

# Penn State University Combined Research and Extension Plan of Work

## 2021-2025

### Status: NIFA Review

#### I. Plan Overview

##### 1. Executive Summary

The College of Agricultural Sciences at Penn State will provide comprehensive support to the residents of Pennsylvania through the activities of the Pennsylvania Agricultural Experiment Station (AES) and Penn State Extension (PSE). We will be responsive to stakeholder needs through translational research and delivery of science-based programs to clientele, but we will also conduct internationally relevant fundamental research that generates baseline data to solve future problems and actively seek new and better ways to communicate our programs to new audiences. Our faculty and staff, supported by federal base funding, will effectively leverage this investment against many other funding sources to conduct programs of the highest caliber. We are committed to excellence in research, educating the next generation of agricultural professionals and citizens, and promoting life-long learning among the citizens of Pennsylvania.

Our College's mission is clear: "The mission of the College of Agricultural Sciences is to discover, integrate, translate, and disseminate knowledge to enhance the food and agricultural system, natural resources and environmental stewardship, and economic and social well-being, thereby improving the lives of people in Pennsylvania, the nation, and the world."

#### Evolving outlook on the future of agriculture

Agriculture faces challenges of rising energy costs, weather extremes, an expanding human population, environmental degradation, loss of biodiversity, and labor shortages. To help meet these challenges, we are developing a conceptual framework based on the science of agricultural sustainability--defined as the integration of natural and social sciences to inform practice and policy for productive, working landscapes, healthy watersheds, and resilient economies. This innovative approach to agricultural research, engagement, and education centers on the impacts and synergies of contiguous rural and urban landscapes. This mosaic of densely populated areas next to forests and agricultural landscapes is unique to Pennsylvania and the Mid-Atlantic Region and requires an integrated strategy to achieve healthy and thriving agriculture, natural systems, economies, and communities. From forests to crops to animal facilities, the location of economically significant agricultural systems in Pennsylvania adjacent to and sometimes within highly populated regions creates distinct challenges and opportunities for the integration of natural and social sciences to inform practice and policy.

A primary component of AES and PSE work in our College will be built on the three integrated pillars of intensification, resilience, and regeneration of agricultural landscapes as solutions to some of the most vexing problems confronting Pennsylvania and similar mosaic landscapes worldwide. We will holistically and comprehensively address these critical issues:

increasing the efficiency and profitability of agricultural production while minimizing environmental impacts  
equipping farmers to absorb and recover from short-term or long-term shocks and stresses to their agricultural production and livelihoods

optimizing plants, animals, and ecosystems for resistance to and/or faster recovery from environmentally related stresses  
developing strategies for better management of nutrient inputs and outputs across complex agricultural and natural resource systems, from field and farm to large watersheds

harnessing spatial data and remote sensing technologies to map and model predictive simulations of environmental change

This framework represents the College's new organizing outlook and leads to our newly endorsed critical issues.

## Our critical issues

Our faculty's proficiencies span the gamut from the molecular to plant and livestock breeding, from farm sustainability to ecosystem modeling, and help ensure that solutions to problems are economically viable, socially acceptable, and equitable.

In summer 2020, the College of Agricultural Sciences is expected to have a draft of our next College Strategic Plan that builds upon the accomplishments of the 2014-2019 strategic plan. A future plan of work will reflect the latest realignment of our critical issues with our new strategic plan. Consideration of the suitability of the critical issues outlined below, which are built upon previous planned programs, found them highly relevant to research and issues facing agriculture and communities today.

This plan and the critical issues addressed will evolve with time as new challenges arise, issues evolve, and needs change.

Advancing Agricultural and Food Systems through the use of state-of-the-art technology and interdisciplinary collaboration to increase agricultural resiliency and efficiency.

Developing Biologically Based Materials and Products to meet the promise of sustainable clean energy, beneficial reuse of agricultural waste, and income generation through new, value-added bioproducts to support struggling rural economies.

Building Community Resilience and Capacity through integrated research and extension programming that promotes economic and social well-being by encouraging agritourism and entrepreneurship, community health, and sustainability in infrastructure, food, and energy systems.

Promoting Environmental Resilience by assessing and protecting ecosystems and ecosystem services, helping agriculture meet its environmental challenges, promoting ecosystem resilience and health, and mitigation and adaptation to climate change.

Supporting Integrated Health Solutions by developing functional foods for positive health outcomes, overcoming food safety concerns, fostering human and livestock health, and fighting insect-borne diseases and parasites.

Fostering a Positive Future for Youth, Families, and Communities by providing a wide range of evidence-based programming to support healthy families, build positive youth skills, strengthen intergenerational relationships within communities, and promote farm safety.

## How we arrived at the critical issues

The critical issues are built from the framework of the College's 2014-2019 strategic plan and incorporate broad internal and external stakeholder feedback. We developed these critical issues by analysis of cross-cutting emerging themes across the College. We solicited and received input from College leadership advisory groups, topical faculty focus groups, College employees, and the Penn State Ag Council.

The College considers both the strategic plan and the plan of work to be dynamic documents that allow new scientific approaches to be developed and integrated into the thematic areas. The College's strategic plan discusses future initiatives in microbiomes, environment and health, applied evolution, human and community resilience, and landscape stewardship, all of which fit well within the cross-cutting thematic areas that provide the basis of the critical issues. Departmental annual reviews and strategic plans, as well as their signature research areas, also inform the POW and critical issues.

Our critical issues capture the systems approach that we have identified as a key element for generating impact. They cut across disciplines, uniting our research efforts with our extension education capacity. Penn State has the good fortune of

providing an environment that encourages interdisciplinary work and values outreach to stakeholders. The University has built a framework of university-wide consortia and institutes (e.g., Life Sciences; Energy and Environment; Children, Youth, and Families Consortium; Materials Research; Ethics; Sustainability; Consortium to Combat Substance Abuse), and the College of Agricultural Sciences plays an integral role in these organizations. This interdisciplinary philosophy has reinforced the natural tendency of our faculty and extension educators to work cooperatively to solve problems. Coupled with the joint research-extension appointments of many of our College faculty, our work, as represented in this Plan of Work, will effectively unite fundamental knowledge with practical solutions delivered to stakeholders. The net result will be a tangible benefit in economic prosperity and quality of life for Pennsylvania citizens.

#### Leveraging funding

Penn State's broad and deep portfolio of agricultural and related research and extension is funded by scores of federal, state, and county agencies, private foundations, commodity groups, businesses and corporations, and international governments. This leveraging of resources allows gains in knowledge, behaviors, and conditions that are much greater than could be realized from any single source of support. Some funders include US Environmental Protection Agency, US Department of Interior, US Department of Energy, PA Department of Agriculture, PA Department of Conservation and Natural Resources, and PA Department of Environmental Protection.

#### Extension reorganized to better serve clients

Changes in operational structure and programming that occurred in spring 2017 are enhancing the value of Penn State Extension to the Pennsylvania communities and clients it serves. Penn State Extension is evolving to better serve its stakeholders with enhanced customer service and relevant products and programs, delivered online and through its statewide network of county-based educators.

The restructuring sought to better align programs and products with stakeholder needs, to deliver those programs in ways that best meet customer preferences, and to maximize statewide operational efficiency. To ensure that legacy continues, we are continuing to evolve in a digital era to capitalize on the technologies that allow us to get science-based educational resources to more Pennsylvanians.

All program teams are participating in a strategic program-development process that will result in a diverse mix of products and services to address Pennsylvania priorities. As part of this process, teams will gather customer and stakeholder input to ensure relevancy.

This Plan of Work presents our vision for the future of the Pennsylvania AES and PSE. It will guide our efforts in the upcoming years.

#### **2. FTE Estimates**

Year	1862 Extension	1862 Research
2021	442.0	432.9
2022	442.0	432.9
2023	442.0	432.9
2024	442.0	432.9
2025	442.0	432.9

## **II. Merit / Peer Review Process**

Both PSE and AES programs undergo comprehensive review utilizing a number of merit review processes.

Internal university panels will be used to review AES projects. The Hatch, McIntire-Stennis, Animal Health, and State projects will be internally reviewed at initiation by at least two qualified faculty. In addition, external university panels are used for Multistate Research Project (MRP) activities. Both extension and academic faculty are encouraged to participate to meet the jointly agreed objectives. These projects are reviewed multiple times through the five-year duration.

External non-university panels are used as new Penn State extension programmatic issues or AES projects are implemented. Stakeholder and/or program advisory groups provide ongoing review of programs to ensure a focus on priority needs as identified by advisory groups. Reviewers' comments provide mechanisms for improving our educational and research programs.

Combined internal and external university panels are assigned to each of the programmatic issues. These panels are integrated, multidisciplinary State Extension Teams (SETs) made up of field-based extension educators and faculty with split appointments in both extension and research. Team members broadly represent all parts of the Commonwealth, and faculty members are chosen to represent relevant research and extension perspectives. Extension Program Leaders provide overall leadership to the SETs, and programs are reviewed by extension administrators. State administrators and academic unit leaders serve as liaisons to each team. Each SET developed a program plan, based on logic model components, that will guide extension programming and applied research efforts.

## **III. Stakeholder Input**

### **1. Actions to Seek**

College administration and faculty advisory groups will confer regularly with key stakeholder groups, state and federal partners, and relevant industry representatives across the breadth of interests in the College. Listening sessions, targeted invitations, surveys, focus group meetings, and engagement on social media will all seek input from traditional and nontraditional stakeholder groups and/or individuals. A primary avenue for stakeholder input is via the various forms of feedback obtained in connection with extension offerings, from volunteered comments and formally sought assessments of learning and effectiveness to retrospective evaluations that seek to measure outcomes such as costs averted or profit increased from implementing extension program suggestions. All of these forms of feedback will be taken together to help set the course for PSE and AES programs. The results of these assessments will be incorporated into our Extension Program SharePoint site and our Extension Program Activity System (EPAS).

### **2. Methods to Identify**

The Penn State Ag Council (Ag Council) will assist our programs with identification and selection of stakeholder individuals and groups. Ag Council members will be selected to represent diverse program areas, emerging issues, geographic areas, and populations (diverse in, for example, race/ethnicity, age, longevity in the ag field, rural/urban, and those historically underserved by extension). Ag Council meetings will be publicly announced, and broad representation will be constantly reassessed to ensure the inclusion of new and traditionally underserved audiences. Maintaining contact with College alumni builds direct links to our stakeholder groups and industries. Alumni and friends' banquets and football tailgates are common and well received throughout the College.

### **3. Methods to Collect**

To collect stakeholder input, educators or faculty will hold regularly scheduled meetings, such as advisory groups and Penn State Ag Council. Ag Council members will work with program teams to develop relevant science- and industry-based programs to meet the educational needs of the residents of the Commonwealth. This effort is part of the Program Development Process. Meetings will occur with traditional and non-traditional individuals and groups. During and after extension programs, participants may verbally or through surveys request additional programs or updates or provide input about effectiveness, both immediate and long term. To collect more detailed information from traditional and nontraditional stakeholders, sophisticated survey instruments or focus group meetings will be implemented and the data analyzed. All departments and extension programs will maintain websites and distribute regular electronic and/or hardcopy communications and/or social media messages to inform stakeholders and to invite feedback. Many programs will hold field tours or site tours, which allow them to hear from stakeholders directly. The dean's industry tour series will bring some of the College's leaders into some of the state's leading agricultural industry facilities to learn about their challenges and about how Penn State researchers might help.

### **4. How Considered**

Budget Process: Availability of funding from certain extramural funding sources will influence resource allocations.

To Identify Emerging Issues: Stakeholder feedback will help to identify emerging issues that would benefit from extension programming and/or research.

Redirect Extension Programs: Information collected from stakeholders will continue to be used to adjust issue areas for extension programming.

Redirect Research Programs: Information collected from stakeholder groups, such as industry associations, will continue to be used to directly influence applied research activity through local decisions about priorities.

In the Staff Hiring Process: Information collected from stakeholders will continue to influence hiring decisions for faculty and extension educators to address unmet needs. Stakeholder feedback also indicates where volunteers and donors would be interested in assisting with programs and initiatives.

In the Action Plans: Our mission is to serve our stakeholders, so we will analyze the information gathered from stakeholders and adjust our action plans as needed to meet their needs.

To Set Priorities: Our stakeholders' priorities must be our priorities, and we will adjust our programs as needed.

To Determine How and Where Programs are Offered: Stakeholder input will continue to directly impact how, where, and when we offer our extension programs. We have been developing and implementing many different platforms for information transmittal in response to previous feedback from stakeholders that additional methods of program delivery were needed as demands for resources and/or time increase. We now offer podcasts, online webinars, videos, field tours, etc., by synchronous and asynchronous means, and continue to migrate away from the traditional classroom setting. We want to maximize the utility of extension educators' time in the field by increasing the depth and breadth of routine educational materials available online.

## **IV. Critical Issues**

### **1 Advancing Agricultural and Food Systems**

#### **Description:**

To meet coming challenges of climate change and increasing human population, agriculture must reduce its required inputs of energy, water, and chemicals while simultaneously increasing crop productivity and producer profitability and improving soil health. Topics will include:

- resiliency in food systems
- agricultural labor shortage
- efficiency of energy and inputs to agriculture
- value-added aspects of commodities
- plant production and protection
- livestock production and reproduction
- pollinator health
- microbiome advances
- agricultural, natural resource, and biological engineering

**Term:** Long

#### **Science Emphasis Areas**

- Agroclimate Science
- Environmental Systems
- Sustainable Agricultural Production Systems

### **2 Developing Biologically Based Materials & Products**

#### **Description:**

Our researchers will help to meet the promise of sustainable clean energy, beneficial reuse of agricultural waste, and income generation through new, value-added bioproducts to support struggling rural economies. Research commercialization and industry engagement are increasingly important as we seek real-world solutions that work. Topics will include:

value-added products from biomaterials  
sustainable energy sources  
new biomaterials exploration and development  
beneficial reuse of agricultural wastes  
eco- and human health-friendly products  
new and improved food sources and products, and processing and packaging technologies

**Term:** Long

**Science Emphasis Areas**

Bioeconomy, Bioenergy, and Bioproducts  
Environmental Systems

### **3 Building Community Resilience and Capacity**

**Description:**

Communities need to build greater resiliency to natural and economic disasters; diversify their economies; restore and sustain robust infrastructure; increase the efficiency of community support systems; and identify and implement cost-effective policies. Our specialists will address topics including:

sustainable infrastructures and food systems  
economic promotion and resilience  
implications of shale gas energy  
agritourism  
entrepreneurship  
changing and declining rural areas  
trend analysis to meet communities' needs  
economic, market, and policy analysis  
identifying and helping to meet the needs of underserved populations

**Term:** Long

**Science Emphasis Areas**

Environmental Systems  
Family & Consumer Sciences  
Youth Development

### **4 Promoting Environmental Resilience**

**Description:**

Society faces increasingly challenging environmental issues as the effects of climate change intensify; the human population grows; water, food, and energy supplies tighten; and land use change and urbanization limit our options. To tackle these issues, our faculty and programs will address:

air quality  
water quality and quantity  
adaptation to climate change  
land use change  
invasive species

integrated pest management  
assessment of and protection of ecosystem services  
forest health and fragmentation  
ecosystem resilience  
soil health  
fish and wildlife ecology  
effects of agricultural production on the environment

**Term:** Long

**Science Emphasis Areas**

Agroclimate Science  
Environmental Systems  
Sustainable Agricultural Production Systems

**5 Supporting Integrated Health Solutions**

**Description:**

Climate change is already affecting the areal extent of some human and livestock diseases and parasites and how they spread, and this is expected to intensify. Decreased access to clean water and healthy food poses health risks. We are making gains in food safety and learning more about the microbiome that we can use to promote health. Topics will include:

functional foods for positive health outcomes  
human nutrition  
food safety concerns  
livestock health and reproduction  
interplay between human and animal health  
insect-borne and zoonotic diseases and parasites  
hazards to human health and safety  
new and improved food products and food processing technologies  
the effects of foods or nutrients on the microbiome in maintaining health

**Term:** Long

**Science Emphasis Areas**

Environmental Systems  
Food Safety  
Human Nutrition

**6 Fostering a Positive Future for Youth, Families, & Communities**

**Description:**

The urban/rural divide continues to grow. The lack of employment options and the opioid crisis take a heavy toll on rural areas. Efforts to foster healthy individuals, families, and communities will cut across local, state, and national boundaries; build sustainable community institutions and strong new leaders; and strengthen intergenerational relationships. The focus will be on:

engaging youth, women, and minorities in social action and leadership  
individual and family resource management  
human development and family well-being

community institutions, health, and social services  
farm safety

**Term:** Long

**Science Emphasis Areas**

Education and Multicultural Alliances  
Family & Consumer Sciences  
Youth Development