

**Mission Statement:** To develop new knowledge and tools through basic and translational research to benefit consumers and expand agricultural sustainability, profitability, and environmental stewardship.

**Vision Statement:** We will be foremost among peer research organizations—both nationally and internationally—as leaders in the discovery and application of agricultural and life sciences. Our discoveries, development, and transfer of innovative technologies will produce economic, environmental, and health benefits that are key to Texas’ success and vital in the lives of its citizens.

## **Imperatives, Goals, and Strategies**

### **1. Sustain Healthy Ecosystems and Conserve our Natural Resources:**

As the population of the State continues to grow, it is imperative that Texas AgriLife Research scientists conduct research that strengthens the economy, sustains and restores healthy ecosystems, conserves natural resources, ensures prosperity, and enriches the quality of life for the present and future generations of Texans.

#### 1.1. Protect water quality and increase the amount of water available for urban and rural use through new technologies and approaches.

Quantity and quality of water are inextricably linked to agricultural production systems, energy industries, urban development, recreation, ecosystem health, and a host of societal issues. We will provide data, technologies, and management systems to conserve, enhance, and protect this essential resource.

1.1.1. Provide data for the development of a market-based program focused on increasing water yield from private lands through rangeland restoration.

1.1.2. Discover new technologies and tools to improve efficiency of irrigation, breed drought tolerant varieties of crops, develop water efficient cropping systems, and enhance processing technologies for recycling water used by urban communities, industries, and by intensive animal agriculture.

1.1.3. Strengthen existing and develop new methods to evaluate the risk of, to mitigate, and to control waterborne pathogens.

1.1.4. Conduct and facilitate research to improve information and management to reduce impacts of extreme events such as flooding and drought, and to

meet the needs of adapting to short-term or long-term climate changes and variations.

- 1.1.5. Improve identification of sources of salinity or excessive nutrients in key Texas watersheds and produce plants and management systems that enable producers to utilize water of impaired quality.
- 1.1.6. Develop plans and systems to support increased efficiency at the nexus of bioenergy and water.
- 1.1.7. Evaluate user decision-making and economic and social choices in consumer, municipal, and industrial uses of water and related public policies.

## 1.2. Sustain and support efficient use of land resources and ensure air quality in the production of food and non-food crops.

Texas is rapidly urbanizing in many areas of the State. Land fragmentation and growth of cities mandates improvements in efficient use of agricultural lands. Air quality is also of increasing concern as population density and intensity of agricultural production practices increase. We will conduct research to ensure and enhance efficient land use while maintaining or improving air quality.

- 1.2.1. Provide data to landowners, farm and ranch managers, and land use planners to ensure efficient, sustainable usage of arable land and rangelands.
- 1.2.2. Expand and develop research and management programs to enhance urban landscapes.
- 1.2.3. Conduct studies of threats to air quality in urban and rural areas, and develop systems to minimize the impact of crop production practices and concentrated animal feeding operations on air quality.
- 1.2.4. Conduct studies of the economic and social choices, and related markets that determine the value of land, water, and air resources in support of business and public investment decisions.

## 1.3. Conduct basic and translational research to minimize the unfavorable effects of agricultural production and urban communities on the environment.

An increasing portion of agricultural production in Texas takes place in or near urban areas. Agriculture and city dwellers interact with and significantly impact each other and the environment. We will conduct research to identify,

monitor, and mitigate unfavorable effects of agriculture and urban communities on the surrounding ecosystem.

- 1.3.1. Develop tools, software applications, and databases to estimate the impact, benefits, and future needs of agriculture with regards to conservation practices designed to reduce erosion, nutrient losses from cropland, and use of crop protection chemicals.
  - 1.3.2. Improve and assess knowledge of sustainable and environmentally sound agricultural practices on a global scale by applying our research findings to critical international environmental issues.
  - 1.3.3. Understand the impact of urban activities on the environment and identify management strategies to mitigate negative impacts, especially regarding water quality.
- 1.4. Conduct basic and translational research into the factors affecting biological diversity and ecosystem structure and functioning, including the role of human activity.
- The health and sustainability of ecosystems depends upon diversity of species and interrelationships among the flora and fauna, including microflora. Human activity impacts ecosystem structure and functioning, both directly and indirectly. We will investigate factors that affect biological diversity and ecosystem structure and functioning.
- 1.4.1. Improve tools for rapid assessment of biodiversity at all scales.
  - 1.4.2. Elucidate the relationship between biodiversity and ecosystem functioning.
  - 1.4.3. Develop a systematic understanding of changes in land uses that are critical to ecosystem functioning and human welfare.
  - 1.4.4. Expand activities in ecological and evolutionary biology research to understand the role of biodiversity in maintaining ecosystem processes and the evolutionary relationships among organisms that contribute to biodiversity patterns and processes.
  - 1.4.5. Develop research networks to expand the application of new biodiversity knowledge to enhanced conservation and sustainable development approaches locally and globally.
  - 1.4.6. Identify the underlying human factors (social, cultural, and behavioral) affecting ecosystem diversity and sustainability. Design institutions and policies to achieve this goal.

- 1.4.7. Develop new strategies and tools, using both basic and translational research, to prevent, intervene, and recover from the intentional or accidental introduction of harmful pathogens or insects to the environment.

**2. Enhance Competitiveness, Prosperity, and Sustainability of Urban and Rural Agricultural Industries:**

Agriculture is big business in Texas, accounting for over \$100 billion in annual economic impact. It is crucial that we engage in research activities that protect and enhance competitiveness, prosperity, and sustainability of Texas agriculture.

- 2.1. Improve agricultural production and efficiency through advances in animal and plant breeding, management, and health.

Although branding of agricultural goods and services is increasing, most agricultural products are still marketed as commodities. As such, little opportunity exists to improve profitability through selling at a higher price. The primary means for farmers and ranchers to survive and prosper is through cutting costs. We will continue to, and expand our efforts to increase efficiency through plant breeding, design and testing of novel management and marketing systems, and improvements in plant and animal health.

- 2.1.1. Determine the effects of environmental stress on livestock production and develop mitigation strategies to improve the growth, reproduction, health, and well-being of animals.
- 2.1.2. Investigate improvements in animal management systems that take a long-term, holistic view rather than a narrow focus on a few parameters or traits of economic importance.
- 2.1.3. Further develop and apply genomic tools to plant and animal breeding and management.
- 2.1.4. Develop and apply new technologies for detection of pathogens and mitigation of the diseases they cause in plants and animals.
- 2.1.5. Assess market structure and performance that link final consumer demand to production, crop, and livestock development and resource allocation.

- 2.2. Add value to raw agricultural products and expand market channels through new product development and enhancements to existing commodities.

Differentiating processes and products enables producers to market branded products. Over time, brand equity increases price point, margins, and

profitability. Branding also expands market channels for goods and services. We will conduct research to enable producers to identify consumer preferences, to implement systems that provide source verification and process controls, and that discover or establish new market channels for agricultural products.

- 2.2.1. Identify and cultivate new market channels domestically and internationally and enable producers and/or marketers to add value to agricultural commodities through differentiation and branding.
- 2.2.2. Focus on development of new, dedicated energy crops for production of bioenergy and adaptation of existing crops as feedstock.
- 2.2.3. Apply fundamental knowledge of intensive raceway production to scalable, economically viable systems to produce shrimp, sea urchins, and other high value products.
- 2.2.4. Survey producers and consumers, both in the U.S. and abroad, to assess branding impacts.

### 2.3. Enhance sales and trade of agricultural products through consumer-guided marketing and economic strategies.

Marketing of food and fiber has traditionally been driven by pushing commodities by the supply side rather than pulling from demand. Maturity of markets, fierce competition, and the plethora of consumer choices have shifted emphasis from what farmers want to sell to what consumers want to buy. We will study consumer behavior, identify market trends, and develop novel economic strategies to facilitate access to new and developing markets.

- 2.3.1. Survey consumers and analyze purchase databases, both in the U.S. and abroad, to assess needs and wants in order to assist agricultural industries to produce and market goods and services in demand by the market.
- 2.3.2. Identify market channels and structure, and develop applications and decision support tools that improve the efficiency of marketing of agricultural goods and services.
- 2.3.3. Enable production systems to more consistently supply quality products that meet the demands of the marketplace.

### 3. Improve Public Health and Well-Being:

Public health is not only a financial concern, but it is integral to quality of life. It is vital that research be conducted to maintain and enhance public health, quality of life, and well-being.

3.1. Promote healthy lifestyles and nutrition to prevent acute and chronic illness.

The relationship between nutrition and health has long been recognized. Recent investigations have established the importance of nutrition within the context of a healthy lifestyle. We will conduct research to assist consumers, nutritionists, and health professionals to include good nutrition as part of a healthy lifestyle that helps to prevent acute and chronic illness.

3.1.1. Develop new fruit, vegetable, and grain cultivars and animal genetics with improved human health benefits, and molecular markers linked to key genes.

3.1.2. Examine the impact of the new Women, Infant and Children food packages on food preference and consumption patterns; examine the implications of dietary guidelines for whole grains in USDA nutrition assistance programs; investigate consumer acceptance of foods formulated with omega-3 fatty acids; explore pharmacokinetics, antioxidant and anti-inflammatory mechanisms of bioactives from whole grains; and explore the relationship between food and physical activity to energy intake and expenditure.

3.2. Minimize the impacts of foodborne hazards and biosecurity threat agents.

Geopolitics, increased international travel, and proliferation of free trade agreements have increased exposure to foodborne hazards and biosecurity threats. We will conduct research to help anticipate, prevent, and minimize the damage caused by foodborne hazards and biosecurity threats.

3.2.1. Foster the development of integrated, multi-disciplined research that improves protection against and minimizes the impact of terrorist attacks on the food supply and agricultural industries.

3.2.2. Build and enhance an emerging program in Forensic and Investigative Sciences to support efforts of first responders in the event of an intentional or accidental biosecurity threat.

3.2.3. Expand capacity to diagnose and mitigate threats to plants and animals.

- 3.3. Prevent transmission of human disease agents through development of improved methods of vector control.

Research and implementation of pest management programs help keep urban and rural agricultural industries competitive and prosperous. New pest threats continually challenge these industries and the overall quality of life. We will continue our research on arthropod identification and life histories, discovery of new control strategies and technologies, and development and evaluation of the most effective implementation programs.

- 3.3.1. Advance discovery of novel technologies benefiting management and control of arthropods.
- 3.3.2. Build multi-disciplinary teams to achieve sustainability of pest control across Texas and beyond.
- 3.3.3. Investigate the interactions of parasitoids, predators and host plants, and develop a biological control program using natural enemies and biorational insecticides.

- 3.4. Develop wholesome, healthful, and affordable foods through scientific discovery, novel technologies, and new processes.

The U.S. enjoys the safest, most wholesome food supply in the world. Global politics, industry consolidation, free trade agreements, and other factors, however, have made us vulnerable to intentional or accidental contamination of the food supply. We will conduct research to identify, monitor, and mitigate threats to the safety and wholesomeness of food.

- 3.4.1. Initiate significant research into quality and safety of foods of animal origin.
- 3.4.2. Improve the health-promoting properties of fruits and vegetable crops through manipulation of pre-harvest factors.
- 3.4.3. Develop integrated production and marketing systems orchestrated to produce nutritious, healthful, flavorful, yet affordable food products.

**4. Mitigate Negative Effects of Global Climate Change**

Climate change and its ramifications are a global challenge. It is essential that scientific investigation and understanding undergird public discourse and policy decisions in matters of this magnitude and potential impact on agriculture, the economy, and society.

4.1. Provide policy makers, producers, and consumers with scientifically sound data regarding carbon cycling and sequestration.

We will conduct research to evaluate and assess the impact of various production and management systems on important ecosystem functions such as carbon cycling and sequestration.

4.1.1. Improve knowledge of traditional and alternative crops and farming systems on yield, biomass production, soil carbon, soil nutrient cycling, and greenhouse gas emissions and provide for both mitigation practices and production adaption to maintain economically viable systems.

4.1.2. Evaluate the impact of climate change on ecosystem services.

4.2. Create economically feasible, sustainable alternative energy systems through basic and translational research in feedstocks, logistics, and conversion technologies.

Research is needed that elucidates the principles, technologies, and interrelationships needed to develop a coherent, economically viable, and sustainable supply chain from feedstock through conversion and utilization of co-products. We will provide the industry with knowledge, data, and systems that enhance the viability and sustainability of alternative energy production.

4.2.1. Determine the interactions among agronomic factors such as nutrition, water use, soil type, harvest frequency, etc., on biomass production, seasonal availability, and sustainability for selected high-biomass crops useful for cellulosic biofuel production.

4.2.2. Develop next generation systems and advanced conversion technologies.

4.2.3. Identify and analyze economic, market, and policy factors influencing incentives for development of alternative energy systems and provide information to investors and policy makers.

4.3. Enhance viability of bioenergy systems by developing markets for co-products of cellulosic, algal, and other alternative energy products.

Although the primary objective of bioenergy systems is production of alternative fuels, economic viability of the system is heavily dependent upon adding value to co-products. We will investigate and develop uses for byproducts and co-products of algae, lignocellulosic ethanol, and other bioenergy systems.

- 4.3.1. Conduct research to establish optimal levels of inclusion of distiller's grains in livestock diets.
- 4.3.2. Develop technologies that facilitate substitution of distiller's grains for high cost fish meal in feed utilized in intensive production systems for shrimp.
- 4.3.3. Investigate the utility of algal co-products as animal feeds and other products.

4.4. Develop novel technologies and systems that enable producers and consumers to improve energy efficiencies.

Increased production of energy is only one-half of the equation; the net impact of improved energy efficiency is that less total energy is needed. We will conduct research that develops novel technologies and systems to reduce energy consumption through enhanced efficiency.

- 4.4.1. Create models, theory, and educational materials and programs to enhance the process of change in the ways that producers and consumers use energy.
- 4.4.2. Develop production and management systems that identify waste and inefficiency of energy utilization.
- 4.4.3. Identify and evaluate market and other sources of risk and design risk management tools and strategies.

**5. Create and Utilize Fundamental Information (Genomic, Proteomic and Metabolomic) to Optimize Plant and Animal Production, and Human Health.**

Texas AgriLife Research has been recognized as a world leader in traditional agricultural production and phenotypes. Our strategy is to sustain our excellence in applied agricultural research while enhancing our emerging excellence in basic research, including genomics, proteomics, and metabolomics. It is of paramount importance that we aggressively advance the basic science that, when applied, will yield solutions to current and emerging challenges.

- 5.1. Model and understand the dynamic relationships among biological molecules to genetically improve production, disease resistance, and environmental adaptability of plants and animals used to produce food, fiber and bioenergy.

We will investigate and discover principles of molecular biology to complement and enhance research in breeding, production, and processing of agricultural products.

- 5.1.1. Utilize advanced techniques in genomics to improve the genetics of plants and animals through marker assisted selection.
- 5.1.2. Identify plants and animals with innate resistance to pests and diseases.
- 5.1.3. Exploit novel technologies in proteomics and metabolomics to optimize plant and animal production.

5.2. Capitalize upon data from high throughput sequencing, proteomics, metabolomics, metagenomics, and other advanced technologies to develop systems biology tools for improving agricultural productivity.

We will apply fundamental knowledge in molecular biology to improve plants and animals by optimizing production efficiency, enhancements to disease resistance, and improvements to quality, consistency, and wholesomeness of foods and fiber.

- 5.2.1. Improve breeding programs through marker assisted selection.
- 5.2.2. Utilize high throughput sequencing, genotyping, proteomics and other advanced tools to increase and expand understanding of biological processes.
- 5.2.3. Identify genetic markers specific to mechanisms conducive to adaptation to prevalent stresses confronting plants and animals.

5.3. Model and understand dynamic relationships among behavioral and economic factors that influence the development and sustainable adoption of new technologies for the benefit of consumers, producers, and society.

Rapid and widespread adoption of scientific discoveries depends not only on the merits of the discovery and the economic value added, but also upon society's willingness to embrace or tolerate change. While we do not advocate any partisan viewpoint on controversial subjects, we will provide unbiased data and scientific rigor to inform policy makers and the general public.

## Measuring Success

The ultimate measure of the successes we achieve in executing and implementing our Agency Strategic Plan will be the economic, environmental, and societal impacts of our research. Metrics that enable leadership to monitor key inputs and outputs have been included in our Strategic Plan as management controls and harbingers of the impacts we can expect to realize in the future.

### Inputs

- Seek to restore State appropriations to FY10-FY11 levels in FY12-13 and maintain at least level funding--adjusted for inflation--in FY14-FY15.
- Increase the total value of research awards by 5% per year.
- Expand our portfolio of corporate-sponsored research to 20% of total awards within five years.

### Outputs

- Increase the number of peer-reviewed publications to 2,250 in FY11 and increase by 5 percent each year thereafter.
- Increase the number of disclosures to the Office of Technology Commercialization to 75 in FY11 and increase by at least 10 disclosures in each succeeding year of the plan.
- Expand the number of visits to the Agency's Web site to 60,000 in 2011 and grow by 10% per year during 2012-2015.

### Examples of Impacts to be Achieved (One per Imperative)

- Develop irrigation systems and decision support models that increase water use efficiency by 5%.
- Build alternative energy systems based upon sorghum, sugarcane, wide hybrids, and algae through the pilot plant stage of development by FY15.
- Develop five new fruit and vegetable cultivars with at least a 10% improvement in human health benefits.
- Characterize popular production practices for carbon and other nutrient cycling, and amount of carbon sequestration.
- Discover genes and genetic markers that assist plant breeders to improve drought resistance in corn by 15% and residual feed intake (feed efficiency) in beef cattle by 10%.