

Department of
Crop and Soil Sciences.

Strategic Plan

SUBMITTED TO THE
COLLEGE OF AGRICULTURAL SCIENCES

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Executive Summary

The Department of Crop and Soil Sciences consists of the three major program areas of Crop Science, Soil Science, and Turfgrass Science that share a common mission of education, discovery, and communication to improve the understanding and management of plant and soil systems. The scope of our work includes both agricultural and non-agricultural landscapes from rural to urban areas. Our vision is to lead in the development and application of science-based knowledge for understanding, designing, and managing diverse and sustainable landscapes for food, fiber, and bioenergy production, sports and recreational uses, and critical ecosystem functions (e.g., soil, water, and air quality, biodiversity, climate stability).

We strive to fulfill our mission and achieve our vision by (i) providing the learning environment necessary to attract and educate individuals who will be well-informed in plant and soil systems and ready to contribute to sustainable land use practices, (ii) identifying and focusing on important and promising basic and applied research needs, (iii) enhancing lifelong learning opportunities through outreach programs, and (iv) fostering a climate in which members of our department can achieve their personal and professional goals.

Strategies for achieving our educational goal include allocation of human resources to recruitment, continued leveraging of departmental graduate assistantships, and the evolution of our course offerings. Strategies for achieving our discovery goal include fostering multidisciplinary research teams that achieve national prominence in understanding and managing sustainable landscapes. Strategies for achieving our outreach goal include increased coordination of extension programs with allied departments, continued development of e-learning approaches, and engagement with the College extension reframing effort. Strategies for achieving a better departmental climate include proactive action by our Faculty, Staff, and Student Affairs Committee, partnership with the College in efforts to recruit a diverse workforce and student body, and fostering alumni support of departmental affairs.

Departmental research priorities directly support the College's strategic initiatives of water quality and quantity, energy, and pest prediction and response, as well as indirectly contributing to the entrepreneurship and food, diet and health initiatives. We are committed to (i) increasing our capacity for integrated, multifunctional landscape/system analysis, (ii) improving food and feed grain, biomass energy crop, and turfgrass production systems, (iii) achieving a balance between production and resource conservation, (iv) expanding understanding of invasive species, (v) assessing the ecosystem services provided by agroecosystems, (vi) servicing stakeholders and informing policy makers, (vii) contributing to international engagement, and (viii) enhancing recruitment and retention of our students.

Critical to achieving our strategic goals is maintaining diverse faculty expertise. Our hiring priorities include a **Crop Production Specialist** to teach Field Crop Management and enhance applied research and outreach programs, an **Urban Soil Scientist** to teach Urban Soils and complement the emerging Metro Center in Pittsburgh, a **Turfgrass System Scientist** to serve as Director of the rapidly expanding eLearning turfgrass programs and provide timely outreach to the turfgrass industry, and an **Integrative Land Use Modeler** who will add to our ability to provide geospatial literacy to our students and advance understanding of the relationships among quantitative landscape data and ecosystem function and management.

Mission, Vision, and Core Values

Mission

The mission of the Department of Crop and Soil Sciences is to improve the understanding, design, and management of terrestrial ecosystems that are the foundation for food, fiber, and bioenergy production, sports and recreational activities, and environmental quality. We *educate* students regarding stewardship of these systems, preparing them for fulfilling private- and public-sector employment; we *discover* mechanisms that promote sustainable land use and address complex real-world problems through science-based research; and we *communicate* our findings through scholarly publications and relevant extension and outreach programs.

Vision

The Department of Crop and Soil Sciences will lead in the development and application of science-based knowledge for understanding, designing, and managing diverse and sustainable landscapes for food, fiber, and bioenergy production, sports and recreational uses, and critical ecosystem functions (e.g., soil, water, and air quality, biodiversity, climate stability). We will proactively address emerging issues related to the stewardship of plant and soil resources by assembling multidisciplinary teams to address critical state, regional, national, and international needs. We will evolve our learning and outreach activities to guide current and future economic, social, and technological innovations by maintaining dialogue with, and providing educational support for, our constituents.

Core Values

The Department of Crop and Soil Sciences affirms the following core values that will guide the implementation of our teaching, research, and extension mission and vision. We agree to pursue excellence, integrity, creativity, shared leadership, supportive mentorship, stakeholder engagement, open access to information, interdisciplinary collaboration, diversity, mutual respect, and a departmental climate that nurtures the intellectual and professional development of faculty, staff, and students.

Strategic Advantages, Challenges, and Priorities

Advantages

A recent report by the Farm Foundation (www.farmfoundation.org) delineates challenges agriculture will face in providing food, fiber, and energy over the next 30 years. These include changes in market regulation and world climate, growing populations and per capita consumption of protein, increasing demand for feedstock by energy producers, continued depletion of natural resources, and the overall need to stimulate economic development. The research, teaching, and extension activities of the Department are poised to address many of these issues.

The agricultural and turfgrass ecosystems that are the purview of the Department comprise a large portion of the Commonwealth (10.5 million acres) and world (> 12 billion acres). Department programs also encompass activities in an array of other ecosystems including forests, wetlands, and minelands. In addition to the traditional role in commodity production, society is increasingly asking these ecosystems to provide an array of “ecosystem services”. The Millennium Ecosystem Assessment (www.millenniumassessment.org) classified ecosystem services into supporting (e.g., soil formation, nutrient cycling), provisioning (e.g., food, genetic resources), regulating (climate, water), and cultural (e.g., aesthetic, educational) services. Furthermore, future increases in agricultural production will be largely derived from increased inputs and technology because there is little new arable land available for production (The State of Food and Agriculture - 2007, www.fao.org). However, poorly managed intensification can result in environmental degradation such as soil erosion, compromised water quality, and salinization. Many of the Department’s programs address means to balance increased efficiencies in crop production without negatively impacting soil, water, and energy resources. Even more, our ambition is to enhance the full array of services provided by sustainable agroecosystems.

Challenges

Challenges for the Department going forward are resource limitations and the lack of public appreciation for complex agricultural and environmental issues. The current recession is likely to curtail formula and competitive funding of research and educational programs, thus threatening our progress in sustainable agroecosystem management development. Relative to our peers (mean tenure-track faculty at Iowa State, Kansas State, Michigan State, Minnesota, Purdue, and Wisconsin is 38), the investment in Penn State’s agronomy and soil science programs is modest (25 tenure-track faculty). Any further erosion of research or educational capacity would limit our ability to make timely contributions to the production and environmental issues addressed above. Space is also becoming a limiting resource. The Department has benefited from recent Ag Admin office

space allocation; but laboratory space remains limiting. Regarding public perceptions, stakeholders and policy-makers often want quick and simple answers, but in reality most agronomic issues are complex and optimal solutions depend on understanding the full suite of tradeoffs of a given course of action. The Department is committed to being a source of science-based information on agricultural and environmental issues, and we will seek to establish productive dialogue to better communicate with our diverse clientele.

Priorities

The Department of Crop and Soil Sciences consists of the three major program areas of Crop Science, Soil Science, and Turfgrass Science. Our common element is the terrestrial ecosystem with the theme of promoting productive and sustainable land use practices. Our scope includes both agricultural and non-agricultural landscapes from rural to urban areas. Here we list the programmatic priorities for the Department over the next five years. These priorities directly support the College's current strategic initiatives of water quality and quantity, energy, and pest prediction and response, as well as indirectly contributing to the remaining initiatives of entrepreneurship and food, diet and health. We are committed to integrative/cross-cutting approaches, thus we did not tag each priority to a specific college initiative.

- Increase expertise in integrated, multifunctional landscape/system analysis in order to better quantify and predict the impact of management actions on ecosystem function.
- Continue basic and applied research on food and feed grains, biomass energy crops, and turfgrass, thereby contributing to an affordable and safe food and energy supply while reducing energy inputs for production.
- Achieve balance between production and resource conservation, including assessment of sustainable systems and pest management options. This area includes the impact of soils on water quality through a “soft engineering” approach.
- Expand our understanding of what makes ecosystems prone to invasions by non-native invasive species and develop a conservation planning process that addresses this problem.
- Assess the scope of ecosystem services provided by agroecosystems, including carbon sequestration and potential impacts of climate change.
- Service stakeholders and inform policy makers by providing proactive outreach of our science to a broad range of clientele ranging from private citizens to government agencies.
- Synergize with College efforts in international engagement to effectively share our expertise around the world for the betterment of humankind.

- Enhance recruitment and retention activities to develop the next generation of professionals who will carry our priorities forward into the future.

Goals, Targets, Strategies and Actions

We strive to fulfill our mission and achieve our vision by implementing the following four goals that are continued from our Strategic Plan of 2005. While our goals remain largely the same, our strategies and actions have evolved to reflect current opportunities and challenges for the Department.

Goal 1. Provide the learning environment necessary to attract and educate individuals who will be well-informed in plant and soil systems and ready to contribute to sustainable land use practices (*This goal addresses College Goals A and C*).

Targets

- Increase enrollment in the Soil Science curriculum by establishing the Soil Science option within Environmental Resource Management.
- Ensure effective leadership and actively contribute to the success of Agroecology so the major can achieve sustainable enrollments.
- Maintain strong enrollment in Turfgrass Science and the 2-year Golf Course Turfgrass Management Program.
- Continue to increase the number and quality of our graduate students, capitalizing on the synergy between departmental and intercollege graduate programs.
- Improve the quality of the learning experience of students in all academic programs.
- Ensure that graduates are prepared for meaningful employment.

Strategies and Actions

- Allocate human resources to enhance recruitment and retention of students in undergraduate programs.
- Leverage department-funded graduate stipends and tuition grant-in-aid funds to promote maximum support of students.
- Evolve course offerings to enhance academic programs in plant and soil systems. Promising areas include: sustainable and organic agriculture, plant genetics and breeding, bioenergy production systems, field and laboratory techniques, urban soil issues, environmental policy and regulations, and a systems approach to design and analysis.
- Continue to support crucial shared resources to enhance learning and discovery. This will include supporting centralized learning laboratories for (i) soil and plant analysis and characterization and (ii) plant and microbial molecular biology.

- Solicit stakeholder input to maintain relevancy of academic programs.
- Maintain faculty expertise in areas central to our teaching mission. Priority hires include:
 - **Crop Production Specialist** to teach Field Crop Management and related courses.
 - **Urban Soil Scientist** to teach Urban Soils, which has a high demand across campus, and complement the emerging Metro Center in Pittsburgh.
 - **Turfgrass System Scientist** to serve as Director of the rapidly expanding eLearning turfgrass programs and provide timely outreach to the turfgrass industry that has been highly supportive of our programs.
 - **Integrative Land Use Modeler** who will develop new courses to support our thrusts in sustainable landscapes (see below) and add to our ability to provide geospatial literacy to all of our graduates.

Goal 2. Identify and focus on important and promising basic and applied research areas (*This goal addresses College Goal B and C*).

Targets

- Continue to increase competitive grant awards.
- Maintain regionally relevant research important to stakeholder interests.
- Foster interdisciplinary research programs within and across departments, including consolidation of PAES projects to enhance collaboration.
- Increase publication in peer-reviewed journals and better articulate the impact of our research findings to stakeholders.

Strategies and Actions

- Continue to identify intersections of nationally fundable research with regional needs to target areas of greatest impact.

The Department has demonstrated excellence in integrated crop production, applied turfgrass research, nutrient management, environmental soil science, and land use assessment. We will use our success in these areas to develop a **CENTER OF EXCELLENCE IN SUSTAINABLE LANDSCAPES** that will allow us to garner additional resources and impact. We envision two thrusts as follows:

Advancing Green Landscapes: Our common framework of promoting productive and sustainable land use practices is for the purpose of maintaining vital landscapes for community health and well being. Areas of national priority and regional impact that fit within the scope of this thrust are sustainable cropping systems (for food, fiber, and energy, conservation practices), pasture management systems, genetic enhancement of plants, urban environmental issues and the green landscape/turf industry, nutrient and waste management, plant health and soil quality, and responses to a changing climate.

Integrating Landscape Knowledge: Digital tools and technologies are rapidly developing that allow better quantification and interpretation of the landscape across scales. There is a critical need to integrate our understanding from molecular characterization of soil and plant processes to regional applications in the landscape. Emerging areas with great promise include the modeling of coupled soil hydrologic and biochemical processes, the expansion of geospatial and remote sensing technologies, spatially explicit characterization of plant communities, and monitoring and assessment of invasive plants in forested and agricultural landscapes.

To make significant progress toward excellence in sustainable landscapes we need to add research expertise in ***integrative land use modeling***. The individual filling such a position will go beyond landscape monitoring to discovering relationships among quantitative landscape data and ecosystem functions and management issues. We expect this individual will contribute to the integrative understanding of soil, water, and plant resource inventory and quality.

- Increase collaboration within the College and across the University, including campus-wide institutes and government agencies, to enhance multidisciplinary research opportunities. The goal is to foster multidisciplinary teams that target appropriate funding opportunities.
- Continue to develop critical shared resources (e.g., laboratory clusters) to enhance discovery.

Goal 3. Enhance lifelong learning opportunities through cooperative extension and outreach programs (*This goal addresses College Goal A & C*).

Targets

- Engage in the College initiative to reframe extension.
- Increase stakeholder satisfaction and program impacts.
- Promote cost recovery for all appropriate extension programs.
- Enhance electronic delivery of extension and outreach programs.

Strategies and Actions

- Faculty with an extension appointment will contribute to one or more of the Natural Working Groups that align with the college strategic initiatives and federal priority areas (see Appendix I).
- Build upon successful interdepartmental collaborations to improve extension and outreach activities. One example is to develop joint programming between the Crop Management Extension Group (CMEG) and the Dairy Extension Team.
- Continue to expand online and electronic resources and communications. A major ongoing initiative is transitioning the online turfgrass science programs to the College

and implementing Gross Revenue Sharing model 3 to increase resources to the program.

- Maintain a user friendly and informative web presence to ensure easy access to information generated by departmental personnel.

Goal 4. Foster a climate in which all faculty, staff, and students can achieve personal satisfaction and appropriate professional goals (*This goal addresses College Goal D*).

Targets

- Increase overall satisfaction with the departmental climate.
- Promote professional development opportunities.
- Seek appropriate promotions for departmental staff.
- Provide increased opportunities for students to be involved in departmental affairs.

Strategies and Actions

- Continue to charge the Faculty, Staff and Student Affairs Committee to evaluate, on an ongoing basis, and make recommendations for improvements to the working climate of the Department. An important goal of this committee will be to increase opportunities for positive interactions among faculty, staff, and students.
- Continue to allocate resources to stimulate productivity among faculty, staff, and students. One mechanism to promote this is to emphasize professional development opportunities during the annual review process.
- Increase efforts to ensure a diverse and inclusive work climate. This will involve partnering with the College to enhance recruitment and retention of a diverse workforce and student body.
- Continue to develop physical workspaces to promote interdisciplinary collaboration and personal satisfaction.
- Improve undergraduate student integration into the departmental culture through various targeted activities such as promotion of seminars and laboratory experiences.
- Enhance development efforts to support student scholarships and professional development.
- Maintain and promote alumni interaction with the Department. Activities will include continued support of alumni activities and promotion of the alumni mentoring program.

Enhancements to the Student Experience

The academic programs of the Department are closely aligned with our tripartite mission in crop, soil, and turfgrass science. Each of these programs has unique educational opportunities and challenges as presented below. One goal is that each program will develop specific student learning outcomes during this planning cycle. An example from the BS degree in Turfgrass Science is provided in Appendix II.

Crop Science (Agronomy)

The crop science faculty in the Department have developed strong course offerings that serve students from the range of agriculture-focused programs within the College of Agricultural Sciences, as well as the other colleges across the university. The fundamentals of crop production are emphasized in courses such as Principles of Crop Management (AGRO 28), Field Crop Management (AGRO 425), Forage Crop Management (AGRO 423), and Principles of Weed Management (AGRO 438). Students gain hands-on exposure to cutting edge plant science technology in Advances and Applications of Plant Biotechnology (AGRO 460). Issue-oriented courses, such as Sustainable Agriculture Science & Policy (AGECO 134), Principles & Practices of Organic Agriculture (AGECO 497A), and Emerging Issues in Agroecosystem Management (AGECO 461), offer students at all levels the opportunity to learn about the challenges of developing and implementing sustainable agriculture systems. Many of our 400-level courses also provide a foundation in agronomy for graduate students that come from non-agriculture backgrounds. We offer a strong suite of advanced level plant science courses, including Response of Plants to Environmental Stress (AGRO 518), Techniques of Plant Molecular Biology (PLBIO 516), and Plant Genomics (IBIOS 597G) that are complemented with courses with a systems-science [Ecology of Agricultural Systems (AGRO 510); World Agroecosystems (AGRO 597D)] and communication [Effective Scientific Communication (AGRO 555)] emphasis. These courses offer our more advanced students the opportunity to hone their disciplinary and interdisciplinary critical thinking skills.

The Interdepartmental Agroecology Program is the venue for undergraduate students interested in a systems approach to agronomy and horticulture, and also serves the Departments of Entomology and Plant Pathology. Although the enthusiasm among the currently enrolled Agroecology students is typically high, overall enrollment in this program has been weak in recent years. However, with the growing interest in food security and sustainable and organic agriculture, we believe there is considerable unrealized potential for growth in student enrollment in the Agroecology program. We further believe that the Agronomy faculty in the Department of Crop and Soil Sciences are central to realizing that potential. We recommend that the Agroecology Program Coordinator position reside in the Department of Crop and Soil Sciences with a formal assignment dedicated to the management, promotion and implementation of the major—including appropriate incentives to excel with this interdepartmental major (see recommendations from the Environmental Curriculum Study Group report; http://strategicplanning.cas.psu.edu/2005_2008/PDFs/Executive%20Summary.Environmental%20Curr.pdf).

With the impending retirement of Dr. Jan Pruss, a portion of this Coordinator position could be dedicated to the teaching of Field Crops Management.

In addition to taking a strong leadership initiative in Agroecology, we recognize that the courses we offer must balance theory and principles with practical knowledge and skills. As such, we will continue to integrate our extension faculty into classroom activities so they can share on-the-ground knowledge with our students. Likewise, we will continue to regularly involve our more research-based faculty in extension/outreach activities so they will be widely exposed to the day to day issues of production agriculture. Practical skill development for our students can also be achieved through promoting existing experiential learning opportunities such as student internships in the public and private sector, as well as developing new Penn State-based field and laboratory participatory activities. We envision development of successful grant opportunities allowing students to participate in laboratory and field based hands on training. We emphasize that a strong recruitment effort is essential to the success of the Agroecology program and we are pleased with Dr. Krista Jacobsen's leadership and efforts in this area, and support her continuation in this capacity. Finally, we will continue to evaluate the Agroecology curriculum to ensure that it offers the depth and flexibility needed to attract strong students with diverse backgrounds and interests.

Graduate education and training in Agronomy is strong and continues to grow. This has been enabled largely by the successful procurement of national and regional competitive research funds by our faculty, as well as strong College and Department support for our programs. Many of our students participate in interdisciplinary research teams, which will prepare them for the challenges associated with agriculture, the environment, and society. The professional, yet accessible, academic environment fostered the faculty will help inspire strong and compassionate leadership qualities in our graduates.

Soil Science

Undergraduate soil science education begins a new era in 2009. In the past, our main undergraduate program was a strong, but small, Environmental Soil Science (ESoils) major. While the job market and societal demand for well-trained soil scientists is high, we were unable to attract a large stream of students into the stand-alone major. Thus, in 2008 we moved to build an equally strong curriculum structured as the Soil Science option in the Environmental Resource Management (ERM) major. By placing soils in the context of a broad environmental science major and leveraging the recruiting capacity of a large major, we expect to maintain a rigorous soils curriculum, but train more soil scientists. Expanding soil science education is essential for training professionals that grow society's food, fuel and fiber; manage surface and subsurface water and nutrient movement; and facilitate sustainable development. The College's water and energy initiative goals cannot be realized without sustained strength in soils education.

While the ESoils major suffered from low enrollment, SOILS classes have not. Most classes are near capacity each semester, and soils faculty recently added three successful classes to satisfy demand in the areas of Environmental Sustainability, Urban Soils, and Chemistry in the Environment. SOILS 101 is our flagship course, drawing >300 students/year from the

agricultural sciences, landscape architecture, environmental sciences, and others. The quality of this service course is one of our highest priorities. The strength of SOILS 101 relies, in part, on the strength of the Soil Science graduate program, which provides experienced TAs for the hands-on laboratory. To meet this demand, 11 tenure-track soil scientists advise 10-11 M.S. and 18-20 Ph.D. students. Graduate students have access to 500-level courses in all domains of soil science, and many enroll in the new dual title Biogeochemistry program, engaging with environmental scientists campus-wide.

The primary goal for our undergraduate program is to design a soil science option within the ERM major that will eclipse the modest enrollment of the ESoils major. Recruiting efforts will reach DUS and branch campus students, but we also seek to develop a long-term interest in soil science by establishing a K-12 soils curriculum initiative working with the AEE department and directly with K-12 teachers to design and disseminate soil science curricula linked to PA state learning standards. To foster post-graduate placement, we will promote a certification program through the Pennsylvania Association of Professional Soil Scientists and strive for all graduates of the ERM soils option to achieve Soil Science Society of America-ARCPACS certification.

The main goal for our Soil Science graduate program is to maintain a critical mass of the highest quality students by leveraging assistantships funded on general funds with increased grant support. To enhance our ability to recruit graduate applicants with non-soils undergraduate degrees, we established a 500-level introduction to soil science (SOILS 502). Over the next 5 years, we will coordinate 500-level SOILS courses so that a student will have access to all of our graduate classes in any 2-year period. Core classes will be augmented by brown bag lunches and seminars that build camaraderie among students and faculty, but are not currently prevalent.

Maintaining excellence in our undergraduate and graduate programs will require strategic investments. The most financially efficient classes (large room lectures) are insufficient for soil science education. We must secure financial support from the Department, College, and alumni to fund the field and lab experiences required to fully train soil scientists. We lack the faculty to teach several important undergraduate classes, including urban soils and two online versions of SOILS 101 that enroll more than 50 students. Furthermore, the recent ERM program review listed the addition of an upper level GIS course as one of three top priorities. Hiring new faculty in the areas of **integrative land use** and **urban soils** would allow us to expand online teaching, provide GIS instruction that is a high-priority for the ERM major, forward the departmental *Green Landscapes* initiative, and advance the water quality and quantity goals of the College strategic plan.

Turfgrass Science

The Turfgrass Science Program strives to attract and educate students representing an array of cultural backgrounds and professional goals; but who as graduates will pioneer the sustainable integration of energy resources, landscape analysis, and soil, plant, and ecological sciences into improved turfgrass management practice.

Resident educational programs include the Golf Course Turfgrass Management Certificate and the Baccalaureate degree (B.S. Turfgrass Science). While both curricula were

originally designed with professional supervision of golf course operations in mind, the B.S. program is easily adjusted to meet a variety of professional interests and educational needs. Additional employment opportunities include sod production, equipment sales and service, athletic field maintenance and technical research support. With appropriate selection of basic science and quantification coursework, turfgrass science students prepare for graduate studies leading to careers in instruction, research, and/or extension. To date, graduates of the Certificate and B.S. degree programs total more than 1,500 and 500, respectively. Alumni serve our growing turfgrass industry as directors of multinational corporate research & development programs, private entrepreneurs, instructors, golf course superintendents, sports facility managers, sod/seed producers, club managers, and consultants. Our graduates pursue excellence and define professionalism everywhere turfgrass is managed. In 2007, forty-three of *Golf Digest's* Top 100 Golf Courses were managed by graduates of Penn State's turfgrass programs.

Turfgrass Science continues to set the standard in distance education. Since the Penn State World Campus first offered a Turfgrass Science course in 1998, our instructional quality continues to evolve with technology and is surpassed only by student interest worldwide. Eleven Turfgrass courses, once only available in residence, are now taught online each year. The enrollment of non-traditional students enriched by the expanding online turfgrass science program to date exceeds 4,500. In 2006, the World Campus Turfgrass Program was awarded the Sloan Consortium's Most Outstanding Online Teaching and Learning Program. In the future, resident students' experiences will be enhanced through recruitment of increasingly proficient and culturally diverse students. Further penetration of international markets will enhance enrollment and student satisfaction within our Certificate and online programs.

As with educational programming, Penn State sets the standard in turfgrass cultivar/variety development. Furthermore, a strong faculty core contributes significantly to fields of pest protection, constructed soils, plant nutrition and environmental quality. Graduate students, aptly trained in the Turfgrass Science discipline, earn M.S. or doctorate degrees in Agronomy or Soil Science and currently serve as university faculty or executives of private and public companies both stateside and abroad. Meanwhile Al Turgeon, the pioneer of Turfgrass distance education, is finalizing the Master of Professional Studies in Turfgrass Mgmt. program. This terminal master's degree, available via the World Campus, will employ an advanced systems approach to solving fundamental problems encountered by professional managers of complex turfgrass ecosystems.

As new political, socioeconomic, and environmental concerns arise; the program will continue evolving to quickly identify our stakeholders and service their needs. Current water quantity and quality requirements of turfgrass may hinder progress toward sustainable management, yet proactive efforts toward improved management practice comprise the most viable solutions. These efforts, coupled with validation and communication, will address and resolve future pest response and plant health concerns, while conserving invaluable water and soil resources.

Implementation of Cost Savings and Cost Avoidance

The Department seeks to achieve its mission and goals in an efficient and cost effective manner. Example strategies to achieve this are list below.

- Restructure some research areas as functional cluster laboratories to allow more cost-effective use of resources.
- Optimize use of technology by consolidating server support, unifying calendar/schedule applications, installing a wireless network, and providing online access to critical journals.
- Encourage cost recovery in outreach programming.
- Replace electric forage sample dryers with a corn furnace, saving about \$1,500 per year.
- Merge smaller regional/commodity meetings into larger and more comprehensive statewide meetings, resulting in greatly improved efficiency. For example, the 2008 Professional Crop Producers Conference drew an attendance of 284 participants at a registration fee of \$180 per participant. Cost savings were realized and increased revenue was generated.
- Develop timely web-based weekly newsletter to provide Agronomic crop management information to producers, extension agents and the agri-business community during the production season – see <http://fcn.agronomy.psu.edu/>.

Contributions to the Four Dimensions to Foster Diversity

Campus Climate/Intergroup Relations

The Department has a standing committee on Faculty, Staff, and Student Affairs that is responsible for (i) reviewing existing and new policies concerning the welfare of all Departmental personnel and (ii) organizing cultural, intellectual and social activities for the Department. The committee has broad representation, consisting of tenure-track faculty, non-tenure-track faculty, non-exempt staff, exempt staff, clerical employees, technical-service employees, graduate students, and undergraduate students. The Department Head has charged this committee to evaluate and make recommendations for improvements to the working climate of the Department. Furthermore, the Department seeks to sustain a positive climate by maintaining open lines of communication among personnel, emphasizing department-wide social activities, and providing departmental staff, student, and alumni awards.

Access/Success

Several faculty and staff members participate in activities aimed at recruiting a diverse student body. These include participation in the Food and Agricultural Institute (FASI), Math Options, McNair Scholars Conference, PA Governor's School for the Agricultural Sciences, and Women in Science and Engineering (WISE). Furthermore, the Department seeks to partner with the College in its diversity recruiting efforts.

The Department's annual reporting document has a specific heading entitled "Recruitment Activities." Faculty participation in recruiting activities is discussed annually and taken into consideration during annual salary adjustment deliberations. (Note: we recommend that a similar category be included in the new university-wide reporting system that is under development.)

Education/Scholarship

The Department has several resident courses and extension programs that promote international experiences. These include (i) Soils, Civilizations, and Societies, organized by Kate Butler that provides a study abroad tour to the Middle East, (ii) Soil Genesis and Management Through Time, organized by Patrick Drohan that provides a study abroad tour to Scotland, and (iii) extension tours of Austria and Germany on the topic of organic waste management and recycling organized by Rick Stehouwer.

In addition, several faculty have international collaborations that promote an appreciation of diverse cultures. These include (i) Surinder Chopra's collaborations with ICRISAT in India, (ii) Sjoerd Duiker's developing collaborations in West Africa, (iii) Carmen Martinez's efforts to establish collaboration between Penn State and the University of Puerto Rico, (iv) Al Turgeon's MOU's with the Agricultural University of Wroclaw (Poland) and the University of Palermo (Italy) regarding cooperation in turfgrass graduate study and research programs, and (v) Rick Day's and Dawn Luthe's hosting of African Borlaug scholars.

Institution viability/vitality

Faculty and staff are encouraged to seek professional development opportunities as appropriate. Furthermore, the Department fully supports the affirmative action process and seeks to advertise opportunities to a diverse audience and recruit individuals from underrepresented groups.

Appendix I

Summary of departmental faculty engagement with the College extension reframing effort.

Natural Working Group	Faculty Participation
Field Crop Management	Beegle Curran Duiker Hall Roth
Renewable and Alternative Energy	Hall Stehouwer Roth
Land Resources	Beegle Day Stehouwer
Water Resources	Day
Horticulture (non-edible)	Landschoot
Economic and Community Development	Day

Appendix II

Example Assessment

Turfgrass Science Undergraduate Program

The curriculum for the Bachelor of Science (B.S.) degree in turfgrass science emphasizes the broad array of principles and practices for effectively managing golf, sports, lawn, and utility turfs. These principles and practices are systematically covered in a series of turfgrass courses totaling 30 credits in a 120-credit curriculum. The remaining credits are from basic science, communications, quantification, health, arts, humanities, social science, business, and professional courses. While the curriculum is designed to prepare students for professional careers in the turfgrass industry, students wishing to pursue graduate study in preparation for careers in academic institutions or elsewhere can choose additional basic science and quantification courses as their professional courses.

GOALS AND OBJECTIVES

Knowledge

Goal 1 - Acquire knowledge and skills necessary to obtain or pursue a professional position or graduate/professional education in turfgrass science and management.

Objectives - by the time you complete your degree, you will:

1. Know the principles and practices of producing, establishing, and managing the primary turfgrass species and cultivars.
2. Be able to identify the primary turfgrass species based on their morphological characteristics and have a basic knowledge of their environmental adaptation and cultural requirements.
3. Be aware of the environmental issues associated with the principles and practices of sustainable turfgrass management.
4. Know how to identify and manage key pests of managed turfgrass communities.
5. Know principles of plant biology, particularly as they apply to the propagation and management of turfgrasses.
6. Have extensive knowledge and practical experience in turfgrass establishment and management, including mowing, fertilization, irrigation, and other cultural operations.
7. Have the opportunity to obtain professional certifications for various purposes, including pesticide application.

Goal 2 - Identify and use appropriate quantitative methods to analyze physical, biological, and social phenomena.

Objectives - by the time you complete your degree, you will:

1. Use basic mathematical operations to solve problems in turfgrass management.
2. Understand the application of mathematics in properly proportioning and applying seed, plant growth regulators, fertilizers, and other agricultural chemicals.
3. Use computer hardware and software for displaying and analyzing data.
4. Accurately comprehend and draw appropriate inferences from numeric data and quantitative models.

Goal 3 – Understand and use appropriate methods of inquiry.

Objectives - by the time you complete your degree, you will:

1. Use observation, exploration, experimentation, and simulation to build a personal body of knowledge about turfgrass management issues and solutions.
2. Devise methods of inquiry to distinguish cause and effect, and to solve relevant problems in turfgrass management.
3. Conduct an investigation or experiment and acquire results as the basis for making informed decisions.

Goal 4 – Use acquired knowledge, skills, and ingenuity to solve complex problems.

Objectives - by the time you complete your degree, you will:

1. Recognize the complexity of most problems arising in the practice of turfgrass management.
2. Identify the resources and approaches necessary to work toward a resolution of these problems.
3. Use your knowledge to make informed choices among various management options based on scientific and/or economic principles.
4. Evaluate the results of your choices, reassess, and alter your management strategies accordingly.

Communication

Goal 1 – Gather and interpret information from diverse sources.

Objectives - by the time you complete your degree, you will:

1. Locate, compile, and organize information from print and electronic media
2. Critically evaluate information gleaned from various sources.

Goal 2 – Communicate clearly and effectively using a variety of methods.

Objectives - by the time you complete your degree, you will:

1. Organize information for presentation.
2. Speak and write logically and effectively for diverse audiences.
3. Produce and deliver a presentation suitable for a large audience.
4. Acknowledge information sources in an appropriate format.

Goal 3 – Recognize the value of and participate in teams with members representing diverse learning styles.

Objectives - by the time you complete your degree, you will:

1. Understand the perspectives of diverse learning styles.
2. Interact effectively with peers and other professionals.

Personal Growth

Goal 1 – Understand and apply ethical principles to issues, problems, and professional practices.

Objectives - by the time you complete your degree, you will:

1. Develop and explain a personal environmental ethic.
2. Know the ethical standards of your professional organizations in which you have membership.

Goal 2 – Develop an awareness of global community and ecology in their physical, biological, and social dimensions,

Objectives - by the time you complete your degree, you will:

1. Become familiar with Earth systems and the impact of human activities on these systems.
2. Recognize the diverse global human cultures and their relationships with the environment.

Goal 3 – Develop a sense of responsibility to self, community, and society.

Objectives - by the time you complete your degree, you will:

1. Understand and respect differences among diverse populations.
2. Know how to find, earn, and keep a position in your professional field.
3. Demonstrate leadership in solving a societal problem.