PENNSTATE

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College of Agricultural Sciences

STRATEGIC PLAN 2014–2019

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Contents

Executive Summary

The Penn State College of Agricultural Sciences is now a quite different, and stronger, organization from that described in the last strategic plan of 2008–2013. In response to the AG Futures process and the Core Council recommendations, the college has taken bold measures to reduce costs, increase operational efficiencies, and maintain the highest possible level of services to our students and stakeholders while strengthening our research programs.

The college has accommodated consecutive 5 percent and 19 percent budget reductions while simultaneously consolidating from twelve departments to nine in response to Core Council recommendations. We addressed the budget reduction in part by offering a voluntary retirement buyout to faculty and staff. These cuts have had a cumulative impact of reducing our college human resources by 25 percent from our state-funded core. We have been able to refill some of these positions on a fixed-term basis to meet critical needs.

This downsizing came amid a significant increase in our student numbers, increasing stress on departments and faculty to meet the demand for our educational programs.

Key changes:

- We have consolidated our graduate/undergraduate degree programs under nine (from twelve) academic departments.
- Penn State Extension county offices have shifted to a district model for administrative services to improve operational efficiency, eliminate duplication, and maximize productivity.
- Extension also shifted from a geographically based extension program model to a program team approach structured around areas of excellence, expertise, and agricultural sectors.
- We have based program priorities on core mission areas of the college, identified areas for disinvestment, and realigned resources and leveraged cost-share dollars from counties to add positions in Pennsylvania's priority areas.
- We have cut more than $19 million out of the college's permanent budget over the last six years and continue to consider implementing new technologies to increase effectiveness and efficiency, and shifting to private market solutions where outsourcing is appropriate.
- We have developed partnerships with the Pennsylvania Department of Agriculture to establish three resource centers to engage Pennsylvania stakeholders around the priority topics of food safety, plant protection, and animal care.

Even amid all this change, our most recent assessment illustrates that we have reached or exceeded many of the targets set for the 2008–2013 strategic plan.

- The number of undergraduates has increased 27.5 percent since 2008.
- In the senior undergraduate survey, 94 percent of respondents rated their Ag Sciences experience as excellent or good in 2013.
- Gifts, including scholarships and program funds, grew from $47.1 million in 2008 (475 awards) to $71.7 million (590 awards) in 2012, an increase of more than 53 percent. Scholarship funding is up by 21.6 percent.
- Extramural funding rose from $52.1 million in 2008 to $56.9 million in 2012, an increase of 9.2 percent.
- Revenue is on the rise. The college received more than $33 million in nongrant income in 2010–2011 from county gifts and fund-raising, cost avoidance and program fees in the counties, sales and fees, discretionary fund gifts, and endowment earnings.
- Extension annual development funding grew from $17,000 in FY2005 to about $2 million in FY2011/2012.

The College of Agricultural Sciences at Penn State has an international reputation for providing leading research and resident and extension education programs. We continue to be a

leader for change and a place for students, faculty, and staff to be innovators for the future as a vital component of our land-grant university in the twenty-first century.

Our previous plan was centered around three systems and five strategic initiatives. Our 2014–2019 plan identifies five cross-cutting themes: advanced agricultural and food systems, biologically based materials and products, environmental stewardship and resilience, integrated health solutions, and human/community connections.

Extension activities within human/community connections will center around community resilience and capacity, and a positive future for youth, families, and communities.

We have also identified four superthemes—topics that are embedded or integrated across all of the cross-cutting themes: sustainability, education, global engagement, and entrepreneurship.

These new cross-cutting themes and superthemes further our aim to implement our current goals and represent critical topics at the intersections of the college's expertise. Our progress in these themes will enhance the sustainability of our agricultural system, our natural resources base, and citizens' socioeconomic well-being.

Our focus on the food and fiber system, the ecosystems in which those products are produced, and the socioeconomic systems that give value to all these elements defines our unique niche and reinforces the relevance of our mission as we enter the next 100 years of agricultural extension and research. Our research will discover solutions that sustain food and energy supplies, protect and enhance natural resources, and revitalize economies and communities in Pennsylvania and beyond. Our educational programs—undergraduate and graduate resident education and extension education—will produce leaders who demonstrate not only scientific and technical excellence but also skills in critical thinking and communication, all packaged within an entrepreneurial spirit. With this vision, we can be a transforming force in society.

What makes our college unique is the socioeconomic and sociocultural aspects that are always present in the issues we address and our connections through extension to the community. These countless connections position the college to help meet societal needs. As such, the college interfaces with virtually every other college at Penn State. The College of Agricultural Sciences, as the foundational unit in the land-grant University, serves as the basis on which all other colleges at the university have grown. We will continue to build on our past success to work synergistically with other colleges and institutes at Penn State to advance our research and educational programs to continue to meet the needs of our stakeholders and clientele.

Mission, Core Values, Core Competencies, and Vision

MISSION

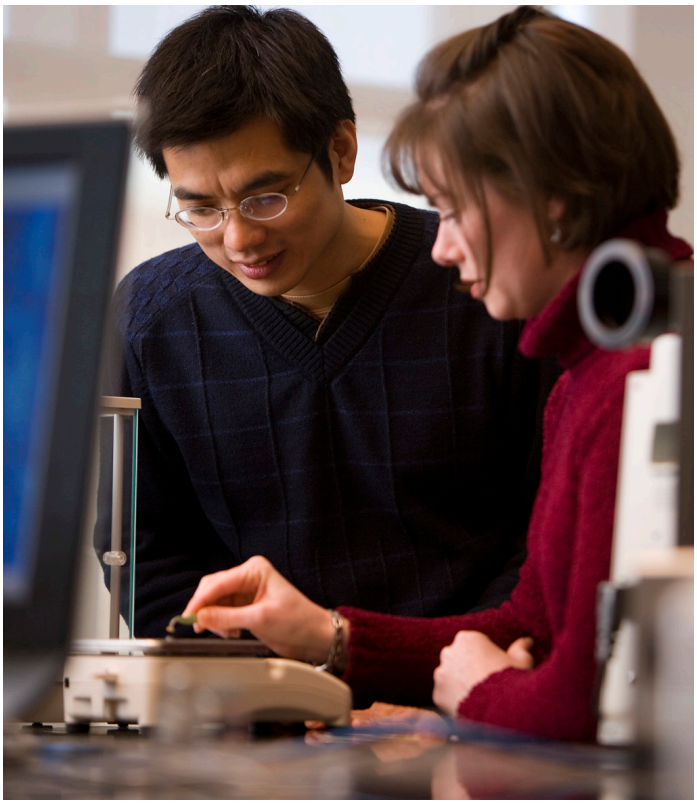
The mission of Penn State's College of Agricultural Sciences is to discover, integrate, translate, and disseminate knowledge to enhance the food and agricultural system, natural resources and environmental stewardship, and economic and social well-being, thereby improving the lives of people in Pennsylvania,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

CORE VALUES

- Passionately pursuing excellence and innovation across all functions, using a team approach for solving complex problems to serve the common good.
- Fostering diversity, multicultural understanding, cross-cultural competency, and an atmosphere of mutual respect.
- Demonstrating integrity, honesty, openness, shared responsibility, and mutual accountability.
- Engaging students and stakeholders through listening, experiential learning, and problem solving.
- Stewarding resources responsibly and sustainably.
- Nurturing personal and professional growth and development.

CORE COMPETENCIES

- **Putting science to work:** effectively discovering and translating relevant research and science to solve real-world problems related to the interface of the food and fiber system, ecosystem, and socioeconomic system.
- **Valuing and building diverse partnerships:** bringing diverse teams of stakeholders to the table to facilitate relevant, comprehensive, and collaborative solutions that are developed by defining and leveraging the emerging issues, opposing viewpoints, concerns, strengths, and knowledge of all partners.
- **Teaching and learning by doing:** engaging students, scientists, leaders, and employees in lifelong experiential learning to increase their preparedness and effectiveness to solve real-world problems.
- **Providing access to information/solutions:** providing unique and user-friendly distribution and access models that rapidly connect students, academia, governments, industry, and consumers to objective information and solutions; engaging stakeholders to ensure that solutions are actually distributed, implemented, evaluated, and improved through feedback.



- **Leveraging unique national networks:** aggressively participating in and leveraging the expertise, resources, and opportunities of the unique, national land-grant system that includes partnerships with land-grant and other institutions, USDA, Pennsylvania Department of Agriculture, and other governmental agencies.

VISION

Penn State's College of Agricultural Sciences aspires to be a regional, national, and international leader in understanding the natural and human systems underlying agricultural sciences, translating that understanding to enhance quality of life, and educating the leaders of today and the future.

Introduction to the College of Agricultural Sciences and Current Cross-cutting Themes

The College of Agricultural Sciences is unique among other colleges at Penn State in that we conduct research and educational activities at the intersection where people and communities connect through environmental, social, and economic issues. Our extension education programs translate and disseminate new knowledge and technology to our stakeholders. A major strength of our college is the integration of resident education, research, and extension through joint appointments. We connect in research with resources across the University through the Penn State Institute system (Life Sciences, Materials, Social Science, Environment and Energy, Sustainability, Rock Ethics), and the statewide extension teams provide a mechanism to connect with and leverage research expertise from across campus. Within Penn State Extension, we continue to work with the state extension teams that serve to unite faculty and county-based educators in common goals of generating new knowledge, offering high-quality, focused extension education programs, and identifying and addressing science gaps on the basis of feedback from our stakeholders. The College of Agricultural Sciences is addressing complex societal issues that transcend disciplines to improve people's lives on scales ranging from local to global. We will organize our approach to teaching, research, and extension/outreach around five cross-cutting themes: advanced agricultural and food systems, biologically based materials and products, environmental resilience, integrated health solutions, and human/community connections. The cross-cutting themes utilize the interdisciplinary expertise of our faculty, extension educators, and staff in all mission areas to generate and disseminate knowledge that can be translated into solutions for these critical issues.

Figure 1 shows how the various major research themes in the

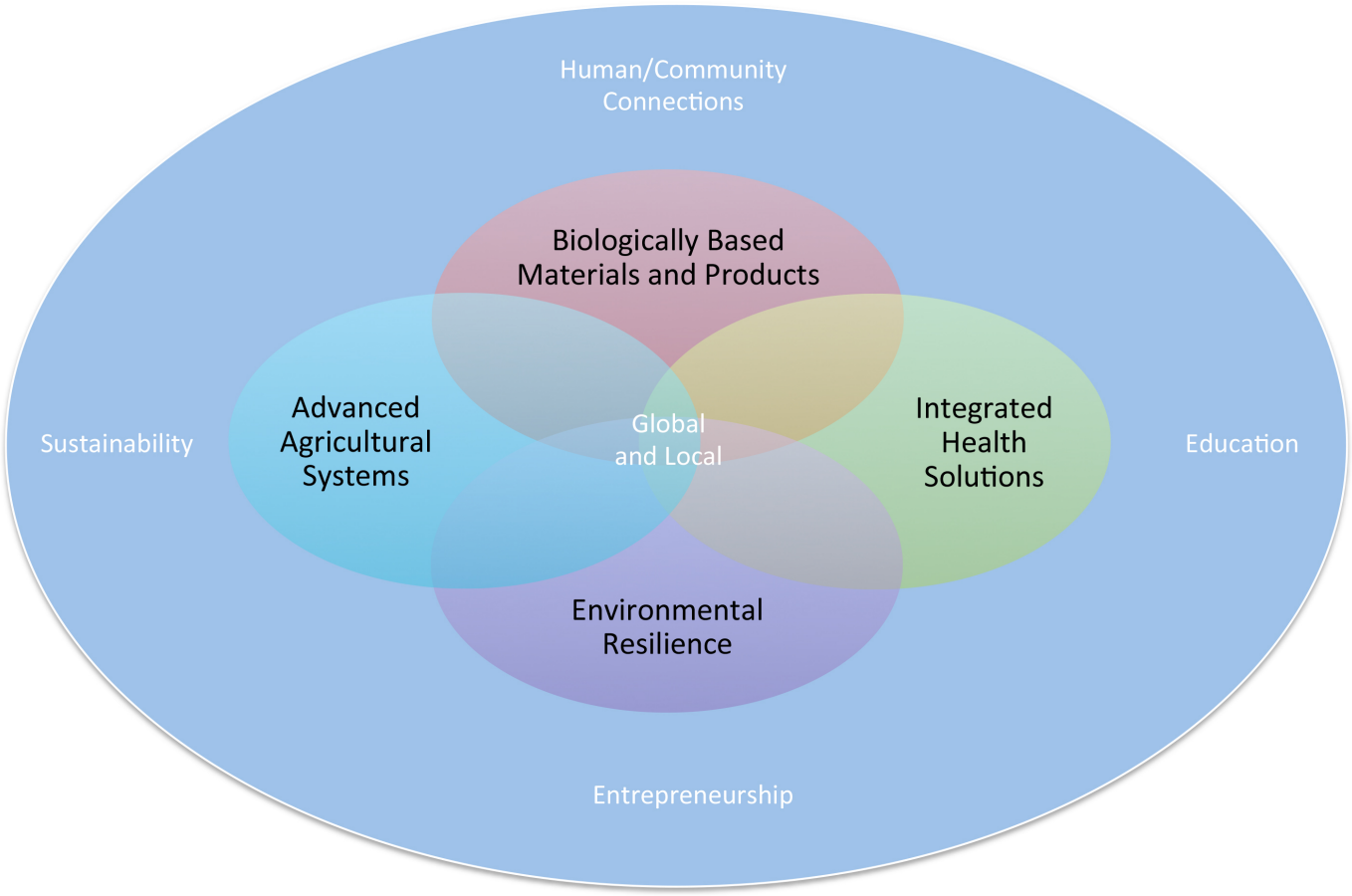


Figure 1. Our college's intellectual vision shows the intersection of major research themes engulfed in superthemes to illustrate the high degree of interconnectedness among the complex issues our college must address to meet society's needs and goals.

college interrelate. The bubbles correlate to the cross-cutting themes identified above. Today's burgeoning areas of scientific exploration occur at the intersections of these cross-cutting themes, requiring interdisciplinary teams and new approaches to achieve progress. Exploration of phytobiomes—the microorganisms living in association with plants—is an example of one such emerging research area holding great promise. To address many of these advanced societal topics, the college must consider the need to increase sustainability, address new entrepreneurial opportunities, provide lifelong learning opportunities, and develop individuals and communities. The work of the College of Agricultural Sciences occurs at multiple scales—from a local field or community in central Pennsylvania to the needs of other countries around the world. Our research, education, and extension work benefits urban, suburban, and rural populations by addressing issues that cut across this continuum.

Figure 1 should be viewed as a three-dimensional construct, with the superthemes of sustainability, entrepreneurship, global engagement, and education overlying and engulfing the five cross-cutting themes. All three missions (extension, research, and resident education) are highly integrated, with new knowledge and technology solutions and emerging societal issues feeding back into each other in a continuous cycle.

To achieve our vision we recognize and validate that the college must move toward an approach in which resident education, research, and extension activities are organized around dominant and interrelated systems. Capitalizing on this approach requires a thoughtful balance between fundamental and applied science and disciplinary and interdisciplinary excellence.

Our work, including the most fundamental research, seeks relevance and practical application. At the interface of these systems we see exceptional opportunities to collaborate, discover, and advance the frontiers of our disciplines. We will discover how the systems interact to develop products, communities, and economies and transform this knowledge into management tools that will support our stakeholders in achieving economic success, quality of life, and environmental sustainability.

CROSS-CUTTING THEMES

The College of Agricultural Sciences is committed to conducting research and implementing solutions that address society's needs and expectations. For example, our researchers seek to improve human and animal health, develop value-added products, examine alternative forms of energy, and investigate the effects of global climate change on biological systems.

Conducting these types of large-scale and complex research projects requires a multidisciplinary approach that integrates the role of institutions, markets, demographics, social norms, laws, and policies with natural science and engineering. Such an approach enables the college's researchers to examine problems from all angles and to use information from this basic research to develop new technologies and solutions to address the challenges facing people in Pennsylvania, the nation, and the world.

Our programs continue to focus on high-profile problems that, in addition to their impact in Pennsylvania, frequently represent regional and national priorities. Our work on nutrient management in the Chesapeake Bay is a regional issue of great interest to the U.S. government, and this work might set benchmarks by which other U.S. watersheds will be approached. Our continuing efforts in Marcellus shale natural gas, now much more focused on environmental and community problems related to extraction, demonstrate how we are addressing issues in energy and the environment. For example, extension education programs led to at least $250 million more in lease payments for Pennsylvania landowners. We are building predictive models that allow more targeted pest management, examining how best to preserve pollinators that support the food supply, and studying the impact of invasive species on Pennsylvania and U.S. agriculture. Our resident education, research, and extension programs must be responsive to new societal needs, investing our federal funds in a manner that furthers national agricultural goals while addressing the local implications of those national priorities.

The College of Agricultural Sciences includes nine academic departments for ease of management, but the nature of agricultural and environmental issues requires cross-cutting themes around which to foster our resident education, research, and extension programs. Almost every issue is complex, requiring the collaboration of new and changing team members. Advancements in research, for example, can help advance resident education and update our extension programs.

Advanced Agricultural and Food Systems

We are entering a new era in which decisions made and actions taken within agricultural and food systems are affecting the nutritional quality of food as well as our environment, with the most noticeable impacts on water quality and land use. As a result, society is increasingly demanding that agricultural and food systems activities be conducted in a socially and environmentally responsible manner.

Researchers in the college aim to transform thinking and practice in agricultural and food systems through research on agricultural productivity, sustainability, and adaptability. This entails coupling the college's strong expertise in the fundamental agricultural sciences (plant sciences, soil sciences, animal sciences, and food sciences) with engineering and precision technologies (agricultural and biological engineering, for example), economics, and social sciences. This work also includes the use of field-level data in conjunction with climate models to increase understanding of the interplay between human activity, agricultural production, and the environment.

Questions addressed in this area include:

- How will agriculture need to adapt in light of a growing urban population and increasing pressure on agricultural land conversion?
- How can we balance the combined needs for energy and food, both now and in the long-term future, with uncertain availability of water resources and global climate change?
- How do field-scale changes in conservation practices or waste handling influence water quality in the Chesapeake Bay?
- How does landscape heterogeneity influence floristic diversity and associated beneficial insects?
- Which microorganisms are active in various environments and why are their actions important?

Biologically Based Materials and Products

The demand for biorenewable resources—materials made from living organisms, often converted into value-added products—continues to rise as a result of the need to reduce our dependency on fossil fuels. Likewise, biobased products that improve human health are becoming increasingly important as safe alternatives to chemically derived medications and personal-care products.

To meet these needs, researchers in the college are using their expertise in plant and microbial genetics and biotechnology to investigate novel approaches to using genetic systems and biological materials to create value-added commercial and consumer products.

Questions addressed by these researchers include:

- How can we remove and replace toxins, such as those found in pesticides, with biobased substances that are safe for the environment and for human health?
- How can we replace petroleum derivatives with green materials and composites?
- How can we use a variety of animal, human, and industrial waste products in economically valued ways?

Environmental Resilience

Humans are changing the environment at an unprecedented rate, from introducing chemicals into ecosystems, to polluting freshwater supplies, to altering the climate. Providing innovative solutions to enhance and protect managed and natural ecosystems, ecosystem services, and human health and well-being is a major focus of researchers in the college.

Questions addressed by these researchers include:

- Can we use climate change to our advantage in agriculture?
- How can we prepare for disasters related to climate change?
- What new technologies can we develop to improve water quality?
- How do various land practices influence water quality?
- What are the effects of synthetic chemicals in the air, soil, and water, and how do they affect sensitive species?
- Can we guide energy development in a way that minimizes environmental and health impacts?

Integrated Health Solutions

The health of an individual is dictated by genetics, but it is also largely influenced by behavior and the environment. For example, the environment can affect human health by influencing food choices. In addition, as the world population continues to rise, plants and animals used in agriculture will be grown in increasing densities, presenting a variety of issues, such as the concentrated use of chemicals and the increased risk of spread of infectious diseases, that may affect human health. Another threat to human health is low genetic diversity among food plants, which can make these species susceptible to environmental perturbations.

Researchers in the college advance and improve the health of humans, animals, and communities through research into preventive, corrective, diagnostic, and predictive solutions to the challenges presented by lifestyle, diseases, pests, and toxins.

Specifically, they are examining the following questions:

- How are infectious and beneficial microorganisms transmitted, and how do they evolve?
- How can we improve human health through behavior and environment?
- In what ways do human interventions affect the health of the environment?

Overall, the goal of researchers in the college is to find solutions to the agricultural problems of our time by conducting basic and applied research with colleagues from around the world.

Human/Community Connections

Humans form socioeconomic systems that are outgrowths of and dependent on the environment in which they live. Their consumption choices (food, clothing, housing, etc.), health, education, employment, quality of life, and ability to cope economically vary, depending on their sociodemographic characteristics, and are affected by the communities in which they live. Communities in turn are strongly affected by socioeconomic forces that play out at the local, regional, and global levels. A socioeconomic system has three levels: (1) individual and household, (2) local community and regional economy, and (3) the various levels of government where policies related to food,

land use, and economic and social development affect human outcomes.

Many major issues that society faces today are social or economic in nature. The national and international energy situation and need for alternative energy sources, rising food prices and impacts on food security and public health, and human population growth and its impacts on the natural environment represent three examples. Solutions to each of these societal problems require an understanding of the economic and social behaviors that comprise the socioeconomic system. Further, the major issues that we face in Pennsylvania, the Northeast, nationally, and internationally will in almost all cases require integration among the socioeconomic system and the natural and physical sciences. The problems are complex, as are the systems that must deal with them.

We have a strong and far-reaching extension effort in the following areas within the socioeconomic or human/community connections theme:

Community Resilience and Capacity

Helping communities improve their economic resilience, create sustainable infrastructures, and promote their local economy through value-added opportunities and new business development. Extension supports this major topic area through leadership training, economic and community development, and entrepreneurship programs. Communities extend beyond the town or city boundary into the surrounding countryside. Therefore, agricultural businesses are a part of the community fabric and contribute to their economic vitality.

Positive Future for Youth, Families, and Communities

Providing a wide range of evidence-based programming to support healthy families, build positive youth skills, and strengthen intergenerational relationships within both rural and urban communities. Extension in the College of Agricultural Sciences is unique in providing one of the largest youth development programs in the nation. 4-H reaches more than 200,000 youth between the ages of eight and eighteen in Pennsylvania and more than six million nationwide. These programs teach youth leadership skills and provide science, technology, engineering, and math (STEM) education. In addition to 4-H, extension also works closely with the College of Health and Human Development on the PROSPER program, a youth and family resilience program designed to prevent development of negative behavior in children. Non-youth-based programs include Healthy Lifestyles and EFNEP (Expanded Food and Nutrition Education Program). All of these programs are interrelated and have a major impact on family and community resilience.

SUPERTHEMES

Our college's superthemes overlie all of the cross-cutting themes.

Sustainability

The University's vision is that sustainability is thoroughly integrated throughout teaching, research, and service. Given our college's focus on agriculture, natural resources, and rural communities, we have a long history of work on sustainability issues. Our extension mission takes sustainability to a higher level through direct engagement with stakeholders on issues affecting their health and well-being, the quality of the environment, and the economic vitality of current and future generations (see Goal D).

Global Engagement

By 2050, a world population of more than nine billion people will result in a twofold increase in the demand for agricultural products. Simultaneously, threats to agricultural systems, such as water scarcity and climate change, will reduce the likelihood that these demands will be met. Our faculty members and students address issues of food security, poverty, environmental sustainability, and economic opportunity by seeking out international collaborations and partnerships and by researching innovative solutions to these global problems. Their efforts are scalable; the work they do in a particular location can be applied toward finding solutions for the world at large. Researchers in the college are improving the outlook for people in Pennsylvania, the nation, and the world.

Entrepreneurship

Entrepreneurship and innovation are essential for everyone involved in food and agriculture as we continue to tackle our challenges of feeding the world, advancing human and animal health, and providing the next generation with biorenewable energy and materials—all while being stewards of the earth's natural resources. This supertheme aligns with President Barron's recently announced entrepreneurship initiative (see Appendix B: Highlighting Our Accomplishments 2008–2013).

Education

Education in our college occurs within the three branches of our mission—resident education, research, and extension. We educate not only students on campus but also, through extension, citizens throughout the Commonwealth and beyond. Our engaged scholarship activities and opportunities involve students in high-impact hands-on learning, often with direct potential applications to their later careers. Our support for precollegiate organizations such as the FFA, 4-H, and other youth organizations provide a connection to excite youth and strengthen their resolve to pursue a career in the food, agricultural, and natural resource sciences.

Future Strategic Initiatives

Although we visualize the college through the above cross-cutting themes, the intersections of those themes provide fertile ground for addressing pressing and difficult questions important to advancing agriculture. The following areas have been submitted as possible initiatives in which the college could make investments to build programs where we already have some critical mass. Although there is a solid base already in the college, key investment in a few of these areas will enhance our efforts, fill some voids, and increase our competitiveness for attracting external funding.

MICROBIOMES

Plants, animals, and humans do not live in isolation, but in the context of microbial communities termed the microbiome. It is now recognized that the microbiome constitutes an important component of any organism's phenotype. Thus, characterization of the microbiome is a key to understanding the health of an organism. The ability to manipulate an organism's microbiome will enable profound opportunities to improve human and animal health and to improve agricultural productivity and sustainability.

Faculty members across multiple departments within the college broadly conduct microbiome research in important environmental, agricultural, and biomedical arenas. Research may focus on microbial ecology, microbial communities, microbial surveys, metabolomics or genomics, and/or the impacts of the microbiome on human, animal, and plant health, as well as plant and animal production. Scientists in the college work in a dynamic environment that brings together basic and applied scientists and encourages them to study and characterize the microbiomes of a variety of organisms and learn how they contribute to, and vary, in health and disease. The synergies resulting from this blending of diverse approaches yields profound insights into the complexity of interactions of environmental factors such as nutrients, toxins, or pathogens on the successful microbiome. For example, research is ongoing to understand the effects of foods or nutrients on the microbiome in maintaining intestinal health, and the effects of natural products on the gut microbiome. Other studies may focus on the microbiome and health in the applied areas of livestock health, production, and on-farm food safety, or may focus on crop health, integrated health, one health, food safety and security, and environmental stewardship and resilience. We will use advances in these areas to improve food production and human and animal health and well-being, promote sustainability, and foster entrepreneurship and profitability. College faculty in the Center for Molecular Immunology and Infectious Disease recently sponsored a popular microbiome workshop, and several were involved in initiating a gnotobiotic facility for the production of germ-free mice.

The college contains a broad spectrum of expertise in these areas and is well prepared to lead microbiome studies. To better integrate and expand this focus, it is essential to continue to support and extend the expertise of our current faculty and increase our capabilities in the areas of metagenomics, metatranscriptomics, metabolomics, and bioinformatics.

ENVIRONMENT AND HEALTH

Faculty members in the college conduct research on the broad impacts of the environment on health. We foster a dynamic environment that brings together basic and applied researchers and encourages them to look for important problems that can be solved collaboratively. The synergies resulting from this blending of diverse skills and approaches yields profound insights into the complexity of interactions of environmental factors such as nutrients, toxins, or pathogens on human and animal health. For example, several new cross-cutting proposals in the college focus at the boundaries of nutrition, microbiology, and metabolomics, in areas such as the effects of foods or nutrients on intestinal health, or the effects of natural products on the gut microbiome. Other studies focus on environment and health in the applied areas of livestock health and on-farm food safety, or may focus on integrated health, one health, food safety and security, and environmental stewardship and resilience. We will use advances in these areas to improve human and animal health and well-being, promote sustainability, and foster entrepreneurship and profitability.

The college contains a broad spectrum of expertise in these areas and is well prepared to address both macro and micro effects of environmental factors on human and animal health. To better integrate and expand this focus, we should continue to support and extend the expertise of our faculty in these areas, and we should increase our capabilities in the areas of bioinformatics, medicinal chemistry, and metabolomics.

APPLIED EVOLUTION

Much of modern agriculture, medicine, and public health is about attacking the life forms that harm us. Yet these life forms are extremely adept at evolving back, and this counter-adaptation is generating some of the most significant agricultural and health challenges for the twenty-first century.

Pathogens rapidly evolve drug resistance, and there is a serious risk that some will evolve around vaccines. Antibiotic-resistant food-borne pathogens are contaminating our food supply. Emergent infectious diseases are frequently the result of adaptation to new hosts or new environments. Cancer too is an evolutionary process: the evolution of drug-resistant cell lines is a major cause of death.

There is another context in which the problems of counter-

adaptation have played out: agriculture. Insect pests, weeds, and plant pathogens all rapidly evolve resistance to insecticides, herbicides, fungicides, and even genetically modified crops. Many of these problems are decades old, meaning that agricultural scientists are often well ahead of medicinal scientists in thinking about resistance management.

It is difficult to determine the global burden imposed by all this counter-adaptation; *in the United States, perhaps two-thirds of a million deaths per year are due to this evolution* (combining cancer deaths with those from drug-resistant infections). Importantly, cancer rates are coming down only slowly, and deaths due to infections are rising rapidly as antimicrobial resistance spreads. Globally, problems of resistance and emergence of infectious diseases are perhaps even more pressing. In short, evolution matters to human health and well-being.

Penn State is uniquely well positioned to lead the world in evolutionary risk assessment and management. This is because we have substantial existing expertise in infectious disease, cancer, evolutionary biology, ecology, herbicide resistance, insecticide resistance, and resistance in plant pathogens. But these specialties need to be brought together and synergized; relatively few targeted hires would go a long way. Moreover, *we are unaware of any competitor institutions with the vision to bring such diverse areas together.* The potential is largely untapped because most people working on infectious disease and cancer have little or no formal training in evolutionary biology (particularly those trained in medicine or clinical microbiology and oncology). This means there are intellectual opportunities at the interfaces of evolutionary biology with agriculture, public health, and medicine that have the potential to generate novel approaches to evolution-proofing existing and new therapeutics.

Examples of specific questions to be addressed include the following:

- Can the evolution of resistance be best retarded by using chemicals (drugs, insecticides, fungicides, etc.) sequentially, in rotations, at random, or in combinations?
- Under what circumstances should chemicals be used aggressively? Standard practice is to hit hard; that approach kills semiresistant mutants but at the price of providing maximum selective advantage to organisms with high-level resistance—the very organisms that cause the problems.
- What properties of chemicals best retard evolution (e.g., short or long half-lives, mode of action)?
- What nonchemical technologies can best retard the evolution of resistance?

The answers to these questions almost certainly are context specific. The intellectual challenge is to identify the general principles, determine the details that matter, and use these to solve real-world problems.

HUMAN AND COMMUNITY RESILIENCE

Human and community resilience stems from the ability of communities and their residents to survive and thrive in the face of social, demographic, economic, and environmental changes. Resilience and sustainability are determined at the intersection of human and natural systems and require that humans recognize the interdependence of human and natural systems to achieve sustainability.

Human communities pose the greatest threat to sustainability but also are the key to achieving sustainability. They are the locus of collective action to improve quality of life and to change human activity that negatively affects natural communities. Community leaders and residents need to be prepared to engage issues and change behaviors that threaten sustainability. The ability to be engaged in communities is affected by the social and economic well-being of children, youth, and families as shaped by networks, opportunities, and support systems that operate at community, regional, and global levels. Projected population increases will challenge the ability of individuals, communities, and nations to address the increased demands on agricultural food and fiber systems, impacts on water and land resources, and ecosystem, human, and animal health and safety. It is critical that scholars, policymakers, and citizens understand how communities and economic systems can change to enhance opportunity, minimize risk, and respond to change in human and natural systems. A full understanding of the impact of human activity on natural systems, and the reverse, is central to achieving sustainability. Our college is uniquely positioned to contribute to research, teaching, and outreach at the intersection of human and natural communities.

The Penn State College of Agricultural Sciences has a distinguished history of scholarship that addresses the social, demographic, economic, and policy issues facing communities and their members. It also has addressed how human activity intersects with natural and agricultural systems. The college should continue to invest resources in efforts to understand the relation of human and natural communities as human societies seek sustainability. The college by itself and in collaboration with other units at Penn State has been adding capacity in analysis of spatial and demographic processes that can increase understanding of the interrelationships of human and natural systems that affect our future, especially in the areas of food, health, and climate change. Similarly, the capacity to design and implement research on community-level impacts of new technologies, production systems, and policy options in the areas of energy development, climate change, and food and agricultural systems reflects current college strengths and future societal needs.

Human and natural community resilience are highly interrelated and can be affected through:

- Better understanding the characteristics of resilient human and natural communities, compared to those communities not able to effectively respond to change.

- Identifying the relationships among place and human and natural systems processes and dynamics through advanced spatial modeling using new and existing data sources on human and natural systems available through the Penn State Restricted Data Center.
- Educating all youth and adults about the interdependence of human and natural communities and how to be effective leaders and participants in their communities, with an emphasis on sustainability.
- Training the next generations of educators and researchers to identify and address issues at the intersection of human and natural communities and the barriers to human and natural community resilience and sustainability.

Decision making in human communities affects the health and sustainability of human, agricultural, and natural systems. Providing knowledge to decision makers and the public to increase understanding of the interdependence of human and natural systems and how these systems are affected by decisions made daily by individuals, organizations, governments, and communities is essential to a sustainable global future. Investment will permit an increased focus on research, teaching, and outreach to understand and identify strategies to increase human and natural community resilience and capacity in the face of increasing populations and the implications of climate change in the short and long run. Such an investment would allow for increased capacity to create opportunities for collaboration within the college and Penn State, and to build broader national and international coalitions to understand and promote sustainability of human and natural systems.

LANDSCAPE STEWARDSHIP: OPTIMIZING WATER AND LAND USE

Human, community, and environmental health are directly affected by availability and quality of water and land worldwide. Water will most likely be the main factor limiting food production sufficient to feed the world's population. The utilization of water and land for growing crops, while concurrently protecting the water from nutrient runoff and hormone and pharmaceutical contamination, and the land from sediment loss and nutrient depletion, are challenges for which the college has a broad range of expertise. Competition for land and water is becoming increasingly intense due to population and economic growth, among other factors. Climate change will amplify these effects, and development of new supplies and water-saving technologies and institutions will become priorities. This links in many ways to advanced agricultural systems and to social policies and institutions to address these issues and thus requires the integration of knowledge from every department in the college. The expertise in the College of Agricultural Sciences will be enhanced by strong collaborations with other colleges (e.g., Engineering, Earth and Mineral Sciences, Eberly College of Science), as well as relevant University centers and institutes.

Goals

Goal A: Enhance Student Success and Optimize Enrollment

Optimizing enrollment and enhancing student success is of prime importance to the success of our college. To do this we will need to enhance some of our programs, making them more attractive to potential students. The student population in the College of Agricultural Sciences includes undergraduate and graduate students, as well as lifelong learners. Key indicators of student success include placement of our graduates with employers, the graduate/professional schools that enroll our students, and entrepreneurial opportunities provided to students.

OBJECTIVES AND STRATEGIES

1. Determine and achieve appropriate enrollments for each undergraduate program while seeking to recruit and retain high-ability and diverse undergraduate students.

Undergraduate enrollment for fall 2013 was 2,879 students (2,091 enrolled at the University Park campus; 788 enrolled at other Penn State campuses). Total undergraduate student enrollment increased by 23.8 percent since fall 2008 when enrollment was 2,326 students. Projected total undergraduate enrollment for fall 2014 is 3,000 students. Optimal enrollment will vary across majors.

- Target college recruiting efforts towards viable under-enrolled degree programs to recruit and retain high-quality diverse undergraduate students by increasing awareness of programs' relevance.
- Periodically review recruiting best practices of successful programs for sharing throughout the college.
- Review instructional needs of all programs to ensure needs match resources.
- Expand efforts to promote equity and increase diversity.
- Ease student acclimation and improve retention by focusing on student life, transition, and academic success skills.
- Sponsor precollege activities in diverse and high impact geographic locations for increased visibility.

- Continue to enhance the college's excellent reputation in academic and career counseling.
- Integrate county extension offices into the recruitment process.

Measures

- Review enrollments in undergraduate programs throughout the college to strategically determine which programs have optimal enrollments and which are under-enrolled but have both strong stakeholder support and viable employment opportunities upon graduation.
- Assess the impact of targeted recruitment programs and campaigns.
- Increase transitional programs and services for international, change of campus, and advance standing students. Secure student feedback on new student, change of campus, and transfer orientation processes.

2. Review undergraduate curricula to ensure graduation of students with multiple opportunities.

With the college's restructuring from 12 to 9 academic units in July 2012, 18 of the 19 baccalaureate majors have submitted, initiated, or completed revisions to their degree programs. The thoughtful and

planned curricular and course revisions and newly developed courses indicate the collective effort of faculty and staff to continually offer the best academic experiences for students.

- Annually review course enrollments and emerging opportunities to drop under-enrolled courses and design new courses, as appropriate.
- Emphasize undergraduate experiential learning opportunities and professional development experiences through undergraduate research, independent studies, and internships.
- Enhance emphasis on topics such as entrepreneurship, innovation, leadership development, and working in a global society.
- Encourage integration of elements of general education, such as critical thinking, problem solving, teamwork, and communication, into all curricula.
- Identify and assess student achievement using program learning objectives.

Measures

- Assess and revise curricula accordingly for relevance to market needs.
- Document progress and impact of the baccalaureate learning outcome assessment process.

3. Increase funding for scholarships and program support.

Scholarship funding is derived from interest income on scholarship gifts and endowments. Funding for scholarships increased by 20.7 percent from $1,797,341 in fall 2008 to $2,168,549 in 2014.

- Seek funding to support, promote, and enhance high impact education practices, such as internships and summer work experiences, undergraduate research, international educational experiences, collegiate student organization engagement, and first-year and campus transition experiences.
- Increase the number of scholarships for first-year and out-of-state students.
- Seek support for student activities, engaged scholarship, and programming.

Measure

- Increase the scholarship portfolio and program funds by 10 percent over the next five years.

4. Recognize and reward faculty, staff, and graduate students for their excellence in teaching and advising as well as in their leadership of co-curricular activities.

The College of Agricultural Sciences at Penn State is one of the premiere institutions in the country offering undergraduate and graduate degrees in the agriculture and renewable natural resources. We believe that quality of instruction, teaching, and academic advising by outstanding and dedicated faculty and staff is pivotal to student learning and success and central to the education mission of the college. We strive to recognize and promote excellence in teaching. We present four annual college-wide awards in this area: the Community of Teaching Excellence Award (est. 2000), the NACTA Teaching Award of Merit (reinstituted in 2007), the Paul R. and Joan M. Shellenberger Award for Excellence in Undergraduate Teaching (est. 2010), and the Community of Advising Excellence Award (est. 2013).

Additionally, the College of Agricultural Sciences Alumni Society recognizes faculty with outstanding skills in undergraduate academic advising, career planning, and personal counseling. The society also offers awards to undergraduate students who have participated in a credit or non-credit internship.

- Assess the scope of professional development opportunities for graduate students, staff, and faculty in the scholarship of teaching and learning.

Measures

- Seek to develop or support two to four new awards that recognize excellence in teaching and/or advising.
- Collaborate with the Faculty Development Committee and other groups to sponsor professional development programs in teaching and learning.

5. Continue to develop graduates who are highly competitive and actively recruited for employment, graduate/professional school, leadership opportunities.

A new senior exit survey was developed to gather employment, co-curricular, and academic information from students. A unit-specific section provides feedback and offers opportunities to measure learning outcomes as part of University-wide assessment policy. We consistently achieve close to a 70 percent response rate from our students. Summary information indicates a high degree of satisfaction and level of preparation. Ninety-four percent of respondents rated their entire Ag Sciences experience as either excellent or good.

Each fall the college hosts an Ag Career Fair. More than 110 vendors/employers and 860 students attended in 2013, the highest attendance to date. Companies share information about internship and employment opportunities with our students.

- Develop and enhance tracking systems for student outcomes.
- Create and enhance opportunities for linking students with employers and stakeholders.
- Showcase nationally and internationally recognized programs and students.
- Promote and reinforce the high standards of ethical behavior and values.

Measures

- Monitor undergraduate senior survey results.
- Showcase recruitment and retention efforts.
- Collect placement data on graduates.
- Maintain accreditation and certification where applicable.
- Conduct program reviews where appropriate.
- Enhance materials and opportunities to assist students to prepare for graduate and professional school.

6. Enhance available learning opportunities and support student participation in engaged scholarship (experiential and high-impact educational practices) at the curricular and co-curricular levels.

Experiential and high-impact educational experiences expand and reinforce content learned in the academic program; reinforce communication, teamwork, and leadership skills; raise global competence; and enhance citizenship and civic awareness. Additionally, co-curricular activities, such as internships, externships, research, international experiences, and student organizations, help develop career-ready graduates. Examples of support in experiential learning opportunities include the following: (1) In 2013–2014 the college offered $94,000 in undergraduate research support. This is a partnership among undergraduate and graduate education and extension as well as academic units and endowments.(2) Increased by 50 percent the level of support to competitive and noncompetitive student organizations, activities, and events from $28,000 in 2010–2011 to $42,000 in 2013–2014. (3) Supported the Spanish in Agriculture Program, a four-course series of agriculture-specific Spanish language instruction, including a four-week immersion experience in Costa Rica.

Enhance the overall undergraduate experience through co-curricular and curricular practices categorized as engaged scholarship or High Impact Educational Practices, as endorsed by the Association of American Colleges and Universities.

Measure

- Seek 100 percent participation by Ag Sciences students in at least one high-impact educational practice (internships and summer work experience, undergraduate research, international educational experience, collegiate student organization engagement, and first-year and campus transition experiences).

7. Strengthen and enhance infrastructure to support teaching, learning, and advising.

Students may begin their academic career at any of the twenty Penn State undergraduate campuses located across the state. Approximately 60 percent of Penn State students elect this path, completing the first two years of their academic career at a campus other than University Park. The college's student population is aligned with this University trend. Aware of the challenges of a dispersed population, the college was the first at University Park to create a position of coordinator of campus enrollment and retention to help narrow the distance between the previous campus and University Park, and to keep students and campus faculty and administrators connected to the college.

The college developed the first Campus College mentoring program, piloted in spring 2013, to help facilitate the successful transition of our campus college students. This program engaged College of Agricultural Sciences students at University Park who began their education at another campus as mentors for incoming campus students.

We initiated a mini teaching sabbatical program for University Park faculty. In 2013 two individuals were selected to participate in the program.

With several department heads, we revised and reallocated the Education and General departmental allocation line of the college's allocation of the Penn State appropriation to help support and infuse funding into resident education programs.

Improve facilities required for student learning.

Measure

- Enhance facility and infrastructure resources for applied student learning experiences.

Goal B: Empower the Engines of Discovery and Application

As one of the premier research universities in the country, Penn State must conduct research valued at local, national, and international scales. It must help illuminate and solve agricultural, environmental, and social problems. The college's research efforts build from the continual discovery through fundamental science at all levels, to the application and subsequent commercialization of some findings.

Through the development of this strategic plan, the college identified cross-cutting research themes that affect the whole of the college. We are moving forward to enhance our research infrastructure and meet the societal challenges of the future.

A key component of building for the future is improving the quality of our graduate students and the education they receive within the college. We strive to prepare our graduate students for a variety of careers by teaching them to meet life's challenges with diverse tools such as excellent writing skills, a sense of intellectual independence and autonomy, an appreciation for the importance of ethical behavior and diversity, the ability to work in teams, and an understanding of technology development and commercialization.

OBJECTIVES AND STRATEGIES

1. Maintain a robust portfolio of fundamental science to generate new knowledge.

The college research program will maintain the pursuit of fundamental science as the core element of discovery. Fundamental and detailed knowledge of the way systems work—from the subcellular to the global food supply—is the root on which all else builds. Researchers in the College of Agricultural Sciences at Penn State are innovators. These highly imaginative people continually generate new ideas that are highly competitive for extramural funding. These activities ensure the college's preeminent reputation and commitment to excellence as a national leader. Fundamental science is pursued in light of potential future applications.

Encourage and invest in faculty co-hiring opportunities with other colleges and institutes.

Measures

- Increase participation in co-hire opportunities across the University.
- Increase our co-hire partnerships outside of the college.

Expand the research portfolio beyond traditional funding sources.

Measures

- Increase faculty participation in research sponsored by non-federal funding sources such as foundations.
- Facilitate visits and workshops by program directors from less engaged federal funding agencies.

Become more interactive with the Penn State institutes to encourage their alignment with college priorities.

Measures

- Increase participation in University-wide initiatives.
- Increase engagement with institute directors to promote college priorities.

2. Translate knowledge into real-world applications through innovation and technology development.

The College of Agricultural Sciences is committed to fostering technology development and translating research results from the laboratory to the marketplace. We seek to enhance our relationships with industry as a way to address societal issues and to expand our research funding base. We will ensure the highest standard of ethics and integrity in balancing private and public benefits in this work.

Promote commercialization of the research portfolio through intellectual property development.

Measures

- Increase number of faculty who learn about the commercialization process and promote new approaches to support intellectual property development that align with University initiatives.
- Recruit an intellectual property development officer for the college to assist faculty and staff with developing the commercial potential of their research.
- Provide competitive proof-of-concept funding that will enable researchers to realize the commercial potential of technologies arising from ongoing research projects.
- Recognize research commercialization as a valued component of faculty scholarship and acknowledge these activities in the promotion and tenure process.

Establish long-term relationships with industry partners that will provide mutual benefits and achieve compatible goals.

Measures

- Increase industry engagement by aligning faculty research expertise with industry interests to support research activities.
- Enhance participation in regional and national research-industry clusters that focus on agricultural and environmental sciences.
- Expand industry relationships that integrate the research, teaching, and extension missions of the college to provide opportunities for internships, employment, outreach, and philanthropy.

Develop innovative programs and products with significant societal impacts.

Measures

- Support cross-cutting themes and champion their advancement throughout the college.
- Intensify engagement with primary stakeholders to identify significant issues and topics that are consistent with the public interest.
- Encourage research that reflects the varied perspectives in areas of public controversy and ensures a balance between public and private benefit.
- Increase innovative efforts to disseminate research findings to a broad audience of stakeholders, policy makers, and the general public.

3. Develop research programs that result in scalable, local-to-global impacts.

To reflect the broad array of stakeholders in the College of Agricultural Sciences, our research must have local, national, and international impacts and value. The new Global Food Institute within the Office of International Programs will facilitate the development of a sustainable and impactful international research portfolio. An active and integrated international programming effort is critical to all aspects of the higher education mission. An international focus will help the college prepare graduates to be effective players in the global marketplace. Work at all spatial scales feeds back into itself. Discoveries in the mid-Atlantic region also sometimes illuminate work globally.

Promote research activities with impacts that are fully scalable from local to international.

Measures

- Increase engagement in research of importance to Pennsylvania and regional stakeholders.
- Increase translation of regional solutions to national and global contexts.

Establish the "Global Food Institute" within the Office of International Programs to address agricultural and environmental challenges as complex integrated systems that require scalable solutions.

Measures

- Recruit a full-time director and staff for the Global Food Institute.
- Establish a new Global Faculty Fellows program to support international research initiatives.
- Develop an endowment to ensure the long-term viability of the institute.

Develop a robust portfolio of sustained, purposeful international research activities.

Measures

- Improve capacity and efficiencies in institutional processes to encourage and grow international research programs.
- Promote long-term international relationships with sustainable funding models.

4. Strengthen institutional capacity to address complex societal issues.

We will continue to build, maintain, strengthen, and update our research infrastructure and enabling technologies. The strategic planning process allows us to see where we should make investments to most effectively pursue new cutting-edge ideas related to the cross-cutting themes discussed above. Infrastructure investments increase our capacity to innovate and allow us to make the most of our human capital.

Invest in advanced infrastructure and enabling technologies.

Measures

- Create a task force to assess the current state of and needs for college research facilities.
- Develop a plan to prioritize investments in strategic and enabling technologies.
- Invest in strategic and enabling technologies and assess the impact of those investments.

Facilitate team-based research activities that focus on strategic granting opportunities.

Measures

- Provide more professional development and leadership training opportunities for faculty.
- Increase investment in sabbatical leaves to enable faculty to re-energize their research activities.

- Boost investment in seed grants that would encourage cross-cutting thematic research teams.

Invest strategically in research faculty and staff.

Measures

- Develop faculty succession planning and strategic hiring processes.
- Coordinate efforts across the college to establish new endowed professorships and chaired positions.

5. Train the next generation of scientists and educators to be competitive and successful in the new economy.

In today's new economy, there are increasing opportunities outside of the academy for graduate students, and the skills graduates need have changed and broadened. Our programs help graduate students learn to work as team members, improve their writing skills, and understand research commercialization and career options in industry. We emphasize engaged scholarship such as internships and externally funded fellowships for stipends and research.

We have achieved our goal of enrolling 600 graduate students, so now we are focused on improving retention, success, and placement of these students. As the diversity of our graduate student population expands, we also need to ensure that we are meeting their cultural needs and their need for community.

Provide professional development opportunities for graduate students and postdoctoral associates.

Measures

- Expand offerings of interactive professional development workshops to enhance the "toolbox" of skills necessary for academic positions or alternative careers in industry, government, or foundations.
- Increase the number of externally funded fellowships awarded to graduate students by engaging the Penn State Fellowship Office to identify appropriate agencies and develop successful applications.

Increase the overall quality of graduate programs in the college.

Measures

- Develop recruiting strategies that attract the highest caliber students to our programs.
- Coordinate recruiting efforts among the interdisciplinary and departmental programs and proactively invest in graduate recruitment activities.
- Create graduate program structures to improve student success (retention, graduation, and placement).
- Ensure advanced ethics training to promote research and scientific integrity.

Increase diversity in our graduate student programs.

Measures

- Create a "Diversity Recruiting Program" that provides incentives to recruit high-quality minority students.
- Develop a college-wide communications strategy that will assist departments in recruiting and retaining underrepresented students.
- Increase participation in University-level minority graduate student programs such as Sloan and STEM scholars.
- Establish a pipeline with select minority-serving institutions to provide increased visibility of college programs through direct interactions with faculty and undergraduate programs.
- Increase mentoring activities that link faculty with minority students to successfully navigate through their graduate programs.

Enhance a global perspective through international graduate educational programs.

Measures

- Increase resources provided for participation in International Agriculture and Development as a dual degree graduate program.
- Strengthen the International Agriculture and Development curriculum by integrating language competency, geography, and culture.

Goal C: Create Dynamic, Customer/Stakeholder-focused Educational Products, Services, and Impacts

We celebrated the one-hundredth anniversary of Cooperative Extension on May 8, 2014. As it enters its second 100 years, Cooperative Extension is undergoing a dramatic transition into an organization that can adapt rapidly to the changing needs of our twenty-first-century customers. These changes are driven by a multitude of external and internal pressures. We will collaborate with diverse statewide, national, and international partners and provide stakeholders universal access to research-based information through high-quality, consistent educational programs delivered using diverse technologies and formats through a county-based presence. The new Cooperative Extension will consequently be a more unified, agile organization that focuses on strategic areas of excellence and uses a team approach to address local needs.

The demographic profile of Pennsylvania residents is changing rapidly. In general there is a major migration of youth toward the larger suburban and urban areas of Pennsylvania, leaving an aging population in many rural communities. In addition, the state's minority population is growing rapidly in support of the service and agricultural industries. In recognition of these significant demographic trends, we are pursuing new opportunities to meet the needs of suburban and urban residents, while continuing to provide high-quality programs to our more traditional agricultural customer base. We recognize that the traditional agricultural focus of our college does not stop at the boundaries of our towns and cities, but permeates rural, suburban, and urban geographies. The Penn State Centers in Pittsburgh and Philadelphia provide opportunities for the college to unite our educational, research, and extension programs with synergistic resources available at Penn State campuses in the Colleges of Health and Human Development, Medicine, Education, Arts and Architecture, and Engineering to better meet the needs of suburban and urban residents. Reaching these residents will also facilitate the college's efforts to educate the nonfarming public about agricultural issues, such as food and fiber production, farmland preservation, and land-use considerations that are vital to everyone's future. Our urban centers focus on community revitalization; efficient energy use; land use; science, technology, engineering, and math; healthy lifestyles; family resilience; green infrastructure; urban farming; and the arts.

OBJECTIVES AND STRATEGIES

1. Provide relevant, high-quality products and customer service.

We will ensure that all teams and departments are guided by the advice of relevant stakeholders on the ground and by science-based information. We will undertake the development of new and updated products and services in a logical and data-driven manner. We will employ the latest marketing technologies and best practices to ensure effective interactions with our customers. We will measure our success by increased customer satisfaction with and demand for our products.

- Fully implement external advisory committees for all teams and departments.
- Implement a strategic, formal product development process.
- Develop a data driven quality control/quality improvement process for continued assessment of products, services, and impacts.
- Implement appropriate online/mobile/marketing technologies and best practices to enhance customer interactions and access (Atlas project).

Measures

- Improve customer satisfaction with our products and services.
- Increase customer demand for our products.
- Implement a product quality assessment and improvement process.
- Develop more integrated packages of educational products and tools in support of programs.
- Fully implement the Atlas project.
- Progress in strategic implementation of an integrated phone and data handling system.

2. Create an environment that rewards innovation and risk taking that explores emerging areas and new products and expands markets and revenues.

We need to simultaneously strengthen the college's bonds to our traditional agricultural and rural customer base and expand our audience to previously underserved populations in urban and suburban areas. We will approach the development of new products and expansion into new markets using data and market research and solid e-commerce technologies. We will encourage innovation and investment in new products through wise, targeted online marketing. We will focus on reducing the amount of time and money that go into new products. Our success will be evident from an increased market share, a more diverse customer base, a broadened advocacy and support base, and more effective cost recovery leading to increased revenues. Extension programs can also trigger innovations that are later incorporated into resident education and/or research as well.

- Strengthen our traditional customer base and expand into new demographics.
- Increase the use of data and marketing research to develop products and expand markets.
- Invest resources and encourage innovation for new product development.
- Implement online marketing and e-commerce best practices.
- Create a process/pipeline to bring products that meet set standards to market in less time with less money.

Measures

- Increase market share and expand the demographic makeup of our customer base.
- Increase demand for products.
- Increase the positive impression of the Penn State Extension brand.
- Broaden advocacy base and support for the college and extension.
- Introduce more robust and consistent product lines from each state extension unit.
- Fully implement the Atlas project.
- Increase cost recovery and revenues.

3. Improve the integration of new knowledge discovery, translation, dissemination, adoption, and evaluation.

For new ideas to flourish, we must provide greater opportunities for faculty, staff, students, and stakeholders throughout the state to interact and collaborate. We will work to ensure the public has access to new research findings through quicker translation and educational program implementation, along with the awareness of expertise available on so many fronts. We will encourage innovative public/private partnerships and projects backed by multifunctional teams. Measures of success will include greater integration of and opportunities for multifunctional teams and more public/private agreements.

- Enhance the opportunities for field-based and on-campus units to interact, communicate, and collaborate.
- Improve awareness and access to research and expertise.
- Develop multifunctional teams and projects in response to grant and other opportunities.
- Expand private/public partnerships.
- Contribute to the preparation of graduate and undergraduate students.

Measures

- More fully integrate multifunctional teams.
- Expand opportunities for multifunctional teams to exchange information and develop collaborative opportunities.
- Increase public/private partnership agreements.

4. Advance a systems approach to address integrated, complex, and emerging issues.

We need to ensure that our various teams and departments always include all of the expertise necessary to solve today's complex problems, while also ensuring the cross-pollination of these groups through open lines of communication. We will know we have succeeded when we have more fully integrated departments and extension teams, more clearly defined appropriate skill sets and attributes for all employees, implemented a new job classification system for extension associates and educators, and provided more relevant professional development opportunities.

- Optimize the disciplinary make-up of teams and integration with departments.
- Create formal communication channels and expectations across teams and departments.
- Assess the skills and attributes of faculty, extension faculty, associates, and educators relative to the continually evolving needs of the customers and the organization.

Measures

- Implement team staffing models that integrate department and extension team needs.
- Improve job descriptions focused on defining appropriate skills sets and attributes for extension faculty, associates, and educators.
- Develop and implement a new associate and educator job classification system.
- Make available more robust professional development and training opportunities.

Goal D: Be a Trusted Source of Information and Provide Collaborative Solutions that Balance Agricultural Productivity and Sustainability

BACKGROUND: UNIVERSITY POSITION ON SUSTAINABILITY

Penn State's vision is for a comprehensive integration of sustainability into the University's research, teaching, and outreach in order to cultivate informed leadership on the part of students, faculty, and staff as they engage with current and future sustainability challenges. Penn State has deemed that academic units "must provide an atmosphere that encourages critical thinking and develops our capacity to account for the ethical, environmental, and economic outcomes of our decisions—an immersive education in sustainability."

Due to our focus on agriculture, natural resources, and rural communities, our college has a long history of engagement with sustainability issues (even before they were named as such). That history and the current breadth and depth of expertise in our college uniquely position us to make significant and unique contributions to the University's sustainability vision and mission.

SUSTAINING AGRICULTURE AND NATURAL RESOURCES: RELEVANCE AND STATUS

The College of Agricultural Sciences is uniquely positioned to identify and teach socially acceptable solutions to a pressing twenty-first-century concern: how we can meet increasing demands for food and fiber, while also ensuring high levels of environmental quality and human well-being. We believe that the work of our college can be centered at this important intersection of rising demands for sustainably managed food and fiber products, healthy ecosystems, and human well-being, and an increasingly resource-constrained planet.

The competing challenges of productivity and sustainability (or doing more with less in a sustainable way) are thought by many policy makers and scientists to be the most important challenge of the twenty-first-century. The Kauffman Foundation provides one framework to help us understand how supply constraints and demand drivers in the food and agricultural system are related to productivity and sustainability. Listed below are some of the demand drivers and supply constraints in the food and agricultural system that must be dealt with while protecting the environment and ensuring societal development:

Supply constraints:
- Land: declining availability and soil quality
- Higher temperatures: plant and animal responses
- Water: declining quality and quantity
- Pests: weeds, insects, disease

Demand drivers:
- Population growth
- Demand for higher quality caloric intake
- Demand for more meat
- Demand for biofuel and bioenergy
- Demand for bioproducts and biosubstitutes

To meet the demand drivers given these constraints, the food and agricultural system will have to achieve even greater levels of productivity—for example, higher yields per acre with less water and fertilizer. We will need 70 percent more food (some estimates are that crop production will need to double by 2050 to feed a population of 9 billion) to feed nine billion people while concurrently sustaining resources and ecosystems for future generations.

Also, the food and agricultural system is increasingly being called on to provide more than food directly eaten by humans. For example, it is estimated that nearly 10 percent of all global crops are now used for fuels, and more than a third are used as feed for other animals.

Penn State's College of Agricultural Sciences has a role to play in each of these critical areas: we work to genetically engineer crops that will produce more calories per acre, while researching how to grow and harvest them in more sustainable manners; we conduct cross-cutting research on managed and non-managed ecosystems that increases the capacity for informed stewardship in public policy and management decisions at numerous scales; and we are in the vanguard of research and development to expand uses of biofuels and bioproducts. With strong expertise in the applied social sciences, the college considers the human, community, social, and economic dimensions of all these issues, both in assessing the current impacts of sustainability problems, as well as the impacts of proposed solutions.

With this background in mind, we state that sustainability in the College of Agricultural Sciences means:

> the simultaneous and democratic pursuit of increased food and fiber production, human health and community resilience, environmental stewardship of managed and natural resources, and economic and social well-being for current and future generations through research, extension, and teaching.

This statement highlights the notion of interdependence between productivity enhancement on the one hand and environmental and societal goals on the other. It includes the idea of mutual collaboration along the agri-food system supply chain

versus thinking only in terms of conflicting goals. For example, technology is a key part of the discussion, but not the only component that needs to be discussed. Although technology is certainly capable of increasing efficiency, sustainability, and quality of food production, it must be accessible and culturally acceptable to those charged with being stewards of the local and regional agricultural system. The "Democratic discussion" would include input from all viewpoints, resulting in a solution that can be implemented broadly. The college is well positioned to start the dialogue in this fashion and advance learning. Working collaboratively, we can solve big problems posed by supply constraints and demand drivers in the agricultural system.

OUR UNIQUE CONTRIBUTION TO SUSTAINABILITY

The college's unique contribution to sustainability is summed up in Figure 2. Each unit at Penn State is being asked to produce such a convergence model as part of its strategic planning. The purpose of the model is to help find a sustainability strategy that builds on our abilities, aligns with our passions, increases resources, and works to resolve environmental and societal challenges. This figure also helps us communicate our unique expertise that can be used to solve complex sustainability challenges.

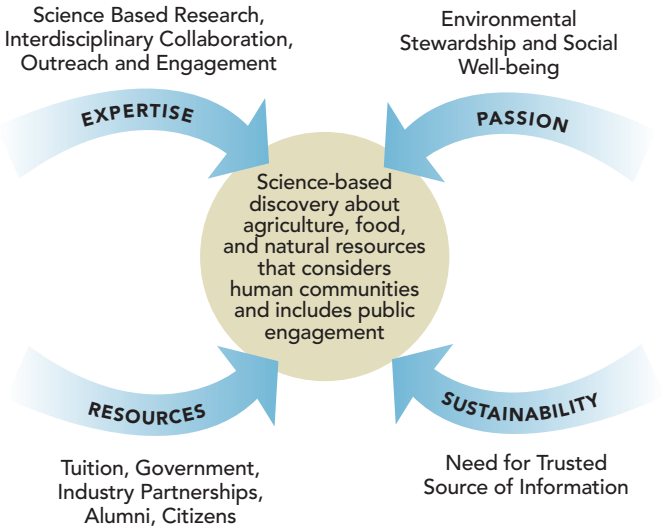


Figure 2. The College of Agricultural Sciences' contribution to sustainability at the University.

INVENTORY OF THE COLLEGE'S SUSTAINABILITY EFFORTS

The following sections highlight the college's contributions toward Penn State's sustainability goals. We describe both the current status and future plans that align with the University's efforts to integrate sustainability across all functions.

Although the three sections have been segmented here to follow the University's own "Live, Learn, Lead" strategy, we acknowledge that these concepts are intertwined and will have considerable overlap.

Teaching (Learn)

The College of Agricultural Sciences has over a century of experience offering degree programs and courses that have prepared graduates to become leaders in sustainable agriculture, natural resources, and ecosystems management. Appendix D provides a more detailed listing of our majors directly or indirectly related to sustainability.

1. The college currently offers several undergraduate degree programs dealing directly with sustainability-related topics. The college offers:
   a. Academic programs in the Department of Ecosystem Science and Management focused on sustainable management of forested ecosystems, wildlife and fisheries populations, and soil and water resources.
   b. The Environmental Resources Management major, which is an interdisciplinary, environmental science curriculum and is one of the premier environmental science programs in the nation, which is directly affiliated with the college's Environment and Natural Resources Institute.
   c. A new major in BioRenewable Systems in the Department of Agricultural and Biological Engineering, with emphasis on the fast-emerging bioproducts industries that will offer alternatives for petroleum-based materials.
   d. The Community, Environment, and Development major in the Department of Agricultural Economics, Sociology, and Education (AESE) that approaches economic, environmental, and community sustainability challenges with an emphasis on the role and functions of economic and social systems in sustainability, broadly conceived, and human well-being. The Environmental Science option under the AESE Ag and Extension Education major, which prepares the next generation of environmental science instructors for Pennsylvania schools.
   e. An interdisciplinary Plant Science major with an Agroecology option that emphasizes a systems approach to managing agroecosystems through a curriculum of plant and soil sciences, pest management, ecology, and some social sciences. It prepares students for agricultural and ecological careers, sustainable food production, and graduate studies.

2. Our college works closely with the University's Sustainability Leadership Minor. Our faculty will serve on the advisory committee, and we will offer courses for students seeking this minor.
3. Our college works closely with the University's Entrepreneurship and Innovation initiative by encouraging cross-college collaboration among students who want to combine entrepreneurship and sustainability.
   a. The College of Agricultural Sciences Entrepreneurship and Innovation Program is actively developing student and faculty entrepreneurs and innovators to address the pressing sustainability challenges in food, agriculture, communities, and biorenewables.
   b. We will host an annual business plan competition requiring our college's students to partner with students from other colleges on environmentally friendly business ideas.
4. Faculty in our college are leading an effort with a faculty member in Hotel-Restaurant-Institution Management to develop a new Sustainable Food Systems minor, in conjunction with plans for a student-centered research farm.
5. A new Rural Sociology graduate course on "Sustainability: Frameworks, Theories, Practice" was offered in spring 2014.

Research (Live)

Many of the topical research areas discussed below cross-cut other areas, reinforcing their contribution to an integrated sustainability research portfolio in the college.

Water

The college has significant expertise and traditions of excellence in an array of water/sustainability-related areas, including forest hydrology, soil hydrology, water quality modeling, water economics, and policy. The major water-related challenges have been and continue to be water quality issues. Most notably for the mission of the college, Pennsylvania's agriculture is nutrient-intensive in an ecoregion where aquatic resources are nutrient-sensitive. The college has been highly responsive to the need for research, community engagement, and outreach to discover and deliver sustainable solutions to nutrient pollution problems applicable within the region and beyond. The college's commitment to leadership in this area is highlighted by the Agriculture and Environment Center, which has been highly successful in catalyzing multidisciplinary research and engagement on nutrient pollution solutions. Another highlight is the recently funded EPA Center for Integrated Multi-Scale Nutrient Pollution Solutions. This center is led by the college but engages faculty from relevant disciplines across Penn State and other academic institutions and government agencies.

Although water quantity has not been a historic challenge, population growth and energy development are beginning to strain the region's water resources. Looking forward, projected climate change will alter the seasonality and variability of precipitation in ways that pose significant challenges to agriculture, forests, and aquatic ecosystems. The college recognizes these challenges and is undertaking initiatives to contribute to sustainability science for climate adaptation in these areas.

Bioenergy and Biofuels

Global shifts away from nuclear power, fossil fuels, and petrochemicals are driving a move to biobased energy, fuels, and chemicals. It is projected that waste conversion alone will become a $29 billion annual market for energy. In the United States, anaerobic digesters could power 2.5 million homes a year if 50 percent of food waste was used as a feedstock.

The college has a strong presence and reputation in bioenergy and biofuels. For example, faculty in Agricultural and Biological Engineering have multimillion-dollar projects developing improved varieties of cellulosic crops, characterizing carbon dynamics in bioenergy crop systems, developing new and improved processing methods for feedstocks, and improving harvest and logistics systems for the bioenergy supply chain.

Bioproducts

Our faculty are also leaders in bioproducts and biosubstitutes research for uses other than energy.

- Working with partners such as Pepsi and Cargill to use biobased food service items to achieve "zero waste" in our athletics venues. This project involves students from our college and others, as well as the Office of Physical Plant, Intercollegiate Athletics, and Hospitality Services, and is another example of the "living lab" philosophy.
- Using nanotechnology to produce coatings that can make biobased packaging perform like petroleum-based products.

Sustainable Farming, Crop, and Livestock Systems

Pennsylvania agriculture is uniquely situated within 300 miles of nearly 40 percent of the population of the United States and still maintains a large number of diversified (both crops and animals on the same farm unit) farming operations. It is imperative these farm operations follow best management practices to protect watersheds such as those feeding into the Chesapeake Bay. The college is at the forefront of sustainable farming research.

Listed below are a few of the areas where the college's research is affecting sustainable farming:

- Integrated pest management (IPM)
- Insect/weed management solutions with reduced pesticides
- IPM for apple and other fruit crops
- Sustainable cropping systems to allow evaluation of ecological strategies for Pennsylvania dairy farms
- Establishment of protocols and best management practices

in the development of nutrient management plans that help farmers conserve nutrients and adapt to water and air quality regulations

- Advanced irrigation techniques that help farmers use less water
- Natural resource engineering research examines the application of biosolids to ag lands and ways to mitigate potential adverse impacts on aquatic species and water quality
- Soil conservation practices, including conservation tillage and cover crops that conserve soil and nutrients and enhance soil health
- Mitigation and adaptation of dairy cropping systems to climate change
- Organic cropping systems research for organic grain, feed, vegetable, and fruit crops
- Horticultural cropping systems for green roofs and urban water management

Economic Development and Community Vitality

It is within and across human communities that resource decisions affecting sustainability outcomes are often made. People make decisions about which foods they want to purchase and/or can afford to purchase, how lands are used, which crops are grown, which technologies are considered appropriate and ethical, which types of energy development and use are desirable and/or needed. These resource issues affect economic development and community vitality and have implications for both the process of working toward sustainability and the outcomes of projects, interventions, technological change, and development.

Some examples of work in this area include:

- An $11.9 million grant from the National Science Foundation supports a multi-institution, multi-discipline research network on Sustainable Climate Risk Management Strategies.
- Faculty across disciplines are heavily involved in research and outreach to determine the costs and benefits of shale gas development to individuals, families, communities, the state, and the region.
- The Northeast Regional Center for Rural Development, including faculty from the Department of Agricultural Economics, Sociology, and Education and with support from the USDA Agriculture and Food Research Initiative, works with land-grant institutions and other key partners across the region and nationally to pursue cutting-edge research, develop educational resources and provide training designed to help individuals and communities understand the impacts of local and regional food systems and how to best capitalize on their potential benefits.
- Pennsylvania Women's Agricultural Network, founded and supported by agricultural economics, sociology, and education faculty and staff and funded by the USDA, supports women in agriculture by providing positive learning environments, networking, educational workshops, and online information-sharing tools with the aim of developing sustainable women-led agricultural enterprises.
- Leadership development is addressed through various programs, including the new UNESCO chair in Rural Community, Leadership, and Youth Development, and the Pennsylvania Rural-Urban Leadership Program that fosters development of adult community leaders primarily in Pennsylvania but increasingly with a national and international reach.
- Faculty have grants from the federal Bureau of Land Management, PA Department of Conservation and Natural Resources, etc., to study risks, public perceptions, and management issues arising from environmental disasters such as forest wildfires, the BP Deepwater Horizon oil spill, and the Fukushima earthquake and nuclear disaster. These projects include a strong emphasis on community process and vitality and often address the broader issues of community economic development as well.

Marketing and Entrepreneurship

- USDA-funded research is looking at sustainability-focused, for-profit entrepreneurs in food, agriculture, and biorenewables. The focus of this research is to learn more about entrepreneurs' sustainability-oriented values and how they affect sustainable practices and performance.
- Faculty are researching market opportunities for bioproducts (e.g., biofuels) and development of supply chains for related innovations.
- They are also investigating cause-related marketing of sustainable horticultural products; how to be profitable while also producing a sustainable product.
- Our college has noted experts in organic food production and marketing.

Food Industry Sustainability

The Department of Food Science has programs in place to train undergraduate and graduate students about how industry should define and pursue sustainable practices. This is partially in response to demands from the large food manufacturers that increasingly require food science graduates to have this knowledge.

Ecosystems Services

- Research focuses on understanding the complex interactions between hierarchically structured, dynamic landscapes and multiple levels of biological organization and how these systems respond to ecological change, including climate change and land development.

- Our experts are investigating how environmental change and stressors affect ecosystem processes, and the responses and adaptations of individuals, populations, and communities to these stressors. Results lead to management guidelines designed to sustain ecosystem services, such as water, energy, food, and fiber, while mitigating negative aspects of change and ultimately benefitting society.
- College projects will continue to provide valuations of ecosystem services in the context of land uses changes, climate change, etc., with an emphasis on informing policy makers.

Sustainability Institute's Reinvention Fund

Our faculty, staff, and students will continue to successfully participate in the Sustainability Institute's Reinvention Fund, which provides resources for teams seeking interdisciplinary, innovative solutions to sustainability issues within and around the Penn State community.

Extension/Outreach (Lead)

Sustainability outreach and engagement have been incorporated into our programming for many years. Below are a few examples:

1. Our Renewable Resources Extension Team provides sustainability-focused programming in water, wildlife, urban and community forestry, bioproducts, and forest resources management. Although our subject areas are diverse, so too are our clientele, as we provide education and resources to individual landowners, well owners, communities, government, industries, and recreationists—nearly anyone who benefits from the social, ecological, and economic values derived from renewable natural resources—from youth to adults.
2. Extension programs seek to engage partners to increase capacity, share resources, and meet the challenges of helping people manage and conserve natural resources through the use of sustainable research-based practices. Our partners include public agencies, nongovernmental organizations, communities, volunteers, schools, and resource professionals.
3. The college's extension priority initiative in On-Farm and Biobased Energy Production and Use (energy.extension.psu.edu) continues to develop and deliver extension programming designed to enable individuals and communities in the Commonwealth and region to take advantage of opportunities for increased sustainability in their personal and business enterprises. This is accomplished through workshops, short courses, project development assistance, equipment loan programs, renewable energy cooperatives, support for the PA Fuels for Schools initiative, and provision of advanced education in bioenergy.
4. In the water quality area, we are highly engaged with state and federal policy makers and communities as a consequence of initiatives of the Agriculture and Environment Center and the Environment and Natural Resources Institute. The Conewago Creek Initiative involves more than twenty Penn State researchers, faculty, and extension specialists conducting research, offering engaged scholarship for students, and delivering innovative programming and workshops to watershed residents and stakeholders. Partnerships were developed with more than thirty entities, including USDA-NRCS, USGS, county conservation districts, Pennsylvania DEP, Pennsylvania Department of Agriculture, local municipalities, private sector consultants, nongovernmental organizations such as the Chesapeake Bay Foundation, and the local watershed group. The initiative resulted in demonstrable increases in engagement of landowners, implementation of conservation practices, and improvements in water quality.
5. We offer seminars, short courses, and other extension programs on topics such as stormwater management, bioenergy, and genetically modified organisms. Examples include:
    a. "Green Infrastructure, Riparian Buffers and Watershed Maintenance," hosted in York by the extension urban forestry program.
    b. "Dive Deeper: Youth Water Educators Summit" in Harrisburg, Sept. 2013.
    c. "H2OSolutions," a mobile app to help private water system owners and professionals evaluate wells, springs, and cisterns for quality problems.
6. We will continue collaborations such as the one with the Rock Ethics Institute on the "Ethics of Genetically Modified Organisms: Food Security vs. Environmental Impact" program scheduled for fall 2014.
7. We host programs such as "Sound Farm Business Risk Management Strategies for Women, Hispanic, and Next Generation Farmers in Pennsylvania." We are piloting a program in Adams County to help Spanish-speaking individuals, predominantly, explore opportunities to build capital and launch new farm/food businesses.
8. Much of the Food Safety Modernization Act addresses issues related to a more sustainable and safe food system. We have partnered with the Food Safety group to provide training in production and marketing in the context of the act.
9. We distribute thousands of Ag Alternatives Fact Sheets every month. As a whole, the series is designed to support small and part-time farmers to maintain an economically viable, sustainable business.
10. A Wildlife Management faculty member partnered with OPP's Organic Materials Processing and Education Center to determine a plan for crow management at this facility, while also allowing the processing of the University's organic waste stream. This project also involved students, and thus was an example of the "living lab" concept.

Operations

The following are examples of a few of the areas where our college is integrating sustainability into our daily operations.

1. We work with the Office of Physical Plant (OPP) to determine which facilities (e.g., Ag Engineering Building) and other infrastructure should be remodeled and/or replaced in order to increase energy efficiency, reduce use of resources, etc.
2. Animal Science is working with OPP to plan for construction of a manure digester at the dairy farm; this would greatly enhance disposal of manure and could be a source of "green" energy.
3. Ecosystem Science and Management faculty will continue working with OPP to assess soil quality and hydrologic capacity in the University's effluent spray fields. This is another example of a "living lab," and how our college fosters programs that meet both research and operational objectives.
4. Sustainability and environmental stewardship are top priorities in the College of Agricultural Sciences greenhouse complex. Our waste stream is minimized by robust recycling and composting programs administered by OPP. Greenhouse complexes contain recycling facilities for plastic, metal, wood, paper, and cardboard waste. All plant waste, spent plant growth media and other organic materials are collected for composting at the Organic Materials Processing Center on campus. Oversight of the greenhouse recycling and composting program is provided by dedicated greenhouse staff.

   Pesticide application in the college's greenhouses has been significantly reduced in the last few years. An effective integrated pest management program, coupled with a shift toward biological pest control methods, has limited the need for pesticide application in our facilities, making the greenhouse environment safer for students and researchers and reducing the potential for environmental contamination. In February 2014 the college greenhouse operations, in collaboration with plant science and entomology faculty, received a Reinvention Fund grant from the Penn State Center for Sustainability to continue developing biological pest control methods and make further reductions in greenhouse pesticide applications. The award also provides funding to extend our greenhouse biological pest control program to other campus greenhouses. In spring 2014 a major reduction in pesticide application was possible in these facilities as a result of our biocontrol program.
5. The college will continue working with the Penn State Sustainability Institute to use its Green Teams to help ensure continual improvement in sustainable practices and infrastructure.
6. The Department of Plant Pathology promotes sustainability in their operations by taking such steps as considering energy efficiency of equipment (e.g., growth chambers, freezers, etc.) when replacing old items; recycling plastics, soils, etc., from greenhouse operations; and sharing equipment and chemicals to reduce amount purchased.
7. Our college manages more than 7,000 acres of farm land, with an additional ~8,000 acres of forest land. We put these lands to multiple uses, including research and education.
   a. Farm Operations has numerous programs related to environmental protection and links those to education and research. Farm Operations personnel regularly conduct tours highlighting their environmental stewardship practices and have actively demonstrated biofuels projects to domestic and foreign audiences.
   b. Farm Operations has a long history of growing energy crops (e.g., forage sorghum or switchgrass). We have also experimented with oil seed crops capable of producing vegetable oil as a possible fuel.
   c. Farm Operations has collaborated with a German firm to investigate creation of biogas via dry fermentation. This system could use manure and various biomass crops as inputs.

Strategies

The overall goal of this initiative should be to make the college a world-recognized leader in sustainability as it relates to the agricultural and natural resources space. The college proposes the following "action items" that should be pursued in the short term to move the initiative forward.

1. Make sustainability a strategic initiative with support similar to what entrepreneurship has received.
   a. As adapted from the University's justification for a greater commitment to sustainability: use the initiative to improve prospects for recruiting high-quality faculty, conducting funded research, developing and teaching new courses, and inspiring stakeholders to pledge more gifts and endowments.
2. Appoint a sustainability leader/champion.
3. Appoint a task force to write a comprehensive sustainability strategic plan.
   a. The comprehensive plan would be completed by December 31, 2014.

Goal E: Strengthen Leadership, Innovation, Participation, and Recognition within the College

OBJECTIVES AND STRATEGIES

1. Promote and build on our culture of innovative and translational science to serve society long into the future.

Empower and engage faculty, staff, and students to excel in our mission.

Measures

- Develop actionable plans across the college that describe steps to enhance productivity or address a key issue.
- Promote projects and programs that align well with the main goals in the college's and the University's strategic plans.
- Hold regular "Dean's Forums" and smaller department meetings to evaluate what's working and what's not working and adjust priorities/strategies if needed.

Create an environment that encourages risk taking and innovation in teaching, research, and extension activities.

Measures

- Support new approaches to research, teaching, and extension that may involve risk taking.
- Promote and support collaborative efforts across departments, colleges, institutes, and universities.
- Create new funding sources and improving on existing ones.

Communicate strategic plans and specific actions effectively and regularly so that members of the college clearly understand their individual roles and the role of their unit(s).

Measures

- Publish the strategic plan in a special brochure and unique place on our website.
- Develop a one-page document that summarizes the strategic plan.
- Deans and department heads should align activities with the strategic plan on a regular basis.
- Disseminate minutes via e-mail and on a common website after strategic planning meetings.

2. Adopt a culture of shared governance in decision making and planning that leverages the wisdom and creativity of diverse members of the college.

Increase direct interaction among administrators, faculty, and staff.

Measures

- Deans should make every effort to attend department meetings and discuss key issues on a regular basis.
- Continue dean's group "brown bag lunches" and private lunches to discuss key issues facing the college and look for input on pending decisions.
- Invite faculty to leadership meetings to present new initiatives/opportunities in research, education, and/or extension.

Involve faculty and staff in important decisions facing the college.

Measures

- Engage faculty to serve as advisers during decision making, particularly as related to cultural and organizational issues.
- Increase faculty/staff engagement in ad hoc groups to assist with making decisions on investment priorities.
- Request that faculty develop white papers to improve policies and processes.

Improve communication in all directions through a variety of possible tools.

Measures

- Encourage social interaction through coffee breaks, informal lunches, and other formats for impromptu discussions.
- Publish individual college communiqués and hold webinars to gather input for important decisions.
- Use social media (e.g., Twitter, Facebook) to communicate with members of the college and stakeholders throughout the state.

3. Recognize and reward faculty, staff, and students when their values and service improve the mission of the college.

Emphasize the set of values described in the strategic plan.

Measures

- Recognize and emphasize the core values throughout the college.
- Recognize and reward individuals who demonstrate the core values on a regular basis, including consideration for a salary increase.

- Promote the core values of the college in various communications.

Highlight opportunities and identify mechanisms for reward and recognition.

Measures

- Provide recognition through additional faculty and staff award programs and salary adjustments.
- Increase frequency of expressing appreciation through thank-yous, phone calls, and face-to-face congratulations.
- Recognize staff and students through "meet the deans sessions," lunch with leadership team, and social events.
- Establish awards for faculty early on in their careers to encourage their development.
- Recognize highest levels of achievement in teaching and research by faculty and staff.
- Recognize long-tenured faculty and retirees through awards and social gatherings.

4. Promote and support the growth and development of faculty, staff, and students.

Provide leadership training and professional development opportunities to faculty and staff.

Measures

- Conduct training programs to prepare faculty for leadership roles.
- Organize and present recognized speakers, symposia, and workshops focused on leadership.
- Prepare graduate students for leadership positions and support their professional development.

Encourage faculty to take on leadership roles.

Measures

- Create formal mentoring programs with clear goals at all levels in the college.
- Encourage faculty to participate in college and University-wide governance organizations.
- Support faculty involvement in external organizations (societies, trade organizations, government programs), particularly in a leadership role.

Improve participation and involvement of faculty and staff at the department and college levels.

Measures

- Conduct a survey to determine employee engagement level and communicate results; follow with action plans to build on areas of strength and work on opportunities for improvement.
- Provide incentives for faculty to take on additional leadership responsibilities.

Fostering Diversity

Given the Core Council's recommendation to mainstream diversity planning into the overall strategic planning, the college was asked to describe the progress the unit has made and the issues it continues to address by answering specific questions in relation to each of the seven challenges presented in the Framework to Foster Diversity at Penn State 2010–2015. The questions include:

- What progress has been made toward each challenge during the reporting period? What diversity efforts and initiatives are planned for the 2014–2015 through 2018–2019 planning cycle?
- What measures of success or strategic indicators gauge your progress toward this challenge? What specific data in relation to these measures and indicators demonstrate your progress?
- Which specific approaches are considered "signature" initiatives and which could be considered "best practices"? What metrics can be used to gauge success and what are the measureable outcomes?

This section addresses the diversity efforts and initiatives that are planned for the 2014–2015 through 2018–2019 planning cycle. A report on the progress toward initiatives in the 2010–2015 plan is included in Appendix B.

Diversity and inclusion are important aspects of everyday life in the College of Agricultural Sciences. Diversity is defined as the state or quality of being different, and as individuals we are all uniquely different. To be an inclusive campus is to respect and value differences and to encourage and create opportunities to capitalize on those differences. Our aim is to create an environment where differences are considered assets that make us better learners, teachers, scholars, researchers, extension educators, employees, and students. A truly inclusive institution benefits all, both educationally and professionally, at Penn State and beyond. Advancing not only diversity, but also inclusion, requires commitment, leadership, and the participation of the entire college. The diversity strategic plan includes strategies and initiatives that work toward creating a truly inclusive environment.

Enhancement of diversity within the College of Agricultural Sciences remains an important goal and a challenge for the college, and is being given increased effort and attention. The Diversity Coordinating Council, including faculty, staff, administration, students, and extension educators, has been revived and reinvigorated with the support of the assistant dean for multicultural affairs. One of the first important functions of the council has been the creation of the Diversity Strategic Plan. The council also worked to increase the number of nominations for the college's Diversity Achievement Award. We continue working toward our vision of weaving diversity into the fabric of the college.

CHALLENGE 1: DEVELOP A SHARED AND INCLUSIVE UNDERSTANDING OF DIVERSITY

Diversity has different meanings to different people. The reinvigorated Diversity Coordinating Council is developing a standard definition of diversity for application throughout the college.

Objectives and Strategies

1. Provide leadership for diversity within the college.

- Continue to support the assistant dean for multicultural affairs position as part of the college leadership team, while additionally supporting the coordinator of multicultural programs position.

Measure

- Retain position as part of the leadership team.

2. Develop a shared understanding of diversity.

- Develop a definition of diversity that is inclusive.
- Post definition and University's nondiscrimination policy on the diversity website. Include in materials received by new students, faculty, and staff.

Measure

- Definition and policies are posted on the diversity webpage.

3. Provide diversity education professional development opportunities for faculty, staff, students, and extension educators in the college.

- Offer a "Diversity in Two-Part Harmony" professional development series—open and advertised to all college personnel and all extension educators across the state—both face-to-face and through videoconferencing.
- Offer a diversity book club opportunity.
- Offer two diversity-focused professional development workshops each year sponsored by the Diversity Coordinating Council and advertised to faculty, staff, and students across the University Park campus.
- Continue the eight-hour diversity training requirement for extension educators on an annual basis.
- Establish awareness and training in diversity issues with local extension advisory boards and volunteers.
- Offer diversity-focused professional development workshops for extension educators in two districts in the state each year.
- Provide incentives for faculty to attend diversity-focused conferences and provide a seminar for other faculty upon return.

Measures

- Offer Diversity in Two-Part Harmony sessions four times each academic year. Participant evaluations will measure between 4 and 5 on a 5-point scale with 1 = lowest, 5= highest. Increase enrollment in the sessions by 5 percent each year.
- Raise participation in the book club by 5 percent each year.
- Offer and widely advertise at least two diversity-focused professional development workshops per year for members of the University community.
- Offer at least one presentation per year by a faculty member in the college on a diversity-focused topic stemming from participation in a diversity conference.
- Document in annual evaluation reports for each extension educator at least eight hours of diversity training.
- Document diversity training sessions in extension advisory board minutes.

4. Inventory current diversity efforts/initiatives.

- Collect, review, and evaluate existing programs and resources.
- Review diversity strategic plans of other colleges.
- Develop a report of the state of diversity for faculty, staff, and students in the college.
- Develop an annual report of the state of diversity for faculty, staff, and students in the college every two years thereafter.

Measure

- Prepare and post on the college diversity website an annual report on the state of diversity.

CHALLENGE 2: CREATE A WELCOMING CAMPUS CLIMATE

The Diversity Coordinating Council increased efforts to obtain a broad pool of applications for the college's Diversity Achievement Award. They also raised the standing of the award by adding a monetary award and making administrators eligible. The hope is that this will encourage administrators to take diversity efforts seriously.

Objectives and Strategies

1. Support opportunities for faculty, staff, and students to participate in University programs that create a welcoming climate.

- Sponsor attendance at the Annual Commission for Women Award Luncheon for faculty, staff, and students.
- Sponsor a table for students and faculty to attend the annual MLK Banquet.
- Partner with other campus organizations to provide programming for faculty, staff, and students.
- Create opportunities for students, staff and faculty to participate in outreach activities in diverse communities.
- Continue participation and communication with other colleges' diversity councils and organizations throughout the University, e.g., College Council on Multicultural Leaders, Administrative Council of Multicultural Affairs.

Measure

- Fill all available sponsored seats for the MLK Banquet and Commission for Women Awards Luncheon.

2. Recognize diversity efforts of faculty and staff.

- Annually award the Diversity Achievement Award to a faculty, staff, administrator, or extension educator or team who demonstrates outstanding efforts to foster diversity in the college.
- Raise the status of the Diversity Achievement Award with a monetary award and news releases distributed about the recipient.

Measure

- Increase the number of nominations for the Diversity Achievement Award by 20 percent over the five-year planning period.

3. Assess climate in the college.

- Create a climate survey for faculty, staff, and students, setting out a data-driven approach to assess and improve the diversity climate with emphasis on differences in background and experiences.
- Re-assess the needs of diversity groups.

4. Engage current students in efforts to create a welcoming campus climate.

- Work with college student groups (e.g., Ag Advocates) to encourage inclusion of activities, visuals, and language that promote a welcoming campus climate.
- Recruit College of Agricultural Sciences students to share their success stories and challenges as part of new student orientations and brown bag sessions and provide postparticipation survey to gauge value of programs.

5. Increase representation of all dimensions of diversity in extension educational publications and marketing materials.

Measure

- Elevate the representation of all dimensions of diversity in extension publications by 2019.

CHALLENGE 3: RECRUIT AND RETAIN A DIVERSE STUDENT BODY

Minority enrollment for fall 2013 was 219 (Black, 67; Hispanic/Latino, 81; American Indian/Alaska Natives, 0; Native Hawaiian/Pacific Islanders, 1; Asians, 36; and Two or More Races, 34) at the University Park campus.

We aim to increase the number and percentage of underrepresented students in our college at both the undergraduate and graduate levels. One of the biggest challenges facing agriculture and natural resource professionals and educators lies in recruiting and retaining traditionally underserved populations. Although minorities are well represented in many fields, minority professionals in agriculture and natural resource careers are still limited. Many students from underrepresented backgrounds, particularly racial minorities, have not considered agriculture as a college major. Many have a limited understanding of the breadth of fields and careers that are under the agriculture umbrella. Increased efforts are needed to expose secondary students to a wide variety of careers in agriculture and natural resources.

We will increase activities to recruit high-achieving underrepresented graduate and undergraduate students by developing new relationships with historically black, Hispanic, Native American, and women's colleges; participating in the STEM Colleges Millennium Scholars Program; participating in national research exhibitions that showcase the work of underrepresented students; and increasing the number of departments that participate in Summer Research Opportunities Program, the McNair Scholars program, and the Upward Bound Math and Science programs. We will also increase the number of departments that hold specific recruitment activities designed to attract underrepresented students to their majors (including women, where they are underrepresented), and increase the number of graduate assistantships available to support underrepresented students.

The high cost of an education at Penn State is a limiting factor in enrollment for underrepresented students. We will seek all University funding opportunities, and also explore external sources of funding to support enrollment of underrepresented minority students.

We have for several years now been translating some of our extension offerings—both publications and workshops—into other languages. This has been done for many of the farm safety and food safety offerings, where the diversity of workers is high. We will continue and expand these efforts, which could help recruit students to the college for further education.

Objectives and Strategies

1. Increase activities to recruit high-achieving underrepresented graduate and undergraduate students to the college.

- Continue current efforts to establish outreach programs that focus on diverse higher education institutions—historically black college and universities, Hispanic and Native American–serving and women's colleges.
- Offer dedicated graduate assistantships (one per department).
- Continue and increase participation in the Committee on Institutional Cooperation Summer Research Opportunities Program to attract underrepresented minority graduate students.
- Continue and expand recruitment visits/activities to high schools in Pennsylvania, and collaborate with the Pittsburgh and Philadelphia recruitment centers.
- Target recruitment activities to private in-state liberal arts colleges.
- At least once every two years, conduct visit by the multicultural coordinator to each commonwealth campus with a large enrollment of underrepresented students.
- Participate in the University STEM Open House program.

Measures

- Increase enrollment of underrepresented students in the college.
- Expand relationships with universities and colleges that serve underrepresented students.
- Increase dedicated graduate assistantships for underrepresented students.
- Increase participation in University STEM recruitment programs, including the Millennium Scholars program and the Sloan Foundation program.

2. Increase efforts to raise external funding to support recruitment and retention efforts for underrepresented minority students at the undergraduate and graduate levels.

- Collaborate with the college Development Office to secure funding from businesses and corporations.

Measure

- Increase financial support from external sources to support minority enrollment.

3. Increase support for recruitment and retention of underrepresented minority students at the departmental level.

- Develop a quantifiable plan within each department to promote diversity recruitment and retention.

- Provide incentives for faculty to explore external funding sources in order to leverage internal resources.
- Continue to provide extension curricula and programs in English, Spanish, and other languages to attract diverse clientele where appropriate.

4. Improve the climate for underrepresented minority students in the college.

- Hold focus group sessions with diverse students to discuss college diversity climate and identify actions to enhance it.
- Include a question regarding climate for diversity on the senior exit survey.
- Hold a professional development workshop series open to all students.
- Identify successful alumni from underrepresented groups. Host seminars open to all with opportunities for alumni to meet with female and underrepresented students.

5. Strengthen the Minorities in Agriculture and Natural Resources and Related Sciences (MANRRS) Student organization.

- Increase the enrollment of student members.
- Establish a Junior MANRRS organization for high school students within the next three years.

CHALLENGE 4: RECRUIT AND RETAIN A DIVERSE WORKFORCE

Minority faculty for fall 2013 numbered 44 (Black, 4; Hispanic/Latino, 10; American Indian/Alaska Natives, 2; Native Hawaiian/Pacific Islanders, 0; Asians, 27; and Two or More Races, 1) in the college.

We will take proactive steps to increase the diversity of faculty and staff candidate pools by creating opportunities to bring underrepresented and female doctoral candidates to the college to deliver seminars and meet with faculty, students, and staff. We will also develop a network of contacts and organizations with ties to underrepresented groups with whom to share position announcements. Internally, we will strengthen our hiring policies and procedures.

Objectives and Strategies

1. Plan for diversity.

- Develop a quantifiable diversity plan within each department.

2. Increase recruitment activities.

- Include in all position announcements for faculty, staff, and extension educators a statement indicating the desirability of experience with diverse populations.
- Review all searches for academic faculty and extension educator positions to ensure a diverse applicant pool.
- Identify contact persons at historically black college and universities, Hispanic-serving institutions, and Native American colleges that are agreeable to sharing our job announcements within their institutions.
- Advertise positions for faculty, staff, and extension educators in venues targeted to women and underrepresented persons.
- Create opportunities to bring underrepresented and female doctoral candidates to the college to deliver seminars and meet with faculty, students, and staff in the department related to their research/area of expertise.

Measures

- Increase number of minority faculty and staff, particularly for those groups that are currently underrepresented.
- Document affirmative hiring policies.

3. Increase retention activities.

- Through exit interviews and mentoring, identify barriers that may hinder retention of women and underrepresented minority faculty and staff.
- Hold focus groups with current diverse students, faculty, and staff to identify issues.
- Include commitment to diversity in the evaluation of department heads.
- Include commitment to diversity in the evaluation of faculty and staff.

Measures

- Develop new strategies to address any barriers discovered during exit interviews.
- Document reduction in faculty and extension educator turnover rates by gender, race/ethnicity, and job classification.
- Document and increase success rates for recruitment and retention by cohort, gender, and race/ethnicity.

CHALLENGE 5: DEVELOP A CURRICULUM THAT FOSTERS U.S. AND INTERNATIONAL CULTURAL COMPETENCIES

When students leave this University and move into the workplace, they need to be prepared for a workplace that is becoming increasingly diverse. In fact, the ability to interact with and work effectively with people from a variety of backgrounds is becoming a job skill and requirement. So an important job of the Diversity Coordinating Council is to make recommendations that create opportunities for all of our students to gain awareness of cultural differences, to be open to diverse perspectives, and to

have the ability to interact effectively with people different from themselves.

This is a great University, and we pride ourselves on helping to prepare the leaders of the future. Cultural awareness and inclusive excellence are critical for leaders of the future. We cannot allow our students to leave the University without having some level of diversity awareness in their educational program.

We will develop a curriculum that fosters U.S. and international cultural competencies by including diversity topics in the first-year seminars, increasing the number of courses that incorporate diversity within the curricula, increasing the number of departmental seminar speakers from underrepresented groups, and increasing the number of faculty, staff, and students with experiences in diverse settings.

In 2012, a record high of 243 of our students traveled abroad, up from 85 students five years ago. These students traveled to twenty-six different countries, the widest scope of international travelers to date. Since the office took over advising and managing the International Agriculture (INTAG) minor two years ago, enrollment in the minor has tripled from eight to twenty-three enrolled in 2013.

Objectives and Strategies

1. Increase numbers of students (undergraduate and graduate) graduating with cross-cultural experience.

- Offer a globally oriented section of AG 150, the first-year seminar.
- Establish an International Programs Office presence at annual Ag Career Day every fall.
- Hold a college International Experiences Fair annually in fall.
- Offer student scholarships via Office of International Programs, Office of Undergraduate Education, and Office of Graduate Research and Education, including Cordivano, World Food Prize, and international research awards.
- Support faculty in development of new educational embedded experiences to international and particularly nontraditional locations, with an emphasis on service-learning and cultural diversity components.
- Encourage faculty to seek international collaboration and funding for internationally based research that involves minority graduate students.

Measure

- Increase number of students who gain an international and/or diversity educational experience.

2. Bring more international and cultural competencies into classes offered in the college.

- Encourage faculty teaching existing courses with U.S. and/or international cultural components to file for US and/or IL course designations.
- Promote creation of new courses with US and/or IL designation.
- Continue offering a diversity-focused seminar course in the college.
- Continue offering a Spanish in Agriculture Program—A four-course series of agriculture-specific Spanish language instruction, including a four-week immersion experience in Costa Rica.
- Encourage faculty to use the Schreyer Institute for Teaching Excellence and other resources to help develop diversity-related content in their curricula.
- Encourage faculty to include diversity in their first-year seminar.
- Encourage faculty to include diversity-related seminars and workshops in their programs, where appropriate. Provide financial incentives to support this effort.
- Provide incentives for faculty to invite speakers from underrepresented groups to present seminars and workshops.
- Develop inter-institutional linkages with minority-serving institutions that primarily serve diverse student populations to encourage development of inter-institutional exchange and cross-cultural programs.

Measures

- Increase number of courses with a US or IL designation for diversity-related content.
- Increase number of courses that include diversity and international/global concepts within the curricula.
- Increase number of departmental seminar speakers from underrepresented groups.
- Continue enrollment in a diversity-focused seminar/course and in the Spanish in Agriculture Program.

CHALLENGE 6: DIVERSIFY UNIVERSITY LEADERSHIP AND MANAGEMENT

We will strengthen our efforts to fill administrative positions with candidates that demonstrate diversity competence. We will create more opportunities for faculty and staff from underrepresented groups to gain leadership skills that will assist them in gaining leadership positions within the college.

Objectives and Strategies

1. Diversify administrative leadership and management of the college.

- Offer administrative leadership internships, mentoring, and professional development opportunities such as leadership development education programs for women and members of underrepresented groups.
- Require demonstrated experience and tangible accomplishments in leading diversity initiatives as a qualification in making administrative leadership and managerial appointments.
- Access a broad range of networks that promote diversity when searching to fill administrative leadership and managerial positions.
- Diversify external college advisory committees.
- Encourage underrepresented faculty and staff to participate in the administrative fellows program for emerging leaders.
- Monitor changes over time in diversity in administrative leadership and management positions as compared to the baseline.
- Using the baseline and monitoring analyses, regularly identify and prioritize actions necessary to increase diversity in administrative leadership and management positions.

Measures

- Increase percentage of administrative leaders, faculty, staff, and extension educators attending administrative leadership development and diversity programs and activities.
- Include in all vacancy announcements for administrative leadership and management positions the need for demonstrated skills in leading and managing diversity.
- Access broad set of networks when searching to fill administrative leadership and management positions as documented in periodic reports.

2. Maintain college representation on University committees focused on promoting diversity and inclusion goals.

- Maintain membership on committees such as the Commission on Race and Ethnic Diversity, Commission for Women, and Commission on Lesbian, Gay, Bisexual, and Transgendered persons, and University Faculty Senate committees and taskforces where appropriate.

Measure

- Increase diverse representation on external college advisory committees documented in periodic reports.

CHALLENGE 7: COORDINATE ORGANIZATIONAL CHANGE TO SUPPORT OUR DIVERSITY GOALS

We will support and work toward the incorporation of diversity into all aspects and all corners of the college.

Objectives and Strategies

1. Establish a strong relationship between college diversity strategic planning and college strategic planning by integrating the two processes and coordinating actions.

- Distribute widely the progress report(s) on the achievement of both college strategic plan goals and college diversity strategic plan goals.
- Review annual progress toward establishing a strong relationship between college strategic planning and college diversity strategic planning.
- Harmonize goals, action strategies, and priorities between the college strategic plan and the college diversity strategic plan.
- Allocate, as appropriate, college funding necessary to implement priority actions.
- Seek University- and college-level funding to support college diversity activities, programs, and initiatives.

Measure

- Make available on the web to all students, staff, faculty, administrators, educators, and the public progress reports on diversity-related issues in the college.

2. Broaden the role of the college Diversity Coordinating Council to include leadership of college-level initiatives to achieve diversity goals.

- Given the outcome of annual progress reviews, identify and implement initiatives necessary to strengthen coordination between the college strategic plan and the college diversity strategic plan.
- Develop and publicize a standard definition of diversity for use college-wide.
- Take a more active role in developing diversity-related professional development opportunities.
- Act as a sounding board for the dean regarding diversity issues or improvements.

Measures

- Identify and implement priority diversity initiatives to implement the college strategic plan and the college diversity strategic plan.
- Make diversity considerations central to all college-level initiatives.
- Establish an annual meeting of the Diversity Coordinating Council with the dean to discuss successes and challenges related to diversity in the college

3. Establish and expand award system for diversity activities for faculty, staff, and administrators.

Promoting a Culture of Integrity and Ethical Behavior

Adopt and operationalize the following principles for faculty, staff, and students:

- Perform all professional responsibilities with the highest sense of integrity and ethical behavior, and maintain objectivity.
- Accept the responsibility to serve the public interest, honor the public trust, enhance the welfare of humanity, encourage environmental stewardship, and demonstrate a commitment to professionalism and excellence.
- Strive continually to improve their competency, efficiency, and quality of service, and discharge all professional responsibilities to the best of their ability.
- Contribute to an atmosphere of respect, tolerance, and fairness in interactions with others in the workplace.
- seek and create new knowledge fostering creativity and innovation to solve problems.

An important concept in ethical behavior is the conduct of our business in an atmosphere of mutual respect. This applies to audiences both internal and external to our organization. A number of activities and procedures are in place that help to promote mutual respect in the organization. Examples of these include the following.

INTERNAL

- Recognition of excellence in performance through frequent personal recognition awards and awards ceremonies.
- Faculty and staff advisory committees to the dean, which provide opportunities to share recommendations and concerns, and have open dialogue with the dean.
- College-wide faculty and staff meetings, which provide opportunities for all faculty to gain updates on important activities and to share concerns and hold open dialogue with administrators.
- Change in the format of the Academic Leadership Team meetings from a one-way information-giving meeting to more open discussion/shared problem-solving format.
- Brown bag lunches with the dean with no set agenda to provide opportunities for discussion with the dean about issues determined by those who attend lunch.
- Administrative retreats to provide opportunities for mutual decision making with department heads.
- Opportunities for extensive leadership training programs for faculty.
- Recommend conducting a college-wide survey to determine faculty engagement (areas of strength and areas for improvement) at least every five years.

EXTERNAL

All extension and research employees in the college must adhere to the following civil rights goals:

- Expand access to educational programs for underrepresented groups.
- Promote nondiscrimination and value differences.
- Treat every beneficiary and employee of the college with fairness, equality, and respect.

In an effort to reinforce these principles and achieve this goal, all extension educators, researchers, and staff are required to participate in civil rights training and document their participation with a certificate of completion.

Facilities and Land: Progress and Future Planning

ACCOMPLISHMENTS

- The University's biosafety level-3 facility, named for former college faculty member Eva J. Pell, has been erected adjacent to the Animal Diagnostic Laboratory, with funds from the college, University, and the Commonwealth.
- In the last three years, the Wiley biocontainment facility and the incinerator facility at the Animal Diagnostic Laboratory (ADL) were upgraded primarily to keep these units operational and meet the Association for Assessment and Accreditation of Laboratory Animal Care International, USDA and Pennsylvania DEP standards.
- The college's land holdings continue to change. The University purchased the Delafield property, adjacent to Interstate 99, in 2013 as a strategic investment. The college's Farm Operations staff are responsible for maintenance and clearing areas of the parcel that are appropriate for crop production.

APPROVED PROJECTS

- Renovation of several growth chambers in the Mushroom Research Center is scheduled for 2014. There is a need for a pole barn and an improved area for composting.
- The Deibler tract, adjacent to Rock Springs Agricultural Center, will be purchased as a strategic property for use by the college.
- Renovation of the Agricultural Engineering Building is on the University's five-year construction plan. Renovation of Henning Building is on the University's most recent construction/renovation plan, and there are indications the project could begin within the next few years. The relevant Board of Trustees committee toured these buildings in May 2014, an early step in the final approval process.
- Planning is underway for the construction of a high-capacity methane digester. The project could be presented in fall 2014 to the Board of Trustees for approval.
- Renovation of existing greenhouses adjacent to Tyson Building has been approved. Renovations of existing research greenhouses are urgently needed to maintain research productivity within the plant sciences. The total cost of all the recommended renovations would be approximately $3,000,000. Renovation of these greenhouses is imperative, not only for research productivity but for energy savings. The current greenhouses readily lose heat because of cracks and gaps in plastic/glass and highly inefficient heating and cooling systems under the control of antiquated sensors and control systems. Renovations should lead to substantially higher energy efficiency and cost savings—in alignment with the University's growing emphasis on sustainability—in addition to greater research productivity.

FUTURE NEEDS

- At the Animal Diagnostic Laboratory, there is an urgent need to replace the windows and flooring throughout the laboratory. Additional space and renovation is sought for the histology and avian serology sections. The flooring and the drainage system in the necropsy facility must be replaced. Installation of a storage facility and a waste disposal shredder for red bags, and replacement of key equipment will increase the service life of the existing incinerator.
- Our large animal facilities need improvements, upgrades, and additional land. Poultry cages at the Poultry Education and Research Center (PERC) do not meet current Ag Guide standards and need to be replaced to maintain accreditation with the Association for Assessment and Accreditation of Laboratory Animal Care International for the facility. New pasture land is needed for the horse and beef cattle herds to replace pasture lost to football parking, expansion of the medical center and research park, and fireworks displays. Additional land is needed for producing forage for the dairy herd. Feed and bedding storage is needed for the horse and beef cattle operations. Fences at the Deer Research Facility, Swine Center, and Haller Farm have reached the end of their service life and need to be replaced. Building repairs are needed at PERC, and building renovations are needed at Haller Farm, the Beef/Sheep Center, and the Dairy Center. Replacement of portable animal shelters at the Swine Center and Sheep facility is an ongoing need. Improved year-round animal watering systems are needed at Farm 5 and Haller/Houtz Farm.
- Construction of new greenhouses as part of a University-wide initiative. The renovations suggested above are only a short-term solution. New greenhouses are needed to allow our plant science programs to excel. The University Park faculty and staff use greenhouses for extensive research, teaching, and landscaping programs that are important to the missions of the University. A college task force recommended the construction of about 100,000 square feet of new greenhouse research space on the edge of campus.
- The Henning Building/Ag Sciences and Industries Building needs added space for research facilities and increased office space for faculty, staff, and graduate students.
- The Meats Laboratory building must be replaced.
- College faculty are providing leadership in collaboration with the Sustainability Institute in development of a University-wide student-centered farm. Funds for planning have been awarded and college faculty and staff are involved in those discussions.

College of Agricultural Sciences Budget History and Summary

Unlike other colleges at Penn State, the College of Agricultural Sciences relies on the 150-year-old land-grant partnership of federal, state, and county governments as the foundation of funding for agricultural research and statewide extension programs. *These programs are not supported by undergraduate tuition dollars.*

The FY2011/2012 state budget process resulted in two major changes in funding for the college's agricultural research and extension programs. Historically, these programs were funded as line items in the Penn State non-preferred appropriations bill. In 2011, through an act of the legislature, the funding was shifted into the state's general fund—specifically into the Land Scrip Fund under the Pa. Department of Agriculture—dedicating these lines to land-grant agricultural research and extension. This removed them from the higher-education debate and more clearly aligned them with agriculture.

Also, in FY2011/2012, state funding for these programs was reduced by 19 percent ($10.5M), returning them to FY1998/1999 funding levels. In FY2012/2013, state funding remained flat from FY2011/2012 levels, which, combined with increased operating costs, resulted in a $1.7 million deficit for FY2012/2013. These deficits, in part, necessitated a significant reorganization and downsizing strategy by the college. In FY2013/2014 we received a $1.5 million increase in funding. However, this still resulted in a deficit due to increased general salary increases and benefits.

EMBRACING CHANGE

The college has been very proactive in planning. Recognizing the need for organizational change, the college began a process in fall of 2010 designed to develop and implement a new business model and address budget strategies. The initiative, called AG Futures, identified opportunities for strategic growth and resulted in an aggressive college strategy.

As a result, the college has taken bold measures to reduce costs, increase operational efficiencies, and maintain the highest possible level of services to our students and stakeholders. Specifically, to date, the following has been accomplished:

- Consolidating the college's graduate/undergraduate degree programs under nine (from twelve) new academic departments. The new departments were officially launched on July 1, 2012.
- Shifting to a district model to provide administrative services to Penn State Extension county offices to improve operational efficiency, eliminate duplication, and maximize productivity. The new district model became operational in 2012 and district directors are working to develop a new district business model.

- Shifting from a geographically based extension program model to a program-team approach structured around areas of excellence, expertise, and agricultural sectors. New extension program leaders are now in place and are working with stakeholders to provide access to relevant and high-quality programming across the state.
- Basing program priorities on core mission areas of the college and identifying areas for disinvestment. Extension has shifted resources and leveraged cost-sharing dollars from counties to add positions in priority areas, including ag entrepreneurship, dairy, poultry, food safety, field and forage crops, vegetable production, and mushrooms.
- Evaluating all cost-saving options in programs, farms/facilities, extension, administration, and academic units. We have cut more than $19 million out of the college's permanent budget and continue to look at implementing new technologies to increase effectiveness and efficiency while shifting to private market solutions where outsourcing is appropriate.
- Approximately 200 positions or 25 percent of the college's workforce was lost when the budget was reduced by 19 percent. We addressed the budget reduction in part by offering a voluntary retirement buyout to faculty and staff. However, the buyout was not strategic, so some positions had to be refilled to meet program needs. Other positions were targeted to transfer off of permanent funding and cost-shared by grants, World Campus, or other sources of revenue. The

impact is that these staff need to focus on projects funded by their source of funds. This limits what can be performed.

- When we transformed from twelve departments to nine, we used a process identified by the Office of Human Resources to place staff in appropriate positions. We also engaged a third party to identify what types of positions were needed to perform the tasks to operate a department. Through this process, we discovered we were operating twelve departments with less staff than we needed to operate nine departments.
- Partnering with Pennsylvania Department of Agriculture on three resource centers to engage Pennsylvania stakeholders around priority topics to include food safety, plant protection, and animal care. The centers will better connect regulatory development and compliance with research, education, and solutions; serve as educators and information consolidators; better leverage the resources of each organization; and provide a focus for programs and stakeholders while allowing umbrellas to address a broad spectrum of issues and connections between respective staff and stakeholders.

Although downsizing is difficult, we are emerging as a more focused and efficient operation concentrating in our areas of excellence and uniqueness where we can have the greatest impact. However, the budget pressures are reaching a tipping point. Another significant cut in extension funding certainly would lead to loss of county presence.

BUDGET OVERVIEW

The college budget comprises funding from many sources, but the core of our funding—the support for our personnel to accomplish agricultural research and extension—comes from state-, federal-, and county-appropriated dollars as part of the land-grant partnership.

The state's commitment to this partnership accounts for about 50 percent of that core funding. The **State Research** and **State Extension** pieces of the pie represent the state's commitment to agricultural research and extension and fund researchers, extension educators, and staff—without which the other revenue sources could not exist. The people we hire with these funds then are able to seek extramural funding to support their programs, and they are exceptionally successful (see Figure 3 Grant/Contracts/Gifts funding information).

The **Education** piece of the pie funds undergraduate/graduate education in the college and includes approximately 12 percent state funding (through the Education and General, or E&G, line of the Penn State appropriation bill) and 88 percent tuition.

The **Federal** portion of the pie represents the federal land-grant capacity (formula) funding for both research and extension, which by law mandates matching state appropriations and would disappear without state funding.

The **County** piece of the pie demonstrates the financial commitments the counties make to extension.

College of Agricultural Sciences —Estimated 2013/2014
Total All Sources = $189,084,000

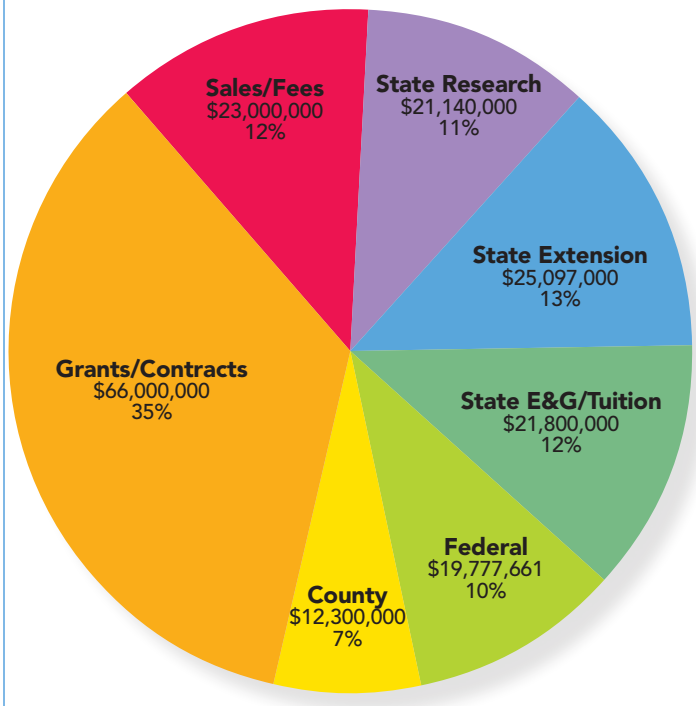


Figure 3. Total expenditures from all sources of revenue.

The researchers and educators funded by the state appropriations are able to compete for grant funding—mainly through federal agencies such as USDA—the amount of which is almost as large as the entire state contribution. Although the current year's budget shows a projected level of $60 million in **Grants/Contracts/Gifts,** in years past we brought in more than $80 million. These external funds largely are tax dollars from elsewhere in the United States coming to Pennsylvania to solve problems and create jobs. These funds then are leveraged to address Pennsylvania priorities, money that also would decrease due to reductions in personnel brought on by decreased state appropriations.

Thus, Pennsylvania's investment in agricultural research and extension programs reaps huge dividends for the state, both in direct dollars leveraged from other sources (resulting in $3.66 for every $1 invested by the state) and in economic impacts from research and extension programs that support agriculture. (Penn State Extension–sponsored Marcellus shale leasing programs alone have resulted in an additional $250 million for Pennsylvania landowners.)

After reviewing various funding models at numerous colleges of agriculture at peer land-grant institutions across the country, we found that it is extremely difficult to draw legitimate comparisons from college to college due to the great variations

in academic programs housed within the various colleges of agriculture, the number of students, structural differences at the college and University levels, diverse funding and distribution models, and differences in University policies.

We did find that our college is not alone in our funding challenges, and nearly all land-grant colleges of agriculture are in jeopardy due to their unique funding models and decreasing state and federal appropriations. However, there was one strong take away from our comparisons with our peers: we strongly believe that the integrated system we have in our college—with our teaching, research, and extension missions—is the right model. Those colleges with integrated teaching, research, and extension structures and budgets, versus those where the three mission areas are silos within the college with regard to budgets and responsibilities, have less duplication, greater efficiencies, and much more strategic planning and operations.

The challenge is to create a transparent budget model where the three mission areas are financially supported from the appropriate funding sources and stakeholders, yet they operate as one system leveraging resources for common needs and goals. That way, increases or decreases in designated funding from our partners/stakeholders will affect the appropriate program areas and not threaten the sustainability of our core teaching and research missions not funded by these separate ag appropriations.

To achieve a sustainable budget model we will:

- Continue to benchmark with colleges similar to ours at other land-grant universities.
- Continue to seek revenue for our extension programs.
- Continue to seek external research funding opportunities.
- Continue to seek partnerships to support our programs.
- Seek to transition the administrative staff salaries for our academic units to Education and General funding.

Appendixes

Appendix A: Core Council Follow-up

The college has been very proactive in planning. Recognizing the need for organizational change, the college began a process in 2010 designed to develop and implement a new business model and address budget strategies. The initiative, called AG Futures, identified opportunities for strategic growth and resulted in an aggressive college strategy.

As a result, the college has taken bold measures to reduce costs, increase operational efficiencies, and maintain the highest possible level of services to our students and stakeholders. Specifically, to date, the following has been accomplished:

CONSOLIDATING ACADEMIC DEPARTMENTS

We consolidated the college's graduate/undergraduate degree programs under nine (from twelve) new academic departments. The new departments were officially launched on July 1, 2012.

- Old units: Food Science, Agricultural and Biological Engineering, Dairy and Animal Science, Poultry Science, Veterinary and Biomedical Sciences, Agricultural Economics and Rural Sociology, Agricultural Extension Education, Plant Pathology, Entomology, Horticulture, School of Forest Resources, Crop and Soil Sciences.
- New units: Food Science, Agricultural and Biological Engineering, Animal Science, Veterinary and Biomedical Sciences, Agricultural Economics, Sociology, and Education, Plant Pathology and Environmental Microbiology, Entomology, Plant Science, Ecosystem Science and Management.

REDUCING UNDER-ENROLLED COURSES

- The number of graduate under-enrolled courses has dropped from 19.2 percent in fall 2009 to 13 percent in spring 2013, and has been as low as 10 percent (in fall 2011).
- We have instituted Instructional Guidelines that specify how many classes faculty are expected to teach with, say, a 50 percent resident instruction appointment, and how team-teaching and experimental courses should be accounted for. The guidelines also specify that all faculty members on any portion of a teaching assignment should teach at least one formal course (or equivalent in team-taught courses) per academic year, and address special cases, such as foreign study courses. Under the guidelines, under-enrolled courses do not count toward fulfilling faculty resident instruction expectations, unless specifically approved by the associate dean for undergraduate education.
- We have been working very closely with departments to reduce the number of special topic courses. The percentage of undergraduate special topics courses in the college dropped from 10.4 percent in fall 2009 to 6.6 percent in spring 2013.

PARTICIPATING IN THE UNIVERSITY-WIDE LIFE SCIENCE GRADUATE PROGRAM REORGANIZATION

We are actively participating in discussions that could ultimately lead to a University-wide life sciences graduate program. The first concrete steps toward this vision have recently been taken with a proposal from the Graduate School to consolidate six intercollege graduate degree programs (IDGPs) into a unified, single program. The Integrative Biosciences (IBIOS) IDGP serves as the core program to integrate the independent IDGPs of Molecular Medicine, Molecular Toxicology, Immunology and Infectious Disease, Cell and Developmental Biology, and Genetics into a new, unified program named Molecular, Cellular, and Integrative Biosciences (MCIBS). This diverse umbrella program maintains the core programs as emphasis areas, allowing consolidated, interdisciplinary graduate training across a wide range of specializations in the biomedical and life sciences. Currently, 47 faculty from seven of the nine departments (VBS, PPEM, PS, AS, FS, ENT, ESM) in the college participate in these IDGPs, with several faculty serving in leadership roles. We anticipate that our

faculty will continue to actively participate and take leadership roles in the MCIBS IDGP.

GENERATING NEW REVENUE

- We are developing and implementing a new revenue-enhancement model and policies as steps toward a more comprehensive financial model.
- We generated more than $33 million in new nongrant revenue in 2010–2011 from county gifts and fund-raising, cost avoidance and program fees in the counties, sales and fees, discretionary fund gifts, and endowment earnings.
- We are evaluating all cost-saving options in programs, farms/facilities, extension, administration, and academic units. We have cut more than $19 million out of the college's permanent budget over the last six years, and we continue to look at implementing new technologies to increase effectiveness and efficiency and at shifting to private market solutions where outsourcing is appropriate.
- Extension annual development funding grew from $17,000 in FY2005 to about $2 million in FY2011/2012.

RESTRUCTURING COOPERATIVE EXTENSION

- We shifted to a district model to provide administrative services to Penn State Extension county offices to improve operational efficiency, eliminate duplication, and maximize productivity. Extension transitioned from sixty-seven county offices managed by fifty-seven county extension directors and four regional directors to nineteen districts and urban centers administrated by nineteen district directors and two center directors. This resulted in a reduction of forty people involved in administration. Thirty-six of these individuals were moved back into programmatic positions. The new district model became operational in 2012, and district directors are working collaboratively with their respective counties to develop a new district business model.
- The reporting lines of county educators were shifted from the county extension director to the extension program leaders. This provided alignment of the responsibility, finances, and authority for management of programs.
- We shifted from a geographically based extension program model to a program-team approach structured around areas of excellence, expertise, and agricultural sectors. New extension program leaders are in place and are working with their program teams and stakeholders to provide access to relevant and high-quality programming across the state.
- We have reorganized to base program priorities on core mission areas of the college and identified areas for disinvestment, including family financial management, emergency preparedness, elderly care staff development, grant writing, tourism, workforce training in prisons, and adult leadership. Extension has shifted resources and leveraged cost-sharing dollars from counties to add positions in Pennsylvania priority areas, including ag entrepreneurship, dairy, poultry, food safety/quality, field and forage crops, vegetable production, and mushrooms. All extension programs are aligned with a science base.
- We invested funding into the two Urban Centers, the Lewistown Center, and Marcellus Shale Center for Outreach and Research in collaboration with Penn State Outreach and the Colleges of Earth and Mineral Sciences and Arts and Architecture.
- We are investing in the implementation of technology to support extension programs. Specifically, extension has implemented an online registration and payment system (Cvent) for its programs, three online reporting systems (EPAS, ACCESS for 4-H, and VMS for Master Gardeners), and a new web design (in Plone) for improved access to educational content. Extension is in the process of implementing an online e-commerce system (Magento) and a customer relations system (Salesforce). These systems are intended to be fully integrated, providing a more data-driven business management system that will enhance service to our customers. Extension is also testing a new integrated data system (phone, video, and other data) that will connect all county offices under one system.

CONSOLIDATING AND STREAMLINING LAND AND ANIMAL RESOURCES MANAGEMENT

- We consolidated our greenhouses under a single manager. We are working on consolidating the Russell E. Larson Agricultural Center at Rock Springs Farm operations.
- The Laurel Haven property, which has been used less frequently in recent years, was sold in early 2014. The property was a potential liability to the college due to lack of on-site staff. The proceeds from the sale will be used to purchase other land that is more suitable for the college's mission.

The end results and impacts of all the changes in the college in response to Core Council and AG Futures allow us to focus our program deliverables, eliminate program areas strategically, align program priorities with budget realities, excel in research and education on topics of greatest impact to Pennsylvania citizens, operate as a cohesive organization, and be more efficient in our operations.

Appendix B: Highlighting Our Accomplishments 2008–2013

We have reached or exceeded many of the targets set in the 2008–2013 strategic plan. We have achieved this while at the same time undergoing comprehensive college reorganization in 2011 and 2012. Coinciding with the restructuring, we were challenged with more than a 19 percent cut to our base budget and had to reduce the workforce by 25 percent. Despite of all of this, we made great strides in reaching our goals.

GOAL A: ENHANCE STUDENT SUCCESS AND OPTIMIZE ENROLLMENT

- Undergraduate student enrollment reached an all-time high of 3,001, and we have stabilized in 2013 at 2,879.
- Scholarships awarded in 2013 totaled $2,168,594, compared to $1,797,341 in 2008.
- The number of honors students in our college has increased from below 60 to above 100.
- Our graduate enrollment has increased to just below 600.
- Based on a graduating senior survey, it is clear that the student satisfaction remains strong. We have increasing number of students doing internships, going abroad, and working on supervised independent research in our faculty's labs. Many students are engaged in co-curricular activities and volunteer or participate in a service learning project.

GOAL B: EMPOWER THE ENGINES OF DISCOVERY AND APPLICATION

- Invested time and resources into moving Entrepreneurship and Innovation from initiative to program phase through the RAIN Grants Program and partnership with Aspen consultants.
- Significantly increased the number of cofunded positions from 14 in FY2007/2008 to 54 in FY2013/2014 (PAF, 2007/2008 and 2013/1204; includes 103 and 104 object codes only).
- Increased the value of awards in collaboration with Penn State colleges (e.g., EMS, Science, HHD) and institutes (e.g., PSIEE, MRL) from $207,223,518 in 2008 to $294,632,292 in 2013.
- Partnered with Pennsylvania Department of Agriculture on the formation of Plant Health Resource Center and provided resources to begin work in the center.
- Active multistate projects increased from 53 in 2008 to 57 in 2013 (RESGRADED Projects Database, 06/23/14).
- Active subcontracts with entities external to the University increased from 95 in 2008 to 134 in 2013 (GCO, 06/23/14).
- Total grants and contracts awards in the college increased from $54,967,750 in FY2007/2008 to $65,563,481 in FY2012/2013 (total administered, SIMS, 2014).
- Developed and held a Graduate Fellowship Writing Workshop in fall 2013. Response was good, and one attendee went on to receive an NSF Graduate Research Fellowship.
- Hosted our USDA National Institute of Food and Agriculture liaison, Dan Schmoldt, in June 2012. This visit provided researchers and administrators throughout the college with two-way information-sharing opportunities, with relationship-building a key benefit. We used this opportunity to showcase our academic, research, and extension programs, activities, and facilities to our federal partners.
- Annually provide a Grantwriting 101 presentation during the Graduate Student Competitive Grants Workshop.
- Provided three years of partial financial support for interested faculty, extension educators, and graduate students to attend USDA Grantsmanship Workshops (held in September 2008, November 2009, November 2010).
- In conjunction with the College of Earth and Mineral Sciences and ENRI, submitted a successful proposal to the EPA to create the Center for Integrated Multi-Scale Nutrient Pollution Solutions.
- Leading the Northeast Woody/Warm-season Biomass Consortium, supported by a $10 million grant from the USDA National Institute of Food and Agriculture.

GOAL C: CREATE DYNAMIC CUSTOMER/ STAKEHOLDER-FOCUSED EDUCATIONAL PRODUCTS, SERVICES, AND IMPACTS

Stakeholder Engagement

- Engaged the College Ag Council in discussion about the design and implementation of our new extension organization and financial model.
- Disbanded the old Pennsylvania Council of Cooperative Extension Associations and implemented a new Penn State Extension Council, which is designed to complement the Ag Council and improve local, state, and federal legislator advocacy efforts.
- Implemented an advisory committee for each state extension team. Although initiated, there is still need to improve the make-up and role of the committees.

- Implemented an advisory committee for the Penn State Center in Pittsburgh to address Penn State's engagement in this major urban center.
- Engaged 197 local extension board member volunteers across the state.
- Implemented a new extension catalog designed to showcase and market the broad portfolio of extension programs.

Dissemination of Research Results

- Increased total annual number of direct contacts in extension programs from ca. 1 million in FY2008 to 1.3 million in FY2012.
- Achieved 13 million indirect contacts in FY2012.
- Increased extension website visits from 1.2 million in FY2010 to 5.2 million in FY2013.
- Expanded mobile device web access to extension's web content from 2 percent in FY2009/2010 to 27 percent in FY2012/2013.
- Grew our online registration from 8,700 participants in FY2011/2012 to more than 15,000 in FY2012/2013. Currently, we are on track to reach more than 20,000 participants in FY2013/2014.
- Continued to distribute about 1 million extension publications annually.

Public Education

- Resigned our website to enhance its Google ranking and position in search engines.
- Redesigned the extension web content to enhance ease of access by our customers.
- Implemented statewide celebration of extension's 100-year anniversary. The governor provided a proclamation on January 9, 2014 at the Farm Show in recognition of extension's 100-year history and contribution to the success of agriculture in the state.
- Implemented a standard e-newsletter format for all state extension teams.
- Engaged 2,198 Master Gardener volunteers in FY2011/2012. These volunteers contributed 127,947 hours of their time to enhance extension's reach—a contribution of more than $2 million in in-kind time. They reported contact with 371,484 individuals.
- In FY2011/2012, engaged around 110,000 youth through 8,196 4-H volunteers, and 203,058 individuals through 62 Family and Consumer Science volunteers.

Programming Impacts

- Developed and implemented an on-line impact and success story reporting site for internal use to support district directors' efforts in building local relationships.
- Implemented twelve extension program teams to link with research faculty and better position the college for success in acquiring grants and contracts.

Operational Efficiencies

- Outsourced publication distribution and warehousing, saving around $250,000 annually.
- Implemented cost centers for each state extension team.
- Flattened extension administration from 79 individuals with administrative responsibility to 38, a 52 percent reduction in individuals with all or part of their assignment focused on administrative duties.
- Consolidated extension program numbers from more than 700 to less than 100.
- Organized all programming under 12 state extension teams.
- Redirected the educator reporting line from county extension director to the extension program leader in charge of state program teams to better align program responsibility with finances and authority.
- Decreased the mailing budget allocated to the counties by 15 percent to encourage a reduction in paper use and mailing expenses.
- Implemented the on-line registration system Cvent to reduce time and cost associated with program registration.

Measures of scholarship

- In FY2011/2012 extension professionals received 64 national and 24 regional awards for programs of excellence.

Fiscal accomplishments

- Increased annual development funding from $17,000 in FY2005 to about $2 million in FY2011/2012.
- Kept county alternative revenues relatively constant, holding between $6.4 million in FY2007/2008 and $8.0 million in FY2009/2010.
- Grants and contract growth is difficult to fully measure because the accounting system captures a significant amount of funding under research that is in support of extension programs. Those funds that are counted as extension funds have fluctuated between $12.2 and $13.1 million annually.

GOAL D: BE A TRUSTED SOURCE OF INFORMATION AND PROVIDE COLLABORATIVE SOLUTIONS THAT BALANCE AGRICULTURAL PRODUCTIVITY AND SUSTAINABILITY

- Group meals where only college employees are present have been eliminated, providing a savings exceeding $367,000 over a two-year period.
- The Ag Communications team developed a comprehensive plan to strategically integrate and manage the production, access, warehousing, ordering, distribution, fulfillment, and marketing of college publications, documents, and products. After extensive consideration and evaluation Ag Communications made a recommendation to the deans that the college pursue a partnership with NPC, a printing and warehouse distribution company located in Altoona, Pa., to manage the warehouse and fulfillment responsibilities formerly managed through the Publications Distribution Center operation. The result is a partnership that will provide the college with a strategic alliance to deliver more flexible, efficient, and affordable services to support the college's comprehensive access and distribution strategy. This formally took place in January 2013 and to date has saved more than $250,000.
- Information Technologies (Ag IT) is transitioning more of the college's computer assets to being centrally managed. Through the implementation of a standard computer imaging process, Ag IT has reduced the number of hours needed to support and maintain computer images by 350 person-hours per year. Further, as college units are incorporated into the college domain, server hardware is migrated to the college's virtual server environment. The result is greater reliability and redundancy for department-specific services (departmental storage, academic research computing) and cost savings due the efficiencies of operating in a virtualized environment. The transition of departmental IT staff to the college IT unit has resulted in management efficiencies as well for many departmental IT services. Services such as network and server management, which previously may have been provided by an individual at the department level, can now be provided by an individual across the entire college. The staffing consolidation has also allowed the college to take full advantage of all of our IT personnel resources.
- Information Technologies redesigned the college's network infrastructure utilizing new University network services. This redesign eliminates the need for individual building and departmental security appliances (an approximate $200,000 investment to cover all college networks at University Park) and instead places all college networks behind a single security appliance (a $35,000 investment). Not only does the new design result in cost avoidance for one-time and recurring equipment, but also it reduces the staff effort to maintain 52 separate security appliances. The new design also better supports the college's restructuring plan for academic units.
- Information Technologies placed its servers and storage appliances in a virtual computing cloud. This action allows IT to more efficiently address the storage and processing capacity of legacy systems as well as allowing a near-seamless integration of servers from academic units. The net result is that enough storage and processing capacity was recovered to forgo the purchase of nearly $75,000 in hardware in FY2011/2012 alone.
- As part of the organizational reframing efforts, extension implemented a centralized event registration system through CVENT in the fall of 2010. The use of this centralized system has facilitated statewide delivery of extension programs, ensured consistent marketing and branding of programs, and increased access to programs. The end result will be increased program participation. A centralized registration system allows educators to focus on program delivery rather than program administration details.

Strategic Initiatives in Last Plan

Entrepreneurship and Innovation Initiative

We have secured more than $450,000 in funding from USDA and more than $1 million in donor support for our Entrepreneurship and Innovation initiatives and program.

Resident Education

- Food and Bio Innovation program center for the new University minor in Entrepreneurship and Innovation.
- Since 2010, more than 50 AgSci students have enrolled in one of the entrepreneurship minor core courses.
- Five Harbaugh Entrepreneurship Forum events that have reached more than 700 students and facilitated 10 entrepreneur classroom visits.
- Ag Springboard business pitch competitions have enlisted 36 student teams, provided more than $13,000 in cash awards, and assisted with the development of more than 24 business ideas and the commercialization of three student businesses.
- Faculty have mentored more than 30 student business idea teams that are exploring commercial opportunities in areas ranging from poultry feed to aquaponics production for urban environments.

Extension and Research

- Entrepreneurship extension efforts have reached more than 750 clients over the past three years in new Penn State–initiated business classes such as Food for Profit and Your Future in Focus.

- Research program in agricultural entrepreneurship has gleaned best practices and insights from more than 100 entrepreneurs in food, agriculture, and natural resources. We are integrating these data into client extension education programs and residential coursework.

Research Commercialization

- Recently established Research Application for Innovation (RAIN) research commercialization research grants program received 10 project applications and has awarded more than $170,000 in funds to advance commercialization on four faculty research projects.
- Sponsored research initiative with the Aspen Group has yielded more than 12 productive engagement sessions with corporate industry partners and is in the process of establishing three on-campus company research forum events.
- More than 50 innovation faculty champions support intellectual property commercialization and entrepreneurship education.

Water Initiative

Resident education

- Formation of Water Science option in the Environmental Resource Management (ERM) undergraduate program.
- New permanent courses in stream restoration, water chemistry, measurements and monitoring of hydrologic systems, and watershed modeling to enhance Water Science option in ERM and Natural Resource Engineering option in Biological Engineering.
- Experimental course offering on Chesapeake Bay issues.
- Integration of resident instruction with Agriculture and Environment Center: undergraduate student internship developed with Conewago Creek Initiative.
- Development of the Natural Resource Engineering option in the Biological Engineering undergraduate major.
- Strategic hire of natural resource engineer with research focus on hydrologic and biogeochemical processes within the natural environment and undergraduate resident instruction in biological engineering, biorenewable systems, and/or environmental resource management.
- Revision of Forest Science major to Forest Ecosystem Management, with revised Watershed Management option.

Extension

Water quality web portal (**extension.psu.edu/natural-resources/water**):

- Drinking water
- Pond management
- Water conservation
- Master Well Owners Network
- Youth watershed education

Courses and workshops:

- Master Well Owner Network volunteer trainings
- PA Groundwater Symposium
- Safe drinking water clinics
- Water testing analysis workshops
- 4-H Stream Teams volunteer training
- Pond and lake management courses
- Regular webinar series in water resources, forest stewardship, and urban and community forestry

Research

Cross-college collaboration and research:

- Center for Green Infrastructure and Stormwater Management (EPA funding)
- Greening the Lower Susquehanna (National Fish and Wildlife Foundation funding)
- Center for Integrated Multi-scale Nutrient Pollution Solutions (EPA funding; Engineering and EMS are collaborators)
- Major cross-University projects on water resource issues and climate change (NSF and DOE funding)

Energy Initiative

Resident Education

- Online master of professional studies in Renewable Energy and Sustainability Systems.
- Redesign of two undergraduate Agricultural Systems Management and Wood Products majors into the BioRenewable Systems major with two options: Agricultural Systems Management and BioProducts.
- New graduate program in BioRenewable Systems with two options: Agricultural Systems Management and BioProducts.
- More than 50 undergraduates had summer or academic-year research experiences on energy crop production or conversion technologies.

Extension

- Developed and offered short courses for industry on fermentation.
- Developed and offered short courses on bioenergy (16).
- Delivered 19 webinars as part of Northeast bioenergy webinar series.
- Developed alternative energy credit marketing cooperative.

- Farm energy efficiency program included workshops through a USDA Rural Energy for America (REAP) grant.

Research

- Eleven college faculty are co-PIs on the Penn State-led, $10-million USDA Northeast Woody/Warm-season Biomass (NEWBio) Consortium. Three other colleges (Smeal Business, Hershey Medical, and Education) and 11 other universities and national laboratories are also involved.
- Four college faculty are co-PIs on a $21 million grant from DOE for the Center for Lignocellulose Structure and Formation. Three other colleges (Eberly, EMS, and Engineering) are also involved.
- The college has received more than $10 million in other energy-related grants from NSF, DOE, and USDA.

Pest Prediction and Response Initiative

Extension and Research

- The Integrated Pest Management Pest Information Platform for Extension and Education (IPM PIPE) continues to evolve to serve a wider range of agricultural stakeholders. IPM PIPE is a web-based geospatial information pest prediction system for insects, diseases, and weeds. IPM PIPE helps to maximize growers' economic returns and improve social welfare and environmental health by promoting efficient and coordinated IPM decision support systems. The spatially explicit monitoring and mapping application reduced fungicide applications, saving soybean growers an estimated $200 million a year in fungicide sprays and the environmental benefits that go along with reduced fungicide use.
- Assessed the need for, planned, and established the new Plant Health Resource Center, a collaboration with the Pennsylvania Department of Agriculture, that will serve as a point of contact for pest outbreak reporting and strategic monitoring and as the nexus for applied pest management planning and implementation.
- Developed and delivered invasive plant species monitoring and management training for PA-DCNR. The program expanded to areas affected by Marcellus shale gas extraction to reduce the likelihood of invasive plant spread into these areas.
- Developed and delivered habitat management training sessions for PA Game Commission.
- Developed PestWatch, a multistate regional pest monitoring system combining data collection by end-users and real-time mapping to allow growers to monitor the arrival of important pests such as fall armyworm and corn earworm. User surveys conducted in 2010 and 2012 indicate program participants have reduced insecticide sprays by 50–75 percent. PestWatch has also been incorporated into a $1.4 million USDA NIFA Climate Change grant and other more basic USDA grants.
- Developed the Phytophthora Database (**www.phytophthoradb.org**) and FUSARIUM-ID (**www.fusariumdb.org**), which, coupled with advanced visualization tools, allow users to visualize the geographic origins of chosen isolates, providing clues to the likely origin of newly discovered pathogens. The database and the coupled visualization tools average ~2,000 visits per month from more than 60 countries. Similar platforms for other pathogen genera also have been constructed.
- Collaborated with the Pennsylvania Department of Agriculture's Plant Disease Diagnostic Lab to enhance their molecular diagnostic capability. The lab is now fully equipped and staffed to conduct rapid diagnosis of multiple pathogens using molecular tools.
- Developed stink bug tracking website.
- Developed slug tracking website.
- Established soybean sentinel plots as an early warning system for disease and insects.
- Received USDA grant to develop a smartphone app to forecast barley yellow dwarf virus in small grains in PA. Provides management recommendations.
- Developed online databases supporting pathogen identification and monitoring worldwide using informatics platforms to systematically catalog and monitor pathogens.

Food, Diet, and Health Initiative

Resident Education

New courses:

- AN SC 497A Natural Toxicants in Foodstuffs and Poisonous Plants
- FD SC 407 Food Toxins
- FD SC 497A Bioactive Food Components
- FD SC 597E Advanced Food Toxins
- PLANT Enhancing Health-Promoting Compounds Through Plant Breeding (pending)
- VB SC 514 Prostaglandins and Leukotrienes
- VB SC 534 Current Topics in Cancer Research

Research

New infrastructure:

- A gnotobiotic mouse facility was developed.
- The Department of Food Science has hosted a symposium on prevention of metabolic syndrome by dietary phytochemicals for four consecutive years.

Diversity: Progress Toward Achieving the Challenges of the College's 2010–2015 Strategic Plan

Since the last diversity strategic plan, a number of changes have occurred in the executive leadership of the college. First, in fall 2012, our dean left the college and we currently have an interim dean who has continued support for diversity. Second, the director of human resources retired. This is especially important because this person led the effort to prepare the college's Diversity Strategic Plan. Third, the equal employment opportunity officer for the college retired after an extended medical leave. This person worked specifically in the area of civil rights compliance. Fourth, a new position—assistant dean for multicultural affairs—was created to provide leadership for diversity efforts in the college.

Please note that in the table below, some of the projected outcomes listed in the 2010–2015 plan are addressed as measures under different challenges in the 2014–2019 plan.

We have made progress toward achieving many of the goals stated in the 2010–2015 plan. We still have challenges and goals that deserve additional attention and effort.

Challenge 1: Developing a Shared and Inclusive Understanding of Diversity

Diversity Efforts and Initiatives	Measures
Create a new position in the college administration—the assistant dean for multicultural affairs.	The position began July 1, 2012. This position is in addition to the coordinator of multicultural programs position that already existed. The assistant dean is a part of the dean's leadership team.
Reconstitute the Diversity Coordinating Council with greater representation of various college positions and with increased responsibilities for the college.	The newly reconstituted council was announced to the college during the dean's webinar on December 30, 2013.
	The new council includes members from administration, faculty, staff, extension educators, and students.
	The Diversity Coordinating Council took leadership in planning the college 2014–2019 Diversity Strategic Plan.
	The Diversity Coordinating Council sponsored a "Women in Science" program attended by 35 students and faculty.
Enhance diversity professional development. ***Best Practice for Challenge 1***	Efforts have been made to provide diversity education to faculty, staff, students, and extension educators across the state. Diversity in Two-Part Harmony is a diversity-focused education program that began in 2011–2012. A diversity-focused video is shown by video conference to extension offices/sites across the state. Then a speaker with expertise on the topic provides a brief presentation and opens the session up to questions and discussion. During the 2012–2013 year, the program was expanded to include faculty and staff in the college, as well as the extension sites across the state. Diversity topics have included a broad array of dimensions, such as race, gender, religion, disability, sexual orientation, biracial populations, and cross-racial adoption.
	During the first year (2011–2012) a series of four sessions was held and shown at 10 extension sites across the state. Approximately 100 extension educators participated in the program.
	During the 2012–2013 year, 130 people participated in the four sessions.
	During the 2013–2014 year, nearly 200 people participated.
	Each year the number of remote sites has increased, varying from 10 to 15 sites per session.
	Evaluations of the programs range between 4 and 5 on a 5-point scale with 5=highest and 1=lowest.

Enhance diversity communication.	A new diversity webpage was created and is prominently listed on the college home page. This website informs viewers of the Office of Multicultural Affairs and the names and photos of the staff are just a click away. The Articles of Interest section is continually updated with news articles to keep readers updated on diversity-focused topics. The Events section shares upcoming diversity-focused events offered through the University. Additionally, emails of some diversity-focused professional development opportunities offered on a University-wide basis are forwarded directly to all faculty and staff in the college. As an example, several faculty attended the Jack Dovidio presentation.
Enhance diversity professional development. A College of Agricultural Sciences diversity book club initiative was begun. An opportunity to receive a copy of *Whistling Vivaldi: How Stereotypes Affect Us and What We Can Do* and engage in a discussion about the book was offered to the first 25 faculty and extension educators who responded to the announcement.	Thirty faculty and educators requested participation in the club. The 90-minute discussion of the book was led by Dr. Suzanne Weinstein, director of institutional counseling, assessment, and research, Schreyer Institute for Teaching Excellence.
	As a measure of effectiveness, one of the participants recommended this book club program be repeated as part of the New Staff Orientation for extension educators. Others requested that additional sessions be scheduled for a continuation of the discussion. Forty-three new extension educators read the book and participated in a facilitated discussion of the book during the New Staff Orientation program for extension educators.

Challenge 2: Creating a Welcoming Climate

Diversity Efforts and Initiatives	Measures
Support opportunities for faculty, staff, and students to participate in University programs that create a welcoming climate.	The Dean's Office supports the attendance of ten faculty and staff at the Annual Commission for Women Award Luncheon each year.
	The Office of Multicultural Affairs supports the attendance of six female students to the Annual Commission for Women Award Luncheon each year.
	The Office of Multicultural Affairs supports the attendance of ten students and faculty at the Martin Luther King, Jr. Banquet each year.
Recognize diversity efforts of faculty, staff, and extension educators.	The College of Agricultural Sciences annually awards the William Henson Diversity Achievement Award to a faculty or staff person in the college who demonstrates outstanding efforts to foster diversity in the college.
	In 2013–2014 the status of the award was elevated with the addition of a $500 award to the recipient and news releases to publicize the accomplishment.

As part of the college's responsibility to comply with USDA Civil Rights/Affirmative Action guidelines, create a new set of civil rights training modules to provide training for all extension and research faculty and staff. ***Best Practice for Challenge 2***	Six on-line modules and six accompanying quizzes were developed and piloted with two extension districts. Based on the feedback received from the pilot, the modules are currently being tweaked to increase user-friendliness.
	The compulsory modules must be passed with at least 80 percent accuracy documented by a certificate of completion. In addition to compliance, the training serves as an educational activity that reminds faculty and staff of what is necessary to ensure that our programs are open, accessible, respectful, and welcoming to all segments of the public.
	Within one year of implementation, 95 percent of all extension educators and 80 percent of all faculty will have completed the modules.
Identify trained personnel to represent åthe college on issues of sexual harassment.	The director of human resources and the assistant dean for multicultural affairs received training by the Office of Affirmative Action to serve as representatives for the college.
Assess the climate for graduate students in the college.	In February 2013, the Office for Graduate Education administered the Graduate Student Survey to all graduate students enrolled and advised by faculty in the College of Agricultural Sciences. Two hundred and seventy-four graduate students completed the survey (45.1 percent response rate). Based on survey results 83.7 percent of respondents agreed or strongly agreed that people in their departments communicate respect towards those with diverse backgrounds.

Challenge 3: Recruiting and Retaining a Diverse Student Body

Diversity Efforts and Initiatives	Measures
Provide financial support to assist in the recruitment of underrepresented students.	The college provided $188,650 in scholarships for underrepresented undergraduate students in 2013/14. This represents an increase of more than $16,000 over the previous year.
Obtain research funding to support recruitment efforts for underrepresented students. ***Best Practice for Challenge 3***	Continued participation in the National Institutes of Health–funded Bridges to the Doctorate Program in collaboration with Alcorn State University. This program is designed to foster students' matriculation directly into doctoral programs after completion of a master's degree in biological sciences from Alcorn State. The program boasts an 80 percent success rate. Since 2006 ten students have participated in the program.
	As part of a National Science Foundation (NSF) Plant Genome Program research project, the Department of Ecosystem Science and Management brings minority students from the University of West Alabama to participate in summer research program internships. The Penn State professor collaborates with an African-American faculty member from the University of West Alabama who visits with the students. The student population of the University of West Alabama is 63 percent female and 52 percent minority. This program is designed to generate student interests in graduate studies at Penn State.
	A USDA grant was obtained to provide scholarship funding to help support three underrepresented students in the veterinary science program.
	A $5,000 grant from John Deere & Company helped support the college's participation in the Upward Bound Math and Science Program summer program for 2014.
Increase networking activities to broaden outreach to potential students from underrepresented populations.	The assistant dean for multicultural affairs and the coordinator of multicultural programs participated in the Florida A&M Graduate Feeder Conference to reestablish a relationship with this historically black college or university. Discussions were held with 27 undergraduate students who expressed an interest in Penn State programs for graduate school. Seven students were specifically interested in College of Agricultural Sciences majors. One Ph.D. student was recruited and will begin in fall 2014. The names and contact information of the other 20 students were shared with the appropriate multicultural leaders in other colleges.
	The Coordinator of Multicultural Programs participated in the Emerging Researchers National Conference in STEM, which provided opportunities to meet underrepresented graduate and undergraduate students from other states who were making oral and poster research presentations. Contact information was collected from several students and follow-up contacts were made.

Expand efforts to interest high school students in our college's programs.	During the 2012–2013 year, the college participated in the Upward Bound Math and Science Summer Research program. Three underrepresented high school students gained research experiences and an increased interest in a degree at Penn State.
Continue and increase participation in the Committee on Institutional Cooperation's Summer Research Opportunities Program to attract underrepresented minority graduate students.	Each summer undergraduate students participate in the Summer Research Opportunities Program in the college. The number of participants has increased each year since 2012 (2). In 2014 all available slots (5) are filled.
	All Summer Research Opportunities Program participants have matriculated to graduate programs.
Provide opportunities for professional development and a sense of community for underrepresented students in the college.	The college supports the MANNRS (Minorities in Agriculture and Natural Resources and Related Sciences) student chapter. The student organization continues to be active. Biweekly meetings are held and students participate in regional and national conferences as a part of this national organization. Three advisers serve as mentors for the student members.
	The "Women in Forestry" program was begun in 2012 to discuss ways to recruit women into the Forest Science major and to mentor young women entering the profession. The group has a goal of "Connecting women in forestry for the purposes of mentoring, networking, recruiting, educating, and developing professionally." The group consists of female faculty, staff, graduate, and undergraduate students, as well as women from the U.S. Forest Service and state agencies.

Six-year Graduation Rates for Minority Students by Starting Cohort*

	Fall Cohort						
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Black/African Am	100% (9)	37.5% (8)	60% (5)	77.8% (9)	70.0% (10)	77.8% (9)	60.0% (5)
Hispanic/Latino	100% (2)	71.4% (7)	83.3% (12)	80.0% (5)	87.5% (8)	83.3% (6)	83.3% (6)
Asian	100% (2)	100% (2)	50% (2)	100% (1)	83.3% (6)	100% (3)	100% (3)
American Indian	100% (1)						
Nat Hawaiian/PI	No data available						

** Data from University Enrollment Management Retention Report*

Challenge 4: Recruiting and Retaining a Diverse Workforce

Diversity Efforts and Initiatives	Measures
Strengthen policies and practices related to recruitment of faculty and staff. *Best Practice for Challenge 4*	The Office of Human Resources has created a new training program that is required for all members of search committees prior to receiving access to applicant pools. Among the topics included in the training are search committee guidelines for selecting diverse committee members, advertising outlets that reach minorities, and reviewing application pools for qualified applicants, especially those that are minorities.
	New positions for extension educators are being advertised on a national extension diversity listserv.
	The dean's leadership team has made it a practice to include a statement regarding the desirability of diversity experience within the body of all faculty and staff job announcements.
	The assistant dean for multicultural affairs participates in all faculty and administrative candidate interviews with the express purpose of asking questions about candidates' diversity experience and attitudes toward promoting diversity goals.
Support University activities/initiatives to retain a diverse workforce.	The college maintains representation of at least one person on each of the following: the Commission for Women, the Commission for Racial and Ethnic Diversity, and the Commission for Lesbian, Gay, Bisexual and Transgender Equity.
	The assistant dean for multicultural affairs participated in the October 17, 2013, Senior Faculty Mentor Seminar, which focused on promotion and tenure case studies designed to shed light on matters related to the advising, support, and promotion and tenure of underrepresented faculty.
Increase the number of underrepresented faculty and staff.	Since 2012 twelve new female faculty have been hired.

Challenge 5: Developing a Curriculum that Fosters Intercultural and International Competence

Diversity Efforts and Initiatives	Measures
Develop a curriculum that fosters international competence.	Two hundred forty three of the college's students had international experiences on Penn State study abroad programs in the past academic year.
	The college's students experienced international education in at least 26 different countries in the past academic year.
	In the most recent senior exit survey, 92 percent of students who had an international experience during their Penn State career indicated that their international experience increased their appreciation of cultural differences.
	The INTAG (International Agriculture) minor was revised and updated in 2012 with a new capstone class.
	Enrollment in the INTAG minor has tripled over the past 3 years.
	A new dual-title graduate degree program in International Agriculture and Development (INTAD) was launched in 2011. Three students have graduated so far and twenty are enrolled in INTAD.
Develop a curriculum that fosters intercultural competence. *Best Practice for Challenge 5*	Landscape Contracting students are required to take Spanish in Agriculture, in which they not only learn Spanish, but they learn about the Hispanic culture of many agricultural workers.
	A new course, ENT 530 Diversity in Science Seminar, was offered in fall 2013 in the Entomology Department.
	Extension programs in Philadelphia and Pittsburgh involving high tunnels for local crop production are aimed at diverse populations.
	Much of the integrated pest management (IPM) programming is associated with serving underrepresented groups both in urban and agricultural settings. Due to the requirements for fulfilling broader impacts in NSF awards, many of our faculty and graduate students have integrated diversity projects within these grant requirements. The IPM program works with more than 45 organizations in Philadelphia.
Support faculty in efforts to incorporate diversity into the curricula.	The Office of Multicultural Affairs supported attendance of a professor in the Department of Ecosystem Science and Management at The Future of Diversity in Our Disciplines and Careers: Natural Resources and the Environment conference. The focus of the conference was on the importance of attracting more diverse students to educational programs and employment in this field.
	"Intersections of Diversity and Outreach," featuring ideas on how to incorporate diversity into research project proposals, was offered as part of the Fall Research-Outreach Dialogue Series sponsored by the Penn State Institutes of Energy and the Environment (PSIEE) in partnership with the Strategic Interdisciplinary Research Office (SIRO).
Adapt curricula to accommodate extension programming for diverse audiences in the state.	Oral presentations in Spanish are provided to better reach Hispanic workers in the mushroom and fruit industries.
	The Department of Agricultural and Biological Engineering has translated materials and presented tractor safety programs to Spanish-speaking audiences.

Challenge 6: Diversifying University Leadership and Management

Diversity Efforts and Initiatives	Measures
Participate on University leadership committees that focus on diversity.	The college is represented by at least one person on each of the following diversity-focused University-level committees: the Faculty Senate Committee on Educational Equity and Campus Climate, the Joint Diversity Awareness Task Force, the Commission for Racial and Ethnic Diversity, the Council of College Multicultural Leaders, the Administrative Council of Multicultural Affairs, the Commission for Women, and the Commission for Lesbian, Gay, Bisexual and Transgender Equity.
Enhance diversity leadership within the college. *Best Practice for Challenge 6*	As mentioned under Challenge 1, a new position was added to college administration—the assistant dean for multicultural affairs. This position is in addition to the coordinator of multicultural programs position that already existed. The assistant dean is a part of the dean's leadership team.

Challenge 7: Coordinating Organizational Change to Support Our Diversity Goals

Diversity Efforts and Initiatives	Measures
Increase accountability for diversity at the department head level. *Best Practice for Challenge 7*	An additional section on diversity initiatives and activities was added to the annual Department Head Annual Reports that are reviewed by the dean's leadership team and discussed with the department head. Feedback and recommendations were given to each department head.
	Each department strategic plan is reviewed for its contribution to diversity efforts and goals.

Appendix C: Learning Outcomes Assessment

In 2012–2013, five baccalaureate majors were in year one of the assessment process due to the development of new majors and changes in staffing in some of the academic units. Eleven of our majors have reported on their first learning objective and are now focusing on a second learning objective for the 2013–2014 academic year (year two). The Assessment Coordinating Committee reviewed the 2012–2013 plans and provided feedback. The associate dean for undergraduate education noted that the plans are "very strong." Plans for 2013–2014 are due in June 2014 and will be submitted to the Assessment Coordinating Committee for review.

Our college transitioned from twelve to nine academic units in July 2012. Since 2011, eighteen of the nineteen baccalaureate majors have submitted, initiated, or completed revisions to their degree programs. Of these, four majors were dropped (Wood Products, Agricultural Systems Management, Agroecology, and Horticulture) and two new majors were added (Plant Sciences and BioRenewable Systems). The Plant Sciences major includes four options: Crop Production, Horticulture, Plant Science, and Agroecology. The BioRenewable Systems major includes two options: Agricultural Systems Management and BioProducts. Programs continue to make informed changes to the curriculum, class/lab content and assessment, and co-curricular opportunities for students.

These thoughtful and planned curricular and course revisions and developments are indicative of the collective effort of faculty and staff to continually offer the best academic experiences for students. This effort is also built on feedback and engagement of our alumni, stakeholders, and students.

Another piece of evidence that we use to facilitate curricular change is our senior survey. At the end of each semester, graduating seniors are sent a request to complete the College of Agricultural Sciences senior survey. The survey includes requests regarding postgraduation plans, career and major information, participation in co-curricular experiences, and perceptions of their academic experience, along with overall satisfaction indicators. Since the revision of this survey in fall 2011, we consistently secure about a 70 percent response rate (spring 2013 ~ 69 percent).

Individual academic units also provide major-specific questions to use for programmatic and curricular enhancement. In addition to the areas mentioned above, starting in fall 2012, three college-wide learning outcome questions (indirect measures) were included and are tailored for each major.

With two years of senior survey data, departments are in the process of identifying patterns and feedback from learning outcomes to make planned and informed curricular and co-curricular changes. Departments can also share the information with stakeholders to secure input from business and industry.

Appendix D: Sustainability-related College of Agricultural Sciences Majors and Minors

BIORENEWABLE SYSTEMS (BRS): AGRICULTURAL SCIENCES MANAGEMENT OPTION

This option applies a technological approach to understanding and managing agricultural production systems to meet economic and sustainability needs. Basic study is emphasized in the agricultural and business management sciences, along with the application of the technical results of engineering research, design, and manufacturing. Graduates of this option apply their technology and management training to the diverse areas of food and fiber production; bioprocessing; and land, water, and air resources.

BIORENEWABLE SYSTEMS (BRS): BIOPRODUCTS OPTION

The scientific nature of biobased resources—their unique design, sustainability, and renewability—constitutes the core of this option. Building upon that foundation, students learn techniques for converting and efficiently utilizing these materials to maximize product life cycles, while simultaneously exploring relevant marketing and management strategies. Technical electives for this option emphasize material sciences, engineering, and/or business. Career tracks are broad, ranging from traditional forest products companies to emerging sectors, including bioenergy co-products.

CIVIC ENGAGEMENT MINOR—SCHOLARSHIP, SUSTAINABILITY, AND CIVIC ENGAGEMENT PROGRAM (SSCEP)

Faculty and staff in agricultural economics, sociology, and education are leading development of long-term scholarly engagement partnerships between Penn State and six to eight host Pennsylvania communities with broad sustainability goals. The program involves a three-course sequence and a summer immersive experience by each participating student (for a total of 12 credits), beginning in the spring semester of each year. Two students are matched annually with each host community, and work with a local community team on place-appropriate sustainability projects. The initiative is receiving funding from Penn State's Sustainability Institute.

COMMUNITY, ENVIRONMENT, AND DEVELOPMENT (CED)

The principal goal of the Community, Environment, and Development major is to develop the knowledge and skills of undergraduate students to enable them to assist local people, their communities, and institutions in effectively understanding, responding to, and ultimately shaping economic and social changes, including those that pose risks to the environment. The CED major focuses on the fields of community and economic development, environment and natural resources, and the critically important interactions between these fields, both locally and globally. Building skills and knowledge to tackle important environment and development issues facing communities today requires a multidisciplinary or transdisciplinary program; the major bridges the disciplines of agricultural, environmental, and regional economics on the one hand and rural sociology on the other. Foundation (Level I) courses introduce students to key concepts in economics and sociology and examine how these disciplines contribute to the basic content knowledge encompassing community and economic development and environmental economics and sociology. Level II courses build on the foundation courses by extending the content knowledge to address the interrelationship between environment and natural resources and community and economic development. Coursework in methods, quantification, and communication is also required, including methods and techniques such as geographical information systems and geographical information analysis, statistics, and survey research methods.

Students select from three options: (1) Community and Economic Development, (2) Environmental Economics and Policy, and (3) International Development. Students specialize in an option that further allows them to develop skills and competencies matching their specific education and career goals. It is expected that some students completing the program will choose to attend graduate school or law school, while others will choose employment after graduation.

ENVIRONMENTAL RESOURCE MANAGEMENT (ERM)

ERM is an interdisciplinary, science-based major designed to prepare students to understand and critically analyze environmental problems ranging from local to global in scale, identify solutions, and communicate ideas related to environmental and natural resource issues. The ERM major also focuses on human interactions with the environment by emphasizing the management of environmental resources. The ERM curriculum begins with foundation course work in the biological, physical, and social sciences. Later courses apply these principles to the management and sustainability of the environment, and include environmental problem-solving, ecosystem management, and

environmental law. The third tier, offered through three options, affords considerable flexibility and the opportunity to specialize.

The major prepares students for employment in a variety of environmental positions, including environmental consulting, public agencies, and nonprofit organizations. Students are also prepared for graduate school or law school upon graduation. Realizing the wide range of career possibilities requiring diverse types of academic preparation, three options of study are available: the Environmental Science option, the Soil Science option, and the Water Science option.

Environmental Science Option

Students select a minor or choose a group of courses (totaling at least 18 credits) that focus on a particular aspect of the environment. Examples include watersheds and water resources, climate change impacts, geographic information systems, energy and air pollution, sustainability leadership, ecology, environmental engineering, wildlife and fisheries science, and others. Courses and minors from across the University can be selected to develop a student's area of specialization in the Environmental Science option.

Soil Science Option

Students take courses in soil composition and properties, conservation, nutrient management, soil ecology, geographic information systems, and mapping. This option also allows students to choose courses that support their strengths and interests. The option prepares students for positions with private, public, and nonprofit firms that evaluate soils for various uses, delineate wetlands, perform environmental assessments, and identify and remediate contaminated soils.

Water Science Option

Students take courses in hydrologic measurements, wetland conservation, stream restoration, stream and lake ecology, watershed management, and land use practices to control runoff and erosion. The option also prepares students for positions with private, public, and nonprofit firms that evaluate water quality and quantity issues, delineate wetlands, perform environmental and hydrological assessments, and identify and remediate contaminated aquatic resources.

FOREST ECOSYSTEM MANAGEMENT (FOREM)

The mission of the B.S. program in Forest Ecosystem Management is to help students develop the knowledge, skills, and professional ethics for understanding and managing forest ecosystems and living as responsible members of society.

Forest Biology Option

This option provides a strong background in the biological and ecological aspects of contemporary forestry and establishes a sound foundation for professional employment and graduate-level study in forestry, ecology, and related disciplines.

Forest Management Option

This option provides professional training in the management of forest lands consistent with the needs of ownership objectives. Employment opportunities include forest management positions with public agencies, industry, and private consulting.

Community and Urban Forest Management Option

This option helps prepare students to manage community trees and green spaces. It emphasizes technical expertise, communication abilities, and skills for working with diverse people. Employment opportunities include municipalities, arboricultural companies, utilities, and government agencies.

Watershed Management Option

This option focuses on water resources and the integrated management of natural resources with emphasis on water. Graduates qualify for federal employment as hydrologists and for water-related careers in municipal watershed management, state and local government, and environmental/engineering consulting.

LANDSCAPE CONTRACTING (LSCPE)

Landscape contracting involves constructing, establishing, and maintaining landscapes from small residential projects to large commercial and industrial projects, as well as producing plans for small-scale residential and commercial sites. Students develop skills in construction, site design, plant material usage, plant establishment, and landscape maintenance. Students are also educated in areas such as graphics, surveying, soils, turfgrass management, weed and pest management, and business operations.

Design/Build Option

This option focuses on the development of skills in the planning and implementation of landscape projects. Employment opportunities exist with landscape contracting companies, irrigation companies, and retail centers.

Management Option

This option provides professional education in the management of landscapes. Employment opportunities include positions with landscape management companies and golf courses.

PLANT SCIENCES (PLANT)

The Plant Sciences major is an applied biological science program designed for students seeking careers in agronomic and horticultural crop production systems and enterprise management, agroecology, sustainable and organic managed and natural ecosystems, crop protection, applied plant physiology, plant

science research, and plant biotechnology. Students will secure: (1) a working knowledge of basic plant biology, soils, pests, and pathogens with emphasis on growth, development, and physiology in an ecological and agricultural context, (2) the scientific, technical, and computational approaches to problem solving in an ecological and agricultural context, individually and in teams, (3) the ability to analyze ethical issues regarding ecosystem sustainability, business practices, and plant science, and critically evaluate and respect different viewpoints in making management decisions, and (4) a high level of proficiency in written and oral communication, particularly with regard to critical evaluation of scientific issues.

Agroecology Option

This option applies an ecological approach to understanding and managing cropping systems to meet society's needs while enhancing environmental protection and resource conservation. Students will develop skills to manage agroecosystems for sustainable productivity, profitability, and environmental protection by studying plant and soil sciences, ecology, and pest management from a systems perspective. The curriculum prepares students for a wide range of careers in agricultural and ecological fields and sustainable food production, and for graduate studies.

Crop Production Option

This option provides students with practical and field-related skills in agronomy (field crop production and soil management). Students will focus on techniques and knowledge necessary to efficiently and economically manage soils, crops, and other farm resources with additional emphasis on pest management and commodity marketing. Courses stress the skills and information needed to work with current production technologies, such as seed traits, crop protection chemicals, and fertilizers to improve yield and productivity.

Horticulture Option

This option prepares students to enter the horticultural industry by providing a broad background in courses related to production and physiology of horticultural crops. Additional courses in pest management and business are required. Graduates may work as orchard, greenhouse, garden center, nursery, or farm managers, with horticultural and landscape service providers, suppliers, or brokers, with Cooperative Extension and other government and nongovernmental agencies, or with public and private gardens, or continue with graduate studies.

Plant Science Option

This option emphasizes the application of the biological sciences to problem-solving in agronomic and horticultural ecosystems. Topic areas include plant biology, plant pathology, plant microbiology, plant biotechnology, plant-insect interactions, horticulture, crop science, plant ecology, and bioenergy. Graduates may find employment in industry, government, and academic research programs as technicians and research assistants, or pursue graduate degrees.

WILDLIFE AND FISHERIES SCIENCE (W F S)

The purpose of the Wildlife and Fisheries Science major is to develop the knowledge, skills, and professional ethics of undergraduates interested in the conservation and management of fish and wildlife and their environments. The curriculum is designed to provide a broad-based science background that incorporates natural resource management principles that prepare our students for a diverse array of opportunities, such as graduate school, natural resource management agencies, consulting firms, nonprofits, etc. Each option enables students to gain greater depth of knowledge in one area of the discipline. Course work required for the Wildlife option meets The Wildlife Society's requirements for professional certification, and course work required for the Fisheries option meets the American Fisheries Society's requirements for professional certification.

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