Department of

Ecosystem Science and Management

Strategic Plan

College of Agricultural Sciences

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Executive Summary

The Department of Ecosystem Science and Management within Penn State's College of Agricultural Sciences is Pennsylvania's leader in preparing students for careers in sustainable management of natural resources. We conduct research to expand our knowledge about Pennsylvania's forests, wildlife and fisheries, soils, and watersheds, and we disseminate that knowledge through the classroom and through extension and outreach education programs serving professionals, landowners, policymakers, and other stakeholders. We aspire to be a world leader in ecosystem science.

For the 2014-2019 planning period, we identify as our strategic opportunities climate change, landscape ecology and management, ecosystem health and sustainability, energy and the environment, human dimensions of natural resources, and water sciences. These opportunities were intentionally described rather broadly to encompass the breadth and depth of talent available in our Department. We also possess the ability to collaborate well with colleagues across Penn State to deliver quality teaching, research, and extension/outreach programs.

Our major goals for this planning period are:

- To strengthen our position as a recognized leader in the College, University, state, and region in providing high-quality undergraduate and graduate education in the science and management of natural resources, including forests, wildlife, fisheries, soils, and water.
- To develop an integrated understanding of ecosystem processes through a holistic and multifaceted approach; to be recognized regionally, nationally and internationally as leaders in this field of research; and to use knowledge from our research to inform management decisions for the benefit of society.
- To promote the integration of extension and research to increase knowledge and adoption of ecosystem science and management values and practices by diverse audiences internal and external to the Department.
- To develop a departmental climate in which all faculty, staff, and students achieve personal satisfaction and professional goals.

Maintaining diverse faculty expertise is critical to achieving our goals. Impending retirements and previous attrition have created a dearth of faculty in several areas important to our mission: a teaching faculty shortage in Wildlife and Fisheries Science; teaching and research needs in remote sensing / geographic information systems / lidar / spatial science; teaching and research need in water sciences; teaching, research, and extension in soil fertility / nutrient management; and extension faculty needs throughout the Department's Renewable Natural Resources Extension program.

Mission, Vision, and Core Values

Mission

The mission of the Department of Ecosystem Science and Management is to expand and disseminate knowledge for the conservation and management of natural and human-dominated ecosystems. We focus on applications in fisheries, wildlife, soils, forestry, water, and agriculture. With global population projections of 10.9 billion by 2100 and increasing consumer demand for goods, the need for scientifically trained managers and efficient use of natural resources is greater than ever. Our Department was designed to help meet this challenge.

Vision

The Department of Ecosystem Science and Management aspires to be a world leader in ecosystem science.

Core Values

The Department of Ecosystem Science and Management affirms the following core values that guide the application of our education, research, and extension/outreach missions and vision. We pursue the highest standards of integrity, excellence, respect, trust, civility, listening, honesty and objectivity, transparency and openness, collegiality and collaboration, and ownership, inclusiveness, and mutual responsibility. These values promote a departmental climate that fosters the intellectual and professional development of faculty, staff, and students.

Current State of the Department

The Department of Ecosystem Science and Management was created on July 1, 2012, through the merger of the former School of Forest Resources and most of the soil science faculty from the former Department of Crop and Soil Science. A plant ecologist from the former Department of Horticulture also joined our Department. The Wood Products major moved to the Department of Agricultural and Biological Engineering, becoming part of the Bioproducts option of the Biorenewable Systems major.

There is a rich history of excellence at Penn State in the natural resources. The Department of Ecosystem Science and Management evolved from academic departments that conducted research, education, and extension/outreach in scientific disciplines related to the management of forests, wildlife, fisheries, wood, soils, and water. Coincidentally, both the Department of Forestry and the Department of Agronomy were established in 1907. Though the organizational structures and the names have changed several times in the ensuing century, our commitment to excellence in our three main missions of education, research, and extension has remained robust through the years, and the recent blending of the two departments has strengthened our ability to address a wide scope of environmental issues. We are building a transdisciplinary foundation in the science and management of ecosystems as we prepare students to apply sound science to real natural resource management challenges.

The Department of Ecosystem Science and Management has two undergraduate majors: Forest Ecosystem Management and Wildlife and Fisheries Science. Students pursuing a degree specializing in soil science enroll in the Soil Science option of the Environmental Resource Management major administered by the College. There are approximately 50 Forest Ecosystem Management undergraduates and 150 Wildlife and Fisheries Science undergraduates. About 10 students are in the Soil Science Option. The Department oversees three M.S. and Ph.D. degrees in Forest Resources (28 students), Wildlife and Fisheries Science (35 students), and Soil Science (24 students).

The Department of Ecosystem Science and Management has 31 tenure-track faculty, 11 non-tenure-track faculty (i.e., instructors, lecturers, and research faculty), and four federal employees who are resident adjunct faculty. Several faculty participate in Intercollege Graduate Degree Programs (Ecology, Neuroscience, Plant Biology, Genetics, Bioinformatics & Genomics, Human Dimensions of Natural Resources) and Dual Title PhD programs (Biogeochemistry). There are 24 administrative and technical staff members in the Department. The majority of faculty, graduate students, and staff in the Department are located primarily in the 95,000-square-foot Forest Resources Building, which opened in 2006. Ecosystem Science and Management members are

also in the Agricultural Science & Industry Building and the Forest Resources Laboratory which houses labs, workshop, sawmill, and greenhouses. Two professional foresters manage more than 8,000 acres of forestland, accounting for more than half of the College's total acreage.

Several natural resource management agencies and organizations are resident partners of The Department of Ecosystem Science and Management. These partnerships provide our students opportunities to collaborate with professional resource managers and scientists. Our stakeholders and the public also benefit from these partnerships that contribute knowledge and expertise for the research-based conservation and enhancement of natural resources. These resident partners include The Nature Conservancy, The American Chestnut Foundation, the National Park Service (one adjunct faculty), and the Pennsylvania Cooperative Fish and Wildlife Research Unit of the USGS (three adjunct faculty). The Agricultural Research Service located in its own campus building adds four adjunct faculty members.

The Department has a 26-member Advisory Board with membership from agencies (city, state, and federal), organizations, industry (including gas), private landowners, and consultants. In addition, we interact through teaching, research, and extension efforts with a wide variety of groups, including the Association of Consulting Foresters, the Allegheny Forest Alliance, the Allegheny National Forest, the DCNR Bureau of Forestry, the Hardwoods Development Council, the Joint Legislative Air & Water Pollution Control & Conservation Committee's Forestry Task Force Advisory Committee, the Keystone Wood Products Association, the PA Council of Professional Foresters, the PA Fish and Boat Commission, the PA Forestry Association, the PA Forest Products Association, the PA Game Commission, the Penn-York Lumbermen's Club, the USFS Lab in Irvine, and the Western PA Conservancy. The preceding list includes just those groups located in Pennsylvania. We also have an active Alumni Group that allows us to maintain contact with nearly 5,000 alumni.

Strategic Opportunities

Faculty in the Department of Ecosystem Science and Management, since the merger in 2012, have been building a shared understanding of strategic opportunities that we are uniquely positioned to address. In this process, we considered our missions in education, research, and extension as we identified the following opportunities.

Climate Change

Frequently defined as the most important environmental challenge facing our nation and the world, global climate change offers us a strategic opportunity. Research opportunities addressing global climate change are relatively abundant; thus, our expertise in terrestrial and aquatic ecosystems comprising the earth's critical zone enables us to pursue those opportunities well into the current planning horizon. Several faculty conduct research on biogeochemical cycles and processes affecting greenhouse gases. The need to foster a societal emphasis on global climate change supplies opportunities to enhance our teaching and extension programs.

Landscape Ecology and Management

Our expertise in forest ecology and management, soil science, wildlife and fisheries science, and hydrology and water management in a range of ecosystems enables us to address diverse issues in a variety of landscapes. In addition, the Department of Plant Science has also identified landscape ecology as a critical area for addressing pressing, cross-cutting issues. Our close working relationship with that unit broadens and deepens this thrust. The fact that working lands in our region span a continuum of core forests to predominantly agriculture positions us to address questions relevant to this matrix of land use. Our faculty, staff and students conduct research, develop educational opportunities, and deliver extension and outreach programs on topics of ecosystem function and management practices. The College's recognition of the need to address water resource issues and Department's focus on terrestrial and aquatic ecosystem management provide a strategic opportunity to enhance our focus on water science.

Ecosystem Health and Sustainability

Challenges facing ecosystems range from human competition for resources to introduced invasive plants, animals, and diseases. Resource use almost always leads to unintended consequences. The state continues to address legacy questions related to

past resource use, contemporary ecosystem health and sustainability challenges include forest regeneration, wildlife management, invasive insects, diseases, and plants, biomass development, and many more opportunities. Our Department is well-positioned to lead efforts to address these challenges. It is the science underpinning these management practices that offer us strategic opportunities for research, teaching, and extension/outreach.

Energy and the Environment

Energy development is currently a very important environmental issue in Pennsylvania and beyond, and will likely remain important well into the future. Specifically, development of the shale gas resource poses multiple opportunities for the Department of Ecosystem Science and Management to conduct pertinent research on the impacts of energy production such as forest fragmentation and its effects on wildlife, the introduction of invasive plants and insects, possible chemical spillage, and effects of water extraction on ecosystem functions and values. Woody biomass and energy crops as sources of biofuels are emerging components of renewable energy portfolios. The development of wind energy poses its own set of challenges. Energy development also provides ample opportunities for our Department in education and extension/outreach.

Human Dimensions of Natural Resources

Ecosystem management in human-dominated landscapes requires the integration of social science approaches and understanding. Pennsylvania's primary land cover is forests, with about 60% of the state covered in forests totaling about 17 million acres. Nearly three-quarters of this forest is held by an estimated 750,000 private woodland owners. Together this public/private forest provides extraordinary social, ecological, and economic benefits to all citizens. Notably, most of our citizens live in cities and towns in rapidly urbanizing landscapes. Responsible management of all components of our ecosystem is important to everyone's quality of life. The Department of Ecosystem Science and Management working with citizens, private forest landowners, resource management agencies, local government and others has multiple opportunities to conduct research, teaching, and extension programs that will contribute to our stakeholders making natural resource decisions that lead to healthy, sustainable ecosystems.

Water Sciences

Water is fundamental to human life and the ecosystems on which we depend. The impacts of population growth, development, and environmental changes put increasing stresses on water resources throughout the world. Pennsylvania, which has benefited from abundant and reliable supplies of freshwater for centuries, is one of 39 U.S. states in the nation that expect some level of water shortage within the next decade. The quantity of water available is impacted greatly by factors such as climatic variability, mining of finite freshwater resources, and water pollution. Increasing and competing demands for water require science-based knowledge and decision-making about water management and allocation for human consumption and agricultural use, for industrial and energy production, for maintaining reservoir levels and providing recreational use, and for ensuring sufficient in-stream flows to support aquatic biodiversity. The Department of Ecosystem Science and Management is well poised to address a myriad of water issues from an interdisciplinary point of view in research, teaching, and extension/outreach. There are established active research programs which are related to both water quality and quantity, ranging from surface and groundwater recharge to Chesapeake Bay water quality; from atmospheric depositions affecting surface water quality to water reuse alternatives impacting groundwater quality and quantity.

Strategic Challenges and Priorities

Our Department faces challenges in pursuing the aforementioned opportunities. Our principal challenge involves faculty attrition in the past decade. This diminution in faculty numbers has strained our ability not only to offer courses, but also to pursue emerging research opportunities. A multiplicative effect of declining numbers has ensued, as fewer faculty numbers result in fewer graduate students, many of whom work as teaching assistants. Our Wildlife and Fisheries Science program has been particularly hard hit. The early retirement buy-out claimed three tenure-track professors, the departure of a fourth to another university, and the loss of a senior lecturer through voluntary separation have cost us five instructors in the WFS program in less than two years. We have since replaced them with two tenure-track assistant professors. This reduction will pose a continuing challenge for our delivery of a high-quality curriculum to our 150 Wildlife and Fisheries Science majors. We believe the establishment of a fixed-term senior lecturer position in Wildlife and Fisheries Science is the minimum required to sustain our well-respected undergraduate and graduate programs.

Another teaching and research area in which needs are not being met is in remote sensing / geographic information systems / spatial science. A 2009 retirement left us with no faculty member in our Department with that range of expertise. A course titled Remote Sensing and Spatial Data Handling is now taught through funding a grant-supported faculty member from another college, but that approach is short-term. This subject area is required for our Forest Ecosystem Management major and is being considered for addition to the Wildlife and Fisheries Science curriculum. In addition, research opportunities abound in remote sensing / geographic information systems / spatial science, as this particular discipline lends itself to collaborative research with a wide range of ecosystem sciences. We believe hiring a tenure-track assistant or associate professor with an appropriate background will be of strategic advantage not only to all programs within the Department of Ecosystem Science and Management, but to our College as well.

A teaching and research discipline with a great deal of potential for our Department and the College is hydrology, or some affiliated area of water science such as hydrochemistry, ecohydrology, limnology, watershed restoration, or integrated water resources management. Our department lost four and gained only one replacement faculty member in water sciences in recent years, and there remains a pressing need to hire in this area. This position has been long-approved by the College, and is awaiting the availability of funds. A possible emphasis includes physical hydrology involving water fluxes across water storage interfaces, including the timing and magnitude of

these fluxes. Another emphasis area might be investigation of land use change impacts on water quality and quantity, surface hydrology, and water demand. A third area involves limnology and aquatic ecology, an area of particular need to the intercollege undergraduate degree program in Environmental Resources Management. Our commonwealth and the neighboring region face environmental challenges resulting from a variety of stressors that ultimately impact water resources. Potential is immense at Penn State to develop a research program investigating the nature of these challenges, and a teaching program that will train the next generation of decision-makers and resource managers to address these challenges in a sustainable manner into perpetuity. Potential is also substantial for a water scientist to interact with the aforementioned remote sensing specialist to form a team with tremendous capacity for building a world-class research and teaching program. The potential is great to interact with collaborators and emerging water initiatives across campus. Both natural landscapes and urban-water systems interface with human systems providing intellectually interesting research-based learning opportunities, as well as presenting the opportunity to understand hydrologic changes resulting from ever-evolving human responses to on-going regulatory controls. A final priority in the water sciences should be to reinvigorate the Center for Watershed Stewardship. The Center has the potential to serve as a focus for building collaborative relationships across the College, and expand collaborative relationships among the College, other colleges, and external stakeholders.

Chesapeake Bay Nutrient Management practice implementation has been, and continues to be, highly informed by work done in the Soil Science program -- particularly work conducted by the Soil Fertility / Nutrient Management extension faculty member. This faculty member has been highly visible in state, regional, and federal decision-making processes, providing respected leadership to agency personnel and land managers. It is critically important for the College (and important to a number of individuals from programs across the College who engage with this Nutrient Management faculty member around water quality protection research, extension and education) to begin positioning the next generation of faculty for successful work in this area. It is envisioned that this topic area rises to such a level of importance to the nation, region, state, and College that some innovation in preparing young faculty to work in this highly charged and critically important area be considered. One of the keys to the effectiveness of the present faculty member in this area was the opportunity to begin work alongside other more senior faculty before the entire burden was placed upon the faculty member. It will be important for the College to identify a mechanism to provide opportunity for one or more highly qualified post-doctoral scholars, for example to actively participate with the Nutrient Management specialist to develop

critical agency contacts, and build relationships with others working in Nutrient Management across the region. Perhaps offering one or more post-doctoral fellowships in the near term will assist in providing at least some small group of young scientists the needed experience and the opportunity to develop skills sufficient to work in this important topic area.

The Department's Renewable Natural Resources Extension faculty have recently experienced significant reductions in number. Three faculty have been lost entirely to extension due to retirement or appointment changes, and two more have agreed to appointment changes that reduced their extension involvement. We anticipate further capacity loss from impending retirements. Furthermore, two of the Department's extension faculty are fully or partially supported by outside grants. There is a critical need to consider how to best serve the state's stakeholders through extension by supporting program development and delivery in natural resources and ecosystem management.

The Department's Soil Chemist has taken a one-year leave of absence in 2013/2014 that is expected to become a permanent departure. Soil chemistry is one of the key SOIL disciplines supporting research and undergraduate/graduate education at this and all other major land-grant universities. Peer institutions that we benchmark against maintain a faculty line in soil chemistry. The soil chemist position links disciplines related to or dependent upon Soil Science in the ESM department, the College of Earth and Mineral Sciences and the College of Engineering. A gap in soil chemistry research will limit our ability to contribute research and outreach to water quality issues in the Chesapeake Bay; soil and groundwater chemistry issues related to unconventional gas development; green engineering and sustainability achievements; Critical Zone Science; and remediation of legacy pollutants like acid mine drainage. The gap in soil chemistry teaching will challenge our ability to provide general education classes that support the Department via revenue generation (we envision the new faculty member teaching SOILS 071 Environmental Sustainability), all options in the ERM major (ERM 440 Chemistry of the Environment: Air, Water, Soil), and graduate education in Soil Science, Biogeochemistry (SOILS 513, Environmental Soil Chemistry), and the Ecology IGDP.

Finally, we propose that a co-hire in the ethics of environmental sciences/natural resources and the social sciences shared with the Department of Agricultural Economics, Sociology, and Education, and co-funded by the Rock Ethics Institute and the College of Agricultural Sciences would fill a critical gap in the College's teaching and research missions. This new professor would address environmental resource challenges that increasingly require applied science research that includes a capacity to address social, ethical, and moral issues. The faculty member would also participate in

preparing undergraduate and graduate students who will be increasingly required to make decisions at the interface of resource use and management in the context of social systems. Research done by this position would use transdisciplinary system thinking that concomitantly crosses and integrates many disciplines and fields. The Human Dimensions of Natural Resources and the Environment (HDNRE) Dual Title Intercollege Graduate Degree Program provides an opportunity for the hire to engage emerging teaching opportunities with PSU graduate students. The departments contributing to the HDNRE program have strong undergraduate majors/curricula suggesting a large and varied student audience for an undergraduate ethics course related to natural resources and the environment.

Goal A – Strengthen our position as a recognized leader in the College, University, state, and region in providing high-quality undergraduate and graduate education in the science and management of natural resources, including forests, wildlife, fisheries, soils, and water.

The faculty of the newly created Department of Ecosystem Science and Management (ESM) has a long tradition of excellence in offering a diverse set of programs in the science and management of natural resources. With the recent assimilation of expertise and teaching competency in fisheries, forests, soils, water, and wildlife within a single department, we are now poised to further strengthen our position as recognized leaders in ecosystem science. Drawing on these newly combined human resources, we will be able to offer new undergraduate and graduate programs that will attract, retain, and satisfy the future leaders of ecosystem science and sustainable resource management.

Objectives	Strategies	Actions / Measures of Success
Offer compelling educational programs that provide the integrated knowledge required for effective ecosystem management in the 21st century.	• Explore the feasibility of developing an Ecosystem Science and Management degree program that attracts a currently under-represented clientele. • Update existing curricula to meet current and projected natural resource management challenges. • Offer graduate programs that take advantage of our core expertise and complement existing programs.	• Approval of revised curricula by CAS and Penn State. • Curricular integration across current majors to improve knowledge integration. • Increase undergraduate participation in research. • Proposal for the creation of an online (World Campus) professional Master's degree. • Leadership of reinvigoration of intercollege graduate program in Environmental Pollution Control. • Participation in intercollege graduate degree programs and the Biogeochemistry Dual-Title PhD degree program

Recruit and attract the future leaders of ecosystem science and sustainable ecosystem management.	• Use a diversity of approaches to recruit undergraduate students to our programs. • Direct recruiting efforts to target students who (1) are already on campus and who may not know about our program offerings (DUS), (2) are under-represented in our programs, and (3) live in areas that are under-served by Penn State but have a sufficiently large population of potential students interested in the environment.	• Utilize current student ambassadors for our degree programs. • Develop an integrated recruiting program that utilizes traditional (e.g. school visits, DUS advisor education, etc.) and social media presence (e.g. Facebook, Twitter) to reach potential students both on and off campus. • Number of women, minority, non-traditional students in our programs. • Diversity of students from different socio-economic classes in our programs. • Number of college or university scholarship offers to recruit high-performance students into our undergraduate and graduate programs. • Number of undergraduate and graduate students who accept college/university scholarships and come to our programs
Increase undergraduate and graduate student satisfaction.	• Provide funding for graduate students and reward excellent student performances through awards and scholarships. • Provide a learning environment that fosters student learning, including curricular flexibility, timely grading of exams, counseling and constructive communication with students, and an open-door policy. • Support student-related	• Number of faculty taking advantage of teaching resources (e.g., Schreyer Institute workshops) and participating in a formal departmental mentoring program. • Improvement in voluntarily reported SRTE scores for faculty in the mentoring program. • Department-funded graduate stipends and tuition grant-in-aid funds leveraged to maximize student support. • Number of students nominated for

	organizations (e.g., honor societies). • Provide mentoring and training opportunities to faculty to further their teaching excellence.	university/college awards. • Number of awards/cash prizes awarded to currently enrolled undergraduate and graduate students. • Self-reported measures of "satisfaction with the major" compared to that of "overall satisfaction" with the Penn State education.
Prepare students for life and a professional career.	• Maintain programs that meet accreditation standards for their respective professional organizations. • Continue to foster strong, positive relations with alumni, stakeholders, and employers of our graduates. • Promote internship/summer work experience opportunities to students. • Graduate students with demonstrated scientific skills. • Graduate students with marketable skill sets that satisfy employer needs.	• Maintenance of professional accreditation/certification qualifications (e.g., SAF). • Number of recruitment events offered for students in our programs. • Number of students attending and presenting papers at scientific meetings. • Number of students engaged in outreach activities. • Number of undergraduate students with internships and summer jobs related to their respective profession. • Number of published peer-reviewed manuscripts per graduate student (target ≥1). • Rate of student job placement. • Results of employer surveys.
Continually improve our performance vis-à-vis educational goals.	• Apply learning outcomes assessments as a tool to improve our educational programs. • Monitor trends in key variables to	• Implement learning outcomes assessments. • Identify a list of key indicator variables for continuous monitoring.

	identify areas in need of improvement.	• Percentage of students who receive a grade of B or better in outcomes assessments. • Identify trends in student performance on key indicator variables. • Propose curricular changes to address unsatisfactory trends in key indicator variables.

Goal B - Develop an integrated understanding of ecosystem processes through a holistic and multifaceted approach; to be recognized regionally, nationally and internationally as leaders in this field of research; and to use knowledge from our research to inform management decisions for the benefit of society.

Our diverse faculty conducts research to understand the interplay between multiple components, acting at various spatial and temporal scales that result in the processes that ultimately structure ecosystems and how they respond to environmental change. Broadly, our 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 and land development. Our research examines how environmental change and stressors affect ecosystem processes, and the responses and adaptations of individuals, populations and communities to these stressors. Our research 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.

Objectives	Strategies	Actions / Measures of Success
Develop an integrated understanding of ecosystem processes through a holistic and multifaceted approach	• Increase the interdisciplinary nature of our research • Encourage participation in Intercollege Graduate Degree and dual-title PhD Programs • Increase collaborative work both within and outside PSU	• Develop a Center of Excellence in Landscape Dynamics with strategic faculty hires as required to fill research and teaching gaps • Increased number of faculty participating in inter-college and dual-title programs and greater faculty visibility and leadership positions in these programs • Number of collaborative research projects • Number of applied research proposals
Conduct a balance of basic and applied research to generate new knowledge and its application in the field	• Increase the research capacity of faculty through new hires, co-hires, and/or reassignments	• Increased Research FTEs • Number of basic research projects • Number of applied research projects

Conduct research with local to global significance and impact	• Encourage participation in local, national and international meetings to increase awareness of issues • Participate in multi-institutional and/or international research projects and training initiatives • Host visiting scholars	• Science citation index • Evidence of application of research results in the field • Number of external collaborations and visiting scholars • Number of invited presentations
Produce high quality scientists and managers positioned to be leaders in the field.	• Encourage and recruit high-quality applicants • Integrate interdisciplinary graduate education in our research • Encourage thesis writing in format that will facilitate publication in peer –reviewed journals	• Student awards • Placement of students • Percentage of students publishing work in a peer reviewed journal within five years of graduation
Maintain a diverse funding portfolio to support research and graduate education	• Encourage faculty to seek diverse funding sources	• Funding sources • Amount of funds
Increase the visibility of our research at multiple scales from local to global	• Increase the visibility of our research through our website, news releases, participation in professional and public meetings	• Number of invited lectures regionally, nationally, and internationally • Number of peer reviewed publications • Research related awards and honors for faculty and students • Number of news releases and popular articles on our work • Website usage

Goal C - Promote the integration of extension and research to increase knowledge and adoption of ecosystem science and management values and practices by diverse audiences internal and external to the Department.

The Department of Ecosystem Science and Management through its Extension and Outreach programming efforts is uniquely positioned to deliver applied research-based education on natural resource issues to a broad suite of stakeholders in Pennsylvania and beyond. Our Renewable Resources Extension Team provides programming in water, wildlife, urban and community forestry, wood products, 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, wood industries, recreationists – nearly anyone who benefits from the social, ecological and economic values derived from renewable natural resources – from youth to adults. Because the clientele base is large and diverse, delivery methods are equally diverse from one on one, to traditional workshops and field events, to peer education networks, to web-based learning. The Department's extension program seeks to engage partners to increase capacity, share resources, and meet the challenges of helping people manage and conserve resources through the use of sustainable research-based practices. Our partners include public agencies, non-governmental organizations, communities, volunteers, schools, and resource professionals. Often the challenge is to first create issue awareness related to ecosystem sciences and management and to work toward adoption of resource stewardship. Therefore, many extension programs focus on basic concepts with the intent of expanding stakeholder interest through the integration of information and knowledge. Outreach varies from extension in that it seeks opportunities to provide professional development to clientele managing ecosystem resources. There is increasing demand for programming in this sector.

The strategies and indicators described in the following goal prescribe better integration of extension and research to achieve increased capacity to create and deliver research-based education materials and programs. The strategies seek to elevate interest in ecosystem science and management by reaching existing and new audiences with products that guide well-informed decision making. The challenge is to find new approaches and vehicles to expand capacity and demonstrate through reporting Departmental achievements and impacts of extension and outreach as part of the Land Grant mission.

Objectives	Strategies	Actions / Measures of Success
Promote the integration of extension and research to increase knowledge and adoption of ecosystem science and management values and practices by diverse audiences internal and external to the department.	• Include extension/outreach in research project proposals • Expand programs to new clientele • Encourage undergraduate and graduate student participation in extension/outreach • Engage field educators in research projects • Identify and integrate emerging issues into existing programs • Include the importance of ecosystem management values and practices into all programs • Provide resources to encourage well-informed decision making • Demonstrate increased knowledge and adoption by program audiences • Use multi-media tools and technology to increase capacity to deliver programs • Expand partnerships to deliver programs	• Number of funded grants including an extension/outreach component • Number of new participants (i.e., audiences or clientele groups) engaged in extension programs • Number of refereed and non-refereed publications authored by extension professionals • Number of research-based extension/outreach presentations • Number of extension professionals participating in research projects • Number of undergraduate and graduate students participating in extension/outreach programs • Number of new programs and resources developed addressing emerging issues • Number of participants intending to or adopting sustainable practices • Number of individuals, households, municipalities or land area impacted by programs • Number of extension professionals, volunteers, and external partners developing and delivering programs • Number and types of delivery methods • Number of external partners supporting programs

Goal D - Develop a departmental climate in which all faculty, staff, and students achieve personal satisfaction and professional goals.

The Departmental culture of promoting a positive atmosphere is important to a vibrant learning environment for our students, staff and faculty. Improving our departmental climate and maintaining a high level of satisfaction in the performance of our various duties will encourage high productivity and increase our ability to compete for the highest quality faculty, staff, and students.

Objective	Strategy	Actions/Measures of Success
Develop a departmental climate in which all faculty, staff, and students achieve personal satisfaction and professional goals.	• Promote positive communications and professional development activities for faculty, staff, and students. • Seek appropriate promotions for staff. • Provide increased opportunities for student involvement in departmental affairs. • Promote collaborative, supportive relationships among personnel. • Foster proactive approaches to management of all issues. • Actively pursue award nominations for faculty, staff, and students. • Maintain our active alumni group. • Expand our advisory board to encompass all disciplines in our new department	• Achievement of a high level of satisfaction by our undergraduate and graduate students. • Incorporation of undergraduate and graduates in departmental governance and social activities. • Robust development activity involving alumni and stakeholders. • Increased number of social events. • Emphasis on professional development activity during annual evaluations. • Increased effort to ensure a diverse and inclusive work climate for faculty, staff, and students.

Diversity Planning

The Department of Ecosystem Science and Management is committed to fostering a welcoming climate for diverse groups of faculty, staff, and students. We rely heavily on the College's Office of Multicultural Affairs for guidance and cooperation in helping us build diversity in our Department. An example of cooperation between our Department and the College was the attendance of Dr. Mary Ann Bruns (ESM) with Dr. Patreese Ingram, Assistant Dean for Multicultural Affairs, at the *National Diversity Conference -- The Future of Diversity in Our Disciplines and Careers* held at Virginia Tech's College of Natural Resources in June 2013. Another example will occur in April 2014 when at least two ESM faculty will attend the Black History Achievement Awards celebration banquet in Pittsburgh that will commemorate the life of Ralph Brock, a Penn State graduate and America's first black forester. This will again be a cooperative effort with the College's Office of Multicultural Affairs. A final example of our Department's commitment to enhancing diversity is the recent formation of an informal group named "Women in Forestry". This is comprised of current undergraduate and graduate students, faculty, and alums and stakeholders whose shared goal is to promote recruitment of women into our Forest Ecosystem Management major.

In summary, the Department of Ecosystem Science and Management will continue to work with the College's Office of Multicultural Affairs to ensure we offer a welcoming departmental climate for all groups. Likewise, we will continue our commitment to working with the College's Office of Human Resource Services to ensure proper hiring and promotion practices that enhance diversity.

Undergraduate Learning Outcomes Assessment

The Department of Ecosystem Science and Management is actively engaged in learning outcomes assessment for our two undergraduate degree programs in Forest Ecosystem Management and Wildlife and Fisheries Science. The most recent example of our commitment to outcomes assessment is the launch of a new course in Spring 2014 titled "Senior Forest Practicum". This team-taught course is designed to assess competency of students in the Forest Management Option of the Bachelor of Science in Forest Ecosystem Management. Students are required to design, collect, analyze, and interpret pertinent data, and then present solutions to problems. The course reinforces and tests students' ability to integrate knowledge, skills, and abilities retained from earlier coursework. Competencies tested include material from required courses in dendrology and silvics, forest measurements, GPS, GIS and remote sensing, forest and fire ecology, statistical analysis of forest-related data, silviculture, and forest economics. Instructors introduce the project and evaluate the students orally, or through a report or in-class presentation. We intend to teach this course annually and refine it as it evolves.

Our work thus far on learning outcomes assessment has been awarded exemplary status in a recent review by the Director of Instructional Consulting, Assessment and Research of the Penn State Schreyer Institute for Teaching Excellence. Our assessment plans for both our majors will be posted on the Institute's website as examples of well-written plans. We plan to continue to develop these assessment vehicles in the future as we believe that curriculum development and assessment are ongoing processes. Furthermore, since our Forest Ecosystem Management major is accredited by the Society of American Foresters (SAF), it is particularly important to indicate a strong assessment process since that organization places heavy emphasis on assessment when decided whether to renew accreditation status.

Practices that Promote Integrity and Ethical Behavior

As discussed earlier in our Core Values, promoting integrity and ethical behavior is a central theme in the departmental culture of Ecosystem Science and Management. We value these principles in our teaching, research, and outreach efforts, and strive to impart them in our students through our actions as well as our words. We include on all syllabi the University Faculty Senate statement on academic integrity, and ensure that all of our graduate students have ample opportunity to satisfy the University's requirement for SARI (Scholarship and Research Integrity) training. At least two of our faculty members offer SARI training for our graduate students. Faculty teaching within the Forest Ecosystem Management degree program will be encouraged to continue to include reference to the Code of Ethics of the Society of American Foresters in their syllabi, assignments, and daily interaction with our students both in and out of the classroom. We endeavor to create a similar code of ethics for our Wildlife and Fisheries Science major, and encourage the leaders of the Environmental Resource Management major to adopt one as well.

For reference, the Principles and Pledges of the SAF Code of Ethics follow:

- Foresters have a responsibility to manage land for both current and future generations. We pledge to practice and advocate management that will maintain the long-term capacity of the land to provide the variety of materials, uses, and values desired by landowners and society.
- Society must respect forest landowners' rights and correspondingly, landowners have a land stewardship responsibility to society. We pledge to practice and advocate forest management in accordance with landowner objectives and professional standards, and to advise landowners of the consequences of deviating from such standards.
- Sound science is the foundation of the forestry profession. We pledge to strive for continuous improvement of our methods and our personal knowledge and skills; to perform only those services for which we are qualified; and in the biological, physical, and social sciences to use the most appropriate data, methods, and technology.
- Public policy related to forests must be based on both scientific principles and societal values. We pledge to use our knowledge and skills to help formulate sound forest policies and laws; to challenge and correct untrue statements about forestry; and to foster dialogue among foresters, other professionals, landowners, and the public regarding forest policies.

- Honest and open communication, coupled with respect for information given in confidence, is essential to good service. We pledge to always present, to the best of our ability, accurate and complete information; to indicate on whose behalf any public statements are made; to fully disclose and resolve any existing or potential conflicts of interest; and to keep proprietary information confidential unless the appropriate person authorizes its disclosure.
- Professional and civic behavior must be based on honesty, fairness, good will, and respect for the law. We pledge to conduct ourselves in a civil and dignified manner; to respect the needs, contributions, and viewpoints of others; and to give due credit to others for their methods, ideas, or assistance.

Contributing towards PSU Goals for Sustainability

Sustainability is a fundamental value at Penn State. In fact, the University has written "The Penn State Sustainability Strategic Plan" and has formed The Sustainability Institute. The Institute describes its mission as "The mission of the Sustainability Institute is to facilitate the integration of sustainability into all functions of the University." The University's Sustainability Strategic Plan describes its mission as "This comprehensive integration of sustainability into the University's research, teaching, outreach, and operations will prepare students, faculty, and staff to be sustainability leaders." It is difficult to read the University's Sustainability Strategic Plan without envisioning multiple opportunities for the Department of Ecosystem Science and Management to lead on campus and beyond. The integration of our mission and vision with those of the Sustainability Strategic Plan is natural and complementary. Although the University defines sustainability broadly ("Sustainability is the simultaneous pursuit of human health and happiness, environmental quality, and economic well-being for current and future generations."), our Department's teaching, research, and extension/outreach programs fit quite well into this broad definition.

All facets of our Department's missions address sustainability, but just as an obvious example illustrating how well our Department will address the University's sustainability goals, two of our Soil Science faculty have an ongoing project with the University's Office of Physical Plant assessing soil quality and hydrologic capacity in the University's effluent spray fields.

The College's approach for their strategic plan is to "address sustainability as an integrated priority … rather than a stand-alone priority." The College has appointed a Sustainability Subcommittee that will "Define accomplishments and priorities in terms of scholarship". This subcommittee is chaired by Dr. Judd Michael, a faculty member of our Department. In addition to continuing our efforts to address sustainability in our teaching, research, extension/outreach, we will ensure that Dr. Michael keeps us abreast of sustainability developments at the College level, including presentations at faculty and staff meetings.