, and rangeland management. This availability of unique data presents a marked, if not unique, occasion to identify research focal points that will address agricultural threats and opportunities. Appropriate big data analyses that coordinately integrate perspectives of agriculture, biology, physics, mathematics, computer sciences, and engineering can provide the necessary insight and understanding to illuminate key current and future opportunities and challenges in food production.

Strategic Research Priorities

Priority One

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



(https://bitesizebio.com/47927/history-crispr/)

Priority One is focused on generating ***cutting-edge discoveries, knowledge and other resources in plant, animal, and natural resource systems that are foundational to translational agricultural and ecological systems, and life sciences research.*** New discoveries and technologies must be assimilated into research if they are to catalyze mission-relevant innovation, discovery, and resource development. Major advances have occurred in new genetic, genomic, molecular, bioinformatics, imaging, spectroscopy, big data, communications, robotics, and artificial intelligence technologies. Their ramifications on agricultural and ecological systems, and the life sciences will be multi-dimensional and diverse. For example, advances in imaging and robotics have rapidly expanding footprints in diverse areas of contemporary basic and applied research. Also, some advances are already being utilized to create, discern, categorize, and apply biological, genetic, and epigenetic variations, and to discover their mission relevance. Research and engineering that integrates new knowledge, technologies and instruments is often key to their applicability in science and application. New technologies, including but not limited to new genetic and genomic technologies, must be integrated into efforts that harness existing genetic diversity in plants and animals for profitable, productive, and sustainable solutions that are appropriate for evolving production systems. Goals include developing new technologies and identifying genetic resources to improve the performance of plants and animals. This may also include using new technologies and biodiversity to produce new varieties or breeds that meet the needs of sustainable production systems with attention to the impacts of climate, unpredictable weather events, and disease on local communities.

Priority One also addresses the need to access, contribute, assemble, and use relevant data and information involving crop and animal germplasm, agroecosystem expertise, climate, and biotic and

abiotic stresses to develop and assess the site-specific suitability for producers, as well as evaluate long-term health and the environmental risks related to new varieties/breeds.

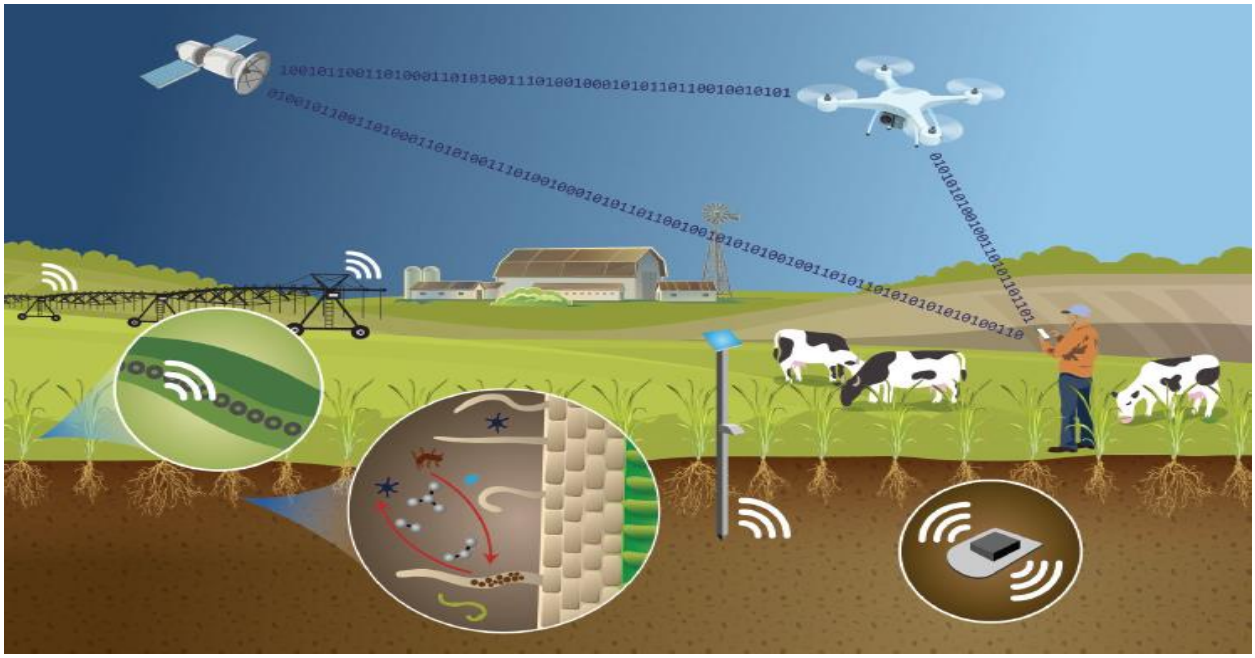
Research includes, but is not limited to:

- Plant and animal improvement using latest technologies, such as genome editing, bioengineering, synthetic biology, and breeding tools
- Gene editing systems – develop methods to create valuable mutations in model and non-model organisms and/or cell lines
- Gene drive systems – develop means to control pests, pathogens, parasites, or vectors
- Characterize natural and induced plant diversity more comprehensively and in new dimensions
- Animal and plant genetics – Improve productivity, disease resistances and nutritive values
- Plant and animal health, microbiomes, endophytes, and beneficial interactions
- Animal diseases (endemic, zoonotic, emerging, re-emerging, and foreign) -- detect, mitigate, control, or eradicate
- Existing and emerging plant diseases and pathogens (e.g., insect-vectored, fastidious), detection, identification, control, prevention and/or treatment
- Bioenergy/biofuels – new value-added bioproducts and processes

Expected outcome:
Leading-edge research and engineering conducted in this priority would empower the discovery of new knowledge, development of new technologies, and creation of science-based solutions to achieve economic efficiency, resiliency, and sustainability of food production systems. The use of genomics/bioinformatics, modern genome-editing, bioengineering, and breeding tools combined with the benefits of exploring genetic diversity and data science would be the groundwork to further improve animal and plant varieties. Big data, AI, model systems and other approaches that lend themselves to robust inferential approaches may be especially valuable in efforts to ameliorate problems that have been most recalcitrant to conventional approaches (e.g., understanding and improvement of crop root systems). Priority One research will increase understanding of animal, soil, and plant microbiomes and benefits to the food production system. It would also lead to gaining fundamental knowledge in early, rapid detection, mitigation and prevention of plant and animal diseases, mitigation of biotic and abiotic stresses, including enhanced nutritional value of foods.

Priority Two

Provide the translational research necessary for the development and production of high-quality, safe, and sustainable food and fiber systems with local, national, and global impact.



https://www.nap.edu/catalog/25059/science-breakthroughs-to-advance-food-and-agricultural-research-by-2030, pp. 150

Priority Two is focused on ***agricultural productivity and environmental sustainability***, which are key components of resilient production systems. This priority takes advantage of new discoveries and scientific advances that generate a wealth of information on components of agriculture systems. For instance, CRISPR technology allowed for the creation of more diverse crops and livestock, permitting the development of new food sources and traits. Innovative crop and animal production systems can lead to improved carbon sequestration strategies and these, in turn, make agriculture systems more resilient to biotic and abiotic stresses, increase yields, and enhance quality of food, feed, and fiber. Agriculture is a sector that has the potential to be a net sink for greenhouse gases because of the ability to sequester carbon in soil and plants and reduce methane and nitrous oxide emissions. Conservation agriculture, crop rotations and residue management, animal agriculture and minimizing food waste are practices that can increase productivity and have economic, environmental, and social benefits. Although, carbon credit markets will need effective methods to quantify and verify changes in soil carbon stocks. Successful research programs working within this priority would require transdisciplinary teams that can integrate knowledge and tools from the life, health, and social sciences with engineering and computing sciences, thus creating the synergistic effect that exists at the interface of multiple disciplines.

Research includes but is not limited to:

- Soil health – sustainability, reducing loss and degradation

- Soil-plant-resiliency – increasing soil organic matter and improving microbiome interactions
- Optimizing the use of water in crop production
- Increasing nutrient use efficiency in crop production systems
- Animal epigenetics, reproduction, nutrition, and welfare
- Precision livestock production systems
- Precision crop production systems
- Carbon sequestration promotion/quantification methodology
- Agriculture production under protected environments
- Using systems approach for digital in-season crop management systems
- Digital forage/livestock production systems
- IoT and connectivity in Agriculture
- Responsive agriculture
- Role of pathogens in food and food safety and security

Expected outcome:
Priority Two takes advantage of leading-edge research, technologies, and genetics to provide the translational research necessary for developing and producing high-quality, safe, and sustainable food and fiber systems with local, national, and global impact. Sensor and remote sensing technology (e.g., unmanned vehicles, connectivity) will enable rapid detection and monitoring of processes across all areas of the food production chain, resulting in:

- Advanced machine-learning-based high throughput phenotyping system
- In-season (satellite-based) large area prescription management (automation) and yield forecast systems
- Controlled environment agriculture (cea) for horticultural crop production systems
- Precision livestock farming
- Nutrition modeling
- Artificial intelligence (decision support systems)

Work in this area would require transdisciplinary cooperation to integrate components of the food system into a functional and sustainable production enterprise.

Priority Three

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

https://gpnmag.com/article/maximizing-hydroponic-crop-production/

Priority Three is focused on ***economic strength and profitability*** of the food production systems. While this system has, at times, been strained by drought, freezing weather, labor and trade issues, and more recently by catastrophic weather events and a global health crisis, it is resilient. It continues to produce and deliver a variety of nutrient-dense foods needed to maintain our health. U.S. consumers are blessed by the abundance and relatively low cost of food, expending only 6.4% of their income on food at home. The diversity of Texas' food supply is one of the state's greatest strengths. As the food supply chain has faced these challenges, seeking opportunities to conduct research that focuses on providing a diverse consumer-oriented food supply has enabled the state to offer the public other food sources – such as animal meat protein, milk, grains, and fruits and vegetables – and food delivery methods. Research conducted under this priority will lead to new production systems that are resilient to environmental constrains, and identification of new and expanding markets capable of providing healthy, safe-to-eat, locally produced food.

Research includes but is not limited to:

- Profitability of controlled environments agriculture systems under greenhouse or protected environments (hydroponics, aeroponics, vertical farming, plant factories)
- Optimizing animal and plant production systems from agriculture to consumer use
- Developing food processing and safety procedures to enhance agricultural product diversity
- Alternative, abundant, and high-quality water sources
- Relationship between energy availability and economic strength
- Carbon Credit strategies for producers
- Water policies/pricing/demand
- Economic and cost-benefit analysis
- Agriculture and food policy analysis

- International market opportunities and challenges
- Transportation and infrastructure challenges

Expected outcome:
Priority Three will result in better understanding how changes in production environment and agriculture policies affect the profitability and resiliency of the food supply chain. Economic and cost-benefits analyses will serve to guide producers, consumers, and policymakers on the economic viability of new plant and animal production systems, considering socio-economic production constraints, as well as transportation and infrastructure needs. Constant feedback between this priority and priorities one, two and four is paramount for the economic and environmental sustainability of the Texas production system. Economic and sustainability analyses will allow more efficient allocation of precious resources by identifying current and future opportunities and threats to satisfy the constantly growing food, nutrition, and human health demands and challenges for Texas and the world.

Priority Four

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

https://www.verywellfit.com/nutrition-basics-4157080

Priority Four is focused on ***nutrition and human health***. Food contains macro and micronutrients that are essential to provide energy, to meet physiological needs and functions, and to help prevent or mitigate the burden of many chronic diseases. The consumption needs of humans are complex. Therefore, understanding the interactions between food access, availability, choice, consumption, and composition—in the context of individualized nutrition needs and the growing food system demands globally—is critical to supporting food environments and product development that meet consumer preferences and nutritional needs, thereby optimizing human health throughout their lifespan.

Supporting food system optimization to achieve economic, environmental, and human health also includes consideration to food waste and food safety. Food waste is responsible for billions of dollars lost in food productivity and availability for consumers. In addition, food safety issues add to these losses in terms of human distress. According to the Centers for Disease Control and Prevention, food borne diseases cause approximately 50 million illnesses, and contribute to more than 125,000 hospitalizations and about 3,000 deaths in the United States alone each year.

Research includes, but is not limited to:

- Discovering evidence relating nutrients in food and human disease prevention
- Precision nutrition and health across the lifespan
- Consumer preferences and acceptances in diverse populations

- Community-engaged intervention, development, and testing
- Dissemination, including implementation science and policy-related initiatives
- Technology innovations to capture real-time consumer responses to interventions
- Targeted message delivery to test or support behavioral adoption/adherence
- Facilitation of the translation of effective interventions with relevant systems and partners (Extension; healthcare; public health; community-based organization)
- Nutritional optimization of foods in the marketplace
- Food waste/losses/mitigation
- Food safety/security
- Food design engineering – packaging, conservation

Expected outcome:
Focused on nutrition and human health, Priority Four integrates fundamental knowledge and new discoveries from the other priority areas to create an interdisciplinary pathway toward cutting-edge innovations, translational research, and a broad spectrum of dissemination strategies that advance human health through agriculture and food system optimization. Work in this area is expected to:

- Illuminate consumer preferences, acceptance, and demand in diverse communities
- Rigorously evaluate the effects of prescriptive diets and/or nutritional products on a variety of health-related outcomes
- Develop technology and tools that enable consumer adoption to personalized dietary and related health recommendations
- Identify mechanisms by which pathogens in food and animals contribute to food safety issues, and development food safety mitigation strategies
- Facilitate the adoption of relevant programs and approaches to improve public health through nutrition