
Purdue University

Department of Agronomy



Final Review Report



Cooperative State Research, Education, and Extension Service
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I. Background

The Agronomy Department Review

In 2008, the Associate Dean of the College of Agriculture and Director of Agricultural Research Programs at Purdue University requested a review of The Agronomy Department programs and activities by the USDA Cooperative State Research, Education, and Extension Service (CSREES). The last review was conducted in 2002. Much of the background information pertaining to the review process is contained in the 2009 Self-Study Document produced from input by the entire faculty and many of the staff, based on more than a year of thoughtful discussions. Readers are directed to the Self-Study for more details. A Departmental visioning retreat was held in 2007 to begin preparations for the CSREES review with the goals of establishing a collective focus for the CSREES review; identifying and prioritizing departmental initiatives, goals and objectives; identifying future directions for the Department; and organizing the steps towards completing the review.

Why review Purdue Agronomy? The timing was right with new faculty and new administration at the College and University levels. A CSREES review would ensure program relevancy and provide a reality check for the Department.

The general expectations of this review include:

1. The Department will have a comprehensive programmatic review of its discovery, learning, and engagement programs,
2. The Review Team will assess the quality of programs and activities offered by the Department,
 - a. Examine the roles and functions of the programs administered by the Department,
 - b. Assess the impact of the Department to Purdue University and to the public within the State of Indiana,
 - c. Identify the strengths, challenges, and opportunities for the Department, and
 - d. Recommend appropriate future strategies for attaining these opportunities, enhancing the content and administration of departmental programs.

More specifically, the Department identified the following considerations, objectives and expectations for the review:

1. Focus on the programs for both education (undergraduate, graduate, and extension) and disciplines (Earth System Science and Crop Science),
2. Provide insight as to where the Department is now, where do they want to be, and how they might move forward,
3. Provide feedback on the grand challenges as an evolution in their thinking,
4. Provide insights into their vision and direction (are they on the right track?),
5. Help evaluate where the Department might need to grow (via priority setting),

6. Give feedback about their solutions to the issues, and
7. Suggest ways to enhance the Department's visibility.

The Review Team

The Review Team was composed of six members:



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The Review Team schedule appears in the 2009 Self-Study Report and the final copy is attached as an appendix. Over the course of five days (February 2-6, 2009), the Team conducted intensive interviews with faculty, staff, students, stakeholders and administrators associated with the Agronomy Department. The morning of the fifth day (February 6, 2009) was dedicated to meeting with university administrators Drs. Randy Woodson, Provost; Christine Ladisch, Vice President for Academic Affairs; Vic Lechtenberg, Vice President for Engagement; and Richard Buckies, Vice President for Research, to communicate the Review Team's initial findings. Team members then discussed the draft review report with College of Agriculture administrators Drs. Jay Akridge, Dean of the College of Agriculture; Sonny Ramaswamy, Associate Dean and Director of Agricultural Research Programs; Chuck Hibberd, Director of the Cooperative Extension Service; and Dale Whittaker, Associate Dean and Director of Academic Programs, in a separate meeting. Closing out the morning of the fifth day, the team presented the draft review report to the Department head, faculty and staff of Purdue Agronomy.

The 2009 Self-Study Document

A CSREES Review Steering Committee made up of Agronomy administrators, faculty and staff developed the Self-Study Document and a shared vision for the Department's programmatic areas in undergraduate, graduate, and extension education in both the crop sciences and earth system science. A separate CSREES Grand Challenges Committee further developed the Departmental vision around six grand challenges, articulated by concept papers for each, included in the Self Study. The Self Study reflects the efforts and thoughts of the complete Departmental community. The Review Team made extensive use of the Self-Study document and appreciated the considerable work of faculty and staff toward its development.

The Review Report

This Review Team document is divided into nine sections. The first section provides the administrative background and context for the review. The second section is an Executive Summary of several key recommendations. The next seven sections focus on the strengths, challenges/opportunities, and recommendations at the more functional levels of the Department: Administration, Faculty and Staff; Undergraduate Education; Graduate Education; Extension Education and Engagement; Research and International Programs; grand challenges; and lastly, Facilities and Development.

Comments relating to this document or the Review Team itself should be directed to: Dr. James P. Dobrowolski, USDA-CSREES (jdobrowolski@csrees.usda.gov).

II. Executive Summary

The Executive Summary offers highlights of the review. It does not replace the more specific and detailed accounting of strengths, challenges/opportunities, and recommendations the Review Team provided under each of the seven sections that follow. Departments of Agronomy or Crop Sciences across the nation are experiencing similar challenges to those outlined in this report. The central issues or challenges include: faculty constantly in search of resources to support their programs, difficulty attracting a culturally diverse undergraduate student population (urban, ethnic, gender), declining graduate student enrollments, difficulty offering graduate-level courses that facilitate timely graduation of MS and PhD students, unequal faculty participation in both undergraduate and graduate advising, and the increasing demand for extension expertise with stable or declining FTE representation. Purdue Agronomy strives to be regarded as the top institution at the forefront of efforts to solve society's complex, potentially global issues requiring diverse perspectives, by focusing around six grand challenges over the next decade (see chapter VIII):

- Bio-feedstock Production and Development
- Chemical and Biological Constituents in the Environment and their Impact on Human and Ecosystem Health
- Climate Change—Impacts on Agriculture and Natural Resources
- Harnessing Plant Breeding and Genetics to Identify and Develop Economically Important Crop Traits
- International Agriculture Research and Engagement
- Landscape-scale Management for Sustainable Plant Production and Ecosystems.

The proposed grand challenges provide their own set of difficulties that might include identifying and delivering appropriate program niches for undergraduate and graduate degrees, and the complementary delivery of extension programming that will uniquely attract students and still serve the public outreach needs. In addition, higher education institutions across the nation struggle with the balance of implementing new programs to address these new niches within their current capacity of faculty, space, equipment, and funding. Purdue Agronomy is in a good position, with greater capacity from the 14 new faculty hires (10 as assistant professors, 1 as an associate professor and 3 as full professors) since the last review in 2002. The Agronomy Strategic Plan (2004-2009) set the stage for the next departmental leap forward towards a new vision:

The Agronomy Department at Purdue University, a comprehensive department in the crop and earth system sciences, will be recognized as a global leader in research and education committed to enhancing the quality of life for all people. Our faculty and staff will work together to develop and deliver innovative and universally accessible educational programs that disseminate science-based information resulting from outstanding and high impact multidisciplinary research focused on serving society's needs.

The ability to capitalize on and create additional capacity to address challenges and opportunities resides with existing faculty and staff. Therefore, greater attention must be given to communication between and among administrators, faculty, staff, students, and collaborators as a necessary foundation for Purdue Agronomy to take on society's grand challenges.

The Review Team found a high degree of esprit-de-corps and a proud sense of dedication among the administration, faculty, staff, and students within the Department and an enthusiastic recognition of Agronomy's quality by College of Agriculture and University administrators. The faculty, supported by the staff, is nationally and internationally prominent, producing graduates and post-doctoral fellows that span the globe as prominent professors, researchers, outreach specialists, administrators, producers and for-profit and not for-profit business women and men.

With this strong foundation and the desire to continue to move forward, the Review Team suggests that Purdue Agronomy continue to develop the grand challenges concept that has so engaged and excited the departmental community. The Department needs to work to create sustainable departmental funding to allow faculty greater flexibility to be innovative and creative. The Department should continue to pursue a cultural balance across the departmental community, creating a staff development plan, particularly for research and teaching professionals that maintains continuity and productivity levels and complements the grand challenges initiative. Purdue Agronomy effectively utilizes their faculty members with greater than 60% teaching commitments—they have developed a nation-wide imprint on teaching of crop, environmental and natural resource sciences. The Review Team suggests that the Department keep attracting these professionals focused on undergraduate teaching, by continuing to provide realistic requirements for tenure and promotion. Undergraduate advisors in the Department of Agronomy should more equally share the undergraduate advising load.

Purdue Agronomy's graduate students are very satisfied, but requested greater emphasis on coordination across the Department, more chances to present their own work and understand their graduate colleague's research, education and extension efforts. The Department should strive to offer the appropriate graduate level courses that provide for a complete program and timely completion of graduate programs. By considering non-traditional approaches for courses with low enrollment, for example, regional partnerships for certain course offerings and opportunities to create course offering efficiencies across the university the Department could meet graduate program demands.

Meeting greater demands for extension expertise and improving the efficiency of extension program delivery requires the increased use of current and emerging technologies focused on web-based efforts and distance education tools. Purdue Agronomy could prioritize extension resources to address both emerging areas defined by the grand challenges initiative and on-going needs. By establishing more effective partnerships with their research colleagues, extension faculty would expand funding

opportunities. Extension educators need to address the need of other agencies (e.g., USDA-ARS) for extension deliverables by expanding extension education opportunities for graduate students.

One of the highest priorities in Agronomy's Earth Systems Science is a new extension specialist who could address a wide range of contemporary environmental issues important to many of the grand challenges. Cropping Systems faculty should identify the issues with help from their stakeholders, focus on tangible objectives and goals to meet the departmental mission and vision, and form broad-based teams to develop a systems approach toward addressing the issues. Turfgrass Management faculty should have a more visible presence and provide leadership in the Department's grand challenges initiative. Breeding and Genomics faculty could more aggressively patent and license germplasm and varieties to create a revenue stream to support innovative applied breeding research. With soybeans so important to Indiana agriculture (\$898 million, 4th in the nation), the Review Team suggests that Purdue Agronomy seek a tenure-track faculty position in soybean breeding. As biofuel production continues to become more important nationally, the Department should seek to improve both research and teaching capacity in biofeedstock breeding for forage grasses.

Faculty in the Department of Agronomy appreciates and values international research, education and extension activities. Purdue Agronomy boasts considerable strength through internationally experienced faculty, with commitments to internationalize the curriculum and their students. Faculty should cater to their strengths and build on existing collaborations before expanding into new areas. They need to continue to recruit students for international experiences, infuse international aspects into coursework and promote international aspects in research projects.

Purdue Agronomy's grand challenges represent a new and forward-looking culture that has energized and captivated the departmental community. The Review Team feels that the overall concept of grand challenges is exactly what Purdue Agronomy should be doing; the concept provides a focal point where faculty, staff and students could bring their strengths to bear as part of a team. The Review Team recommends that the Department reduces the number of grand challenges, explains how resident and extension education and international activities fit into each challenge, and provides metrics for establishing success.

Purdue Agronomy, through increased private giving, effectively converted and built facilities to establish state-of-the-art laboratories, storage space and space for teaching, extension and field research since the last review. Faculty act as effective entrepreneurs towards acquiring needed equipment, and generously train and provide access to graduate students and staff both inside and outside of their programs. The Review Team encourages Purdue Agronomy to develop a strategic plan for the acquisition, management, and maintenance of this key analytical equipment, high performance computing and field instrumentation. This plan would guide the prioritization of major equipment purchases and relieve faculty from significant maintenance and management responsibilities. The Department should continue to

work with their Office of Development to expand private giving for additional equipment purchases, space renovation, additional graduate student support, and internal funding capabilities to stimulate collaborative activities focused on the grand challenge initiatives.

III. Faculty, Administration and Diversity, Staff

The University

Purdue University, founded in 1869 as Indiana's land grant university for agriculture and mechanical arts, established the need for agronomic subjects in agriculture as early as 1905. Over the last 140 years, it has evolved into a fully accredited, comprehensive, coeducational, state-assisted system in Indiana. The University is one of the nation's leading research institutions with a reputation for excellent and affordable education. Building upon historical strengths in engineering and agriculture, the West Lafayette campus currently offers 5,800 courses in more than 400 undergraduate majors and specializations in the schools/colleges of Agriculture, Consumer and Family Sciences, Education, Engineering, Health Sciences, Liberal Arts, Management, Nursing, Pharmacy and Pharmacal Sciences, Science, Technology, and Veterinary Medicine. The Purdue System includes four satellite campuses (Fort Wayne, Indianapolis, Calumet, and North Central) that add eight colleges, 27 schools, and three divisions to the capacity and offerings to a diverse population of undergraduate and advanced degree students across Indiana, the U.S. and around the world.

The College

The College of Agriculture is one of 11 colleges/schools that make up Purdue University's West Lafayette main campus. The College is a world leader offering food, agricultural, and natural resources programs provided by 320 faculty members, in 43 undergraduate majors plus graduate education in 10 subject matter areas, seven multidisciplinary programs in one of 11 academic departments. The current Dean of Agriculture began his tenure officially in 2009 and the current University Provost is the former Agriculture Dean. The College of Agriculture was established in 1874 and supports and promotes the mission of Purdue University, with an emphasis on the tripartite land-grant mission of academics, research, and extension. Emphasis is given to faculty preparation, scholarly presentation, and student preparation for graduate and professional school as well as related careers. Contributions to Indiana's agriculture and natural resources, the home, family life, consumers and business, and the state are major endeavors. The stated mission of Purdue's College of Agriculture is (2003-2008 Strategic Plan):

Purdue Agriculture serves the food, agriculture, and natural resource systems by providing exceptional education, discovering new knowledge, and helping citizens improve their lives and livelihoods.

This mission of the College of Agriculture is currently supported by a strategic plan with the following goals:

1. To develop the basic knowledge and applied science and technology to make Indiana's agriculture, food, and natural resource industry competitive worldwide, and to provide maximum benefit to Indiana's economy. To provide responsive outreach efforts to identify and solve problems.

2. To develop strong fundamental research programs to advance the scientific foundations of the agriculture, food and health, and related natural resource systems.
3. To provide information, consultation, and technical expertise needed by production agriculture, the food industry, agriculture-related new businesses, and entrepreneurs in the state. To foster economic development by commercializing the products of discovery and learning programs. To assist communities in developing the capacity to effectively address local issues to improve the community's social and economic well-being.
4. To expand interdisciplinary research efforts in environmental sciences. To assist in the development of science-based regulations.
5. To provide world-class undergraduate and graduate student education and training, and postdoctoral fellowship experiences that include strong research experiences and enhanced disciplinary and multidisciplinary skills, as well as skills in communication, teaching, grantsmanship, professionalism, and teamwork. To ensure that Agriculture graduates have the ability to capture prominent positions in industry, universities, and government agencies, and to become outstanding leaders in an increasingly diverse society.
6. To improve the College's capacity to excel in its discovery, learning, and engagement missions by increasing funding and improving or adding space.
7. To increase diversity among students, faculty, and staff. To build awareness of diversity issues among students, faculty, and staff.
8. To achieve and promote high-quality interdisciplinary, multidisciplinary, and collaborative research and educational programs.
9. To assist Indiana citizens and others in their understanding of controversial public issues. To offer science-based information in a non-advocacy manner to individuals and groups engaged in public education efforts involving food, agriculture, and natural resource systems.
10. To deliver high-quality distance learning and lifelong learning programs and materials.
11. To help parents, students, Indiana teachers, counselors, and the general public understand the importance of agriculture and agricultural careers to Indiana and the world, and to make them aware of the science and business opportunities in the food, agriculture, and natural resource arenas.

One of the highest priorities in 2009 is to develop a new, five-year strategic plan for Purdue Agriculture. Strategic planning is a critical process encompassing all levels of the university, linked to and influencing the activities of Purdue Agronomy.

The Department of Agronomy

Purdue Agronomy, officially established in 1907, is one of 11 departments within the College of Agriculture at Purdue. Agronomy is one of the largest departments in the College, with 52 faculty including 9 USDA-ARS scientists that are fully integrated, 70 staff, and more than 250 undergraduate and graduate students. The Department is administered by Dr. Craig Beyroudy, department head, who reports to the dean and associate deans/directors of the College's Agricultural Research Program, Office of Academic Programs, Cooperative Extension Service, and International Programs in Agriculture. Integral to the Department is strategic planning that produced mission and vision statements and grand challenge initiatives among faculty at annual retreats and staff and students at town hall meetings.

The mission statement of Purdue Agronomy provides a backdrop for the review:

The Agronomy Department at Purdue University provides progressive and relevant undergraduate, graduate and extension

educational programs; conducts high impact fundamental and applied research at multiple scales to ensure that our science addresses immediate problems and anticipates future challenges; actively engages partners in the public and private sectors; and contributes to the development of the national and international agenda for research and education.

Purdue Agronomy described and published their departmental values that direct and guide strategic planning: understanding and solving the needs of their diverse clientele, universal access to their programs, excellence and creativity in their teaching, research and outreach, multidisciplinary approaches to their mission, having a positive presence among their constituency, the success of faculty, staff and students, and collegiality among the departmental community.

Since the last review, the Department diversified its faculty both culturally and subject matter area, by adding 14 new faculty for a total of 38.55 FTE tenure and tenure-track faculty, an increase of 5.05 FTEs, split roughly fifty-fifty across research and education. The Department consists of 8 assistant professors, 5 associate professors, and 30 full professors—with 3 recognized as distinguished professors, 1 holding an endowed chair, and 3 holding named professorships. About half of the faculty reflects disciplines in Earth Systems Science and half in Crop Science. Diverse faculty backgrounds from traditional agronomic related sciences through hydrology and atmospheric sciences provide linkages among other departments on campus through joint and partial administrative appointments.

Faculty

Strengths:

- Many faculty members in the Department of Agronomy are nationally and internationally prominent and have educated undergraduate students, graduate students and post-doctoral fellows that populate major universities, research centers, for-profit and not-for-profit enterprises across the U.S. and around the world.
- The Agronomy faculty has developed a nation-wide imprint on teaching and learning in the crop sciences, environmental sciences, and natural resources for 35 years. They have engaged their clientele, are responsive to industry needs and focus efforts on mutually identified areas of opportunity.
- The Department has a culture of strategic planning and an open, participatory administrative process.
- The Department has worked to establish a collective focus, prioritize initiatives, develop goals and objectives, identify future priorities and directions, and formulate some actions plans for implementation.
- The Department has a core of senior faculty (30 full professors) with a rich history of knowledge and experience to mentor new faculty and to launch the “grand challenges.” The new mentoring committees, developed by the

Department under the leadership of Craig Beyrouthy appear to be strongly positioned for retention and transitioning of new faculty hires.

- The Department has a proud sense of dedication to service to the College of Agriculture, the University, the state of Indiana, the nation, and the world.
- There is a demonstrated commitment to multidisciplinary activities in the Department. They reach out across campus through their six faculty with joint appointments in other departments and five faculty with partial administrative appointments in other units. The Agronomy faculty routinely collaborates through research, education and extension with other faculty across campus.
- The faculty is collegial, positive and enthusiastic about their work, all three missions of the Land-Grant System and vision of the Department. There is no discernable distinction among adjunct faculty, faculty with split appointments and faculty with 100% appointments in Agronomy.
- Faculty members have demonstrated entrepreneurial leadership in program development increasing departmental non-appropriated funds by 24% since the last review, the highest in the College of Agriculture.
- Many faculty members are committed to leadership roles and shared governance in the Department.
- Sabbatical and Enhancing Expertise opportunities are offered by the university and exploited by the Agronomy faculty.

Challenges:

- Faculty feel they are always searching for funds and that academic year and fiscal year appointments make working together with colleagues a challenge.
- The faculty is challenged by their current approach to research, education and extension and they are seeking new approaches to work together on relevant and emerging issues.
- Advisory Council members felt that the number of both extension faculty and students trained in the applied sciences is shrinking. Local entrepreneurs felt they would hire graduates that could effectively translate science into practice.
- There is a perception that faculty have no voice in the decisions for funding scientific research. They feel that they would not be allowed to write a white paper without negative repercussions.

Recommendations:

- Continue to develop the Grand Challenge concept that has excited and engaged the faculty.
- While the need for additional faculty is important to the Department, there is a major concern about the need for additional, ongoing support for the research and extension programs of current faculty. The Review Team encourages the faculty to discuss with college administration all options, including not filling open faculty positions and incorporating all or part of the funds into support for existing programs or grand challenges, when identified.

- Consider a more sustainable funding model within the Department that would allow faculty more time to develop new ideas rather than chasing funding.
- Work with traditional stakeholders and encourage them to support research programs that will help the citizens of Indiana directly.

Administration

Strengths:

- Faculty and staff are supportive of the department head. They feel he is an effective administrator who is responsive to questions and requests for direction.
- Undergraduate and graduate students, Administrative/Professional (A/P), clerical and service staff, and stakeholders feel that the department head is accessible, and an able listener who asks the right questions. The department head has an excellent understanding of what everyone does in the Department combined with a tremendous breadth of knowledge.

Recommendations:

- There is an opportunity to provide fairness and long-term continuity in the Department by developing by-laws or a departmental code for administrative and on-going policies.
- Facilitate proper communication by providing written copies of annual performance evaluations to each individual faculty and staff member.

Diversity

Strengths:

- Diversity is a departmental initiative and a priority based on departmental strategic planning.
- Gender balance has improved with new faculty hires, increasing the number of women faculty from six to nine.
- Underrepresented minority groups within the faculty have increased from three to seven since the last review.
- The Department has a welcoming culture and strong relationships to minority institutions (HBCUs)
- Purdue Agronomy has coordinated departmental visits, developed a strategy for interacting with regional high schools with large minority populations, and adopted an urban high school to reach out to K-12 underrepresented audiences and potential students.
- The Department has graduate assistantships for minority students.
- Agronomy has reallocated resources, supported faculty and staff to attend minority and gender workshops, and participated in the Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS) program.

- Fifty percent of the graduate students come from diverse, international backgrounds.

Challenges:

- The Department's undergraduate student, staff and faculty population do not match the cultural make-up of the population in the State of Indiana.

Recommendations:

- Continue to pursue a cultural diversity balance in the Department of Agronomy by engaging two-year institutions with diverse cultures, producing web and other recruiting materials that are inviting to underrepresented groups, and striving to provide additional role models for multicultural students.
- Strive to maintain and improve diversity in the Department's advisory groups.

Administrative/Professional (A/P), Clerical and Service Staff

Strengths:

- The Department maintains both A/P and clerical staff in a business office that helps faculty with communications, proposal and budget preparation.
- The A/P and clerical/service staff advancement program offers a training scholarship that is equally matched by the Department of Agronomy.
- The A/P and clerical/service staff feels valued; mutual respect exists with the faculty. These relationships are underpinned by trust and pride in their work.
- The Department "feels more like a family than a working group."
- Longevity of employment and loyalty exists for A/P and clerical/service staff in the Department.
- Clerical/service staff feels that the town hall meetings with the department head are worthwhile though they would like to meet together with the A/P staff.
- Training opportunities are wide open; staff can choose to take university courses toward a degree, and formal/informal professional training.
- Staff has the flexibility to plan and implement their own "lunch and learn" and other retreats.
- Purdue has a promotion policy for A/P, clerical/service staff.

Challenges:

- As money becomes tighter, the Department needs a backup plan for A/P, clerical/service staff that is funded with soft-money—beyond available but limited bridging funds.
- A/P staff is evaluated each year---but there are inconsistencies in the commitment to the process and how the evaluations are delivered.

- A/P staff recognition for efforts on research and subsequent publications is inconsistent across projects.
- Staff may be recognized for what they do within their small group settings—but communication among all A/P staff about individual accomplishments is inconsistent.
- Service staff felt the need for a safety training policy that targets faculty, post-doctoral fellows and graduate students who operate both project-specific and experimental farm machinery.
- Clerical, service and A/P staff felt the town hall meeting days were problematic and conflicted with crop research and production milestones (e.g., harvest, plowing and seeding, etc.).
- Staff is confused about the lack of formal evaluation for contract employees such as post-doctoral fellows.
- Staff felt the need to be kept in the communication loop to accommodate special activities that arise in their departmental subgroups.
- As technical staff positions for individual grant projects are lost, farm crews must cover additional field efforts.
- As faculty become more successful and busier, departmental clerical staff are asked to provide greater support.
- Clerical staff requested advanced warning for large numbers of competitive proposals delivered simultaneously for budget construction and assistance.

Recommendations:

- Professional and technical staff that supports research in laboratories and at field locations expressed a high degree of job satisfaction. Most have years of experience and are an extremely valuable resource for the Department. Given the seniority of many A/P, the Review Team encourages the Department to develop a staff replacement plan, particularly for research and teaching professionals, which will complement their grand challenge initiatives.
- Find town hall meeting times that fit better with the field season schedule.
- Provide a consistent policy for staff evaluations and strongly recommend supervisory adherence.
- Improve communications among faculty, graduate students, post-docs and service staff within their departmental subgroups through regularly scheduled meetings.
- Develop a consistent and fair workload plan for clerical and service personnel.
- Encourage faculty to effectively communicate with clerical staff to ensure appropriate support for proposal preparation.

IV. Undergraduate Education

Purdue Agronomy's undergraduate education program consists of 168 students enrolled in eight Bachelor of Science degree options and one Associates of Science degree. Options include Agronomic Business and Marketing, Soil and Crop Science, Turf Science, Plant Genetics and Plant Breeding, Applied Meteorology, International Agronomy, and the Agronomy Associates Degree. They have seen significant growth in matriculation to the Plant Breeding and Genetics and Applied Meteorology options. Although enrollments decreased since the last review by 5%, numbers are up 16% from a low of three years ago. Enrollments remain strong when compared with other similar departments across the U.S. Currently undergraduate student population diversity remains a challenge, with 79% male undergraduates with only 8% minority and international students. The Department emphasizes experiential education, providing 47% of the 64 100-500 level courses in the Department as laboratory or field experiences. The faculty is committed to maintaining the sense of a shared mission to the scholarship and value of departmental teaching by providing a strong, forward-looking and innovative program attracting a high-quality student group. The faculty is developing educational programs that reach beyond Purdue's campus to address pre-university, distance education and provide other Internet-based learning resources.

Since the last review, Purdue Agronomy expanded their K-12 outreach program, provided more study-abroad opportunities, established a curriculum committee, incorporated curricular review from stakeholders such as the Advisory Council, revised their Natural Resources and Environmental Sciences program, invested in state-of-the-art instructional technologies, established soils and crops teaching resource centers, and inaugurated their distance education programming. Beyond student technical expertise, the Department emphasizes leadership and teamwork skills, communication and interpersonal skills, the application of social science to agriculture, ethical practices, international and cultural understanding, a desire for life-long learning, and business and management skills.

Strengths:

- The faculty has a passion for undergraduate teaching. Many faculty look to improve existing course offerings or develop experimental courses.
- Undergraduates were pleased with the access to professors and teaching assistants at the departmental teaching resource centers.
- Access to peer-tutoring, professors outside of their office hours (by appointment), and the Department's recitation sessions were seen as strengths.
- Good job opportunities for undergraduates exist in the Department. Students worked as clerical or laboratory support. Students receive weekly e-mails announcing job and internship opportunities.
- Students felt satisfied that they received appropriate training in resume preparation, interview skills, and professional dress from departmental faculty and staff.

- The Agronomy Department has very good space and financial resources allocated to undergraduate education. This is an outstanding legacy for the Department.
- Learning centers (e.g., the Beck Agricultural Center) are internationally renowned.
- The faculty and teaching assistants are highly dedicated to student learning and achievement.
- Collegiality among the teaching faculty is excellent.
- The use of greater than 60% teaching positions allows a very strong focus on undergraduate teaching. The fact that individuals in these positions can be rewarded for “educational” scholarship is very important for maintaining a preeminent undergraduate program.
- Outstanding use of technology (learning and resource centers, clickers, on-line tutoring, tablet PC with soil mapping) is demonstrated at all course levels.
- All subject-matter areas have hands-on laboratory courses.
- The students are articulate, responsive, and engaged in departmental clubs, judging teams, and other activities. The Department provides excellent support for participation in extra-curricular professional activities.
- The Agronomy Ambassadors program is an excellent effort.
- Current students and undergraduate alumni (based on a formal survey) have the highest regard for the departmental programs, staff, and faculty.
- Departmental leadership in the Natural Resource Environmental Science Program is an important linkage to non-agricultural students.
- Opportunities to work on faculty research projects are available and important in developing “real-world” experiences for students.
- The Department implements and evaluates critical thinking skills that are important in preparing students for life outside of college.

Challenges:

- The student diversity (urban, ethnic, gender) should be greater. Recruitment of a diverse student population will necessitate innovative approaches and faculty stepping out of their “comfort zone”.
- Providing more than one course in distance education. Although distance education programs exist at other institutions, the citizens of Indiana would benefit from “local” courses.
- Replacement of retiring club advisers will be a daunting task.
- Promotion and tenure decisions for teaching are presently based primarily on student evaluations and teaching portfolios.
- Updating course syllabi should occur on a more regular basis.
- Maintaining support for personnel and equipment for the learning centers will require continued diligence, especially in times of an economic downturn.
- Students indicated the need to be integrated into the fabric of the Department as soon as they arrive on campus and throughout their first year. They want to become a part of the “Agronomy Family” as soon as they arrive on campus, so as to have quicker access to a support and counseling network.

- With new faculty hired on a 9-month contract and as 12-month faculty retire, who will cover the summer orientation program for the Department?
- Uneven distribution of students among faculty advisors needs to be addressed.
- Students from rural areas feel overwhelmed their freshman semester, particularly in large classes.
- Some new students are not as prepared for math and chemistry as other students—they don't know where to find help their first year.
- High school is not providing sufficient computer skills.
- The capstone course experience for the Department is not well defined.
- The crops teaching resource lab is under-resourced.

Recommendations:

- The Department should continue the hiring of faculty in greater than 60% teaching positions and should continue granting promotion and tenure to those faculty who primarily have a teaching appointment. The Department should maintain its preeminent position in undergraduate education by continuing the hiring and support of outstanding teachers who are focused on undergraduate education.
- The Department should continue the solid financial support for the personnel (faculty, staff, and graduate teaching assistants) and equipment for the learning centers.
- The development of an interdisciplinary sustainable food systems minor program with Horticulture and other departments could attract non-traditional cohort students. This curriculum should focus on the “science” of sustainable food systems.
- If possible, use departmental scholarship money to partially fund two or more students from an inner-city high school (e.g., the high school “adopted” by the Department). This will help foster student diversity in the Department. Once a critical mass of diverse students is reached, finding diverse students will be easier.
- The Department should recruit diverse students who participate in high school science fairs. Faculty could accomplish this while serving as judges of regional and state science fairs.
- A comprehensive review of each course syllabus should be conducted every five years. Courses with consistently low enrollments should either be re-designed to be more relevant/attractive to undergraduates or should be dropped. Experimental course-development should be encouraged.
- The Department should hold more informal social functions early in the fall semester and several times throughout the academic year. Departmental clubs could organize these events for all students, faculty, and staff in the Department. This will more quickly connect the students to their “home” department.
- The Department should ensure all incoming freshmen know where to seek counseling and assistance from the first day. Right now they take a year or so before they are comfortable seeking help from Department members.

- The 17 undergraduate advisors should advise an approximately equal number of students. Just advising one or two undergraduates does not allow the faculty member to learn the necessary advising protocols.
- The Department should institute a formal peer-evaluation system for each course. The teaching coordinator should assign a faculty member to a course for review. The evaluator should attend many class sessions so that they can effectively appraise the course and the instructor. Each course should be evaluated every fourth or fifth time it is offered. This process should be a part of the evaluation of every faculty member who teaches.
- A seed science curriculum could be established that would help seed companies recruit former students.
- Increase the introductory 101 course from 8 weeks for 1 hour to 16 weeks for 2 hours, and use the additional time to help with computer skills (spreadsheets, word processing), introduction to software they will learn about later (ArcMap, GIS, GPS), and introduction to the various areas of research covered by the Department.
- Many students remain unaware of existing departmental resources, such as the Agronomy Center for Research and Education (ACRE). More activities to familiarize students with departmental resources would be helpful.
- The career fair is terrific, but it needs to be held a second time in the year so students who did not get jobs the first time get a second chance at the jobs still empty.
- The Department should better define the capstone course experience for undergraduate students.
- Provide more resources to the crops resource lab. This primarily included equipment, hardware, software, and teaching assistantships.
- Continue to implement critical thinking skills into the curricula.
- Market Purdue-developed teaching modules to other states. Many of the software programs would appeal to introductory soils and crops instructors.
- Add the communication tools Facebook, Yahoo, Twitter, etc., that could better link opportunities from and to the departmental web site. These tools are how students interact socially and would more effectively invest students into the departmental website.
- Advisory Council members and other outside stakeholders felt that graduates should have a business background with knowledge of strategic planning, budgeting, and personnel management. Graduates need new technologies to manage large complex farms—universities can play a role to help businesses understand how to apply these technologies, manage large data sets, and make the appropriate decisions.
- Keep close communication with former students—frequently ask them and their employer if their degree program met employment expectations.
- The Earth System Science faculty is considering a new undergraduate option/major in “Soil and the Hydrologic Sciences” that would replace the “Environmental Soil Science” option. The Review Team encourages the Department to defer this change until some firmer decisions have been made on the grand challenges.

- The Department is encouraged to review the need for two majors that seem very similar (“Soil and Crop Science” and “Soil and Crop Management”) as they evaluate the need for a third major (Soil and Hydrologic Sciences). The two majors in question could be merged into one.
- Provide instruction in crop physiology. This is a critical course for the students interested in crop sciences.
- Establish a plant breeding practicum at the 500 level (stand alone, as opposed to part of existing 500 level breeding courses).

V. Graduate Education

Graduate student numbers for Purdue Agronomy declined by 22% since the last review. Although this decline was partially offset by an increase in the number of post-doctoral fellows hired in the Department, both the provost and vice president for research emphasized that graduate education is a core mission of Purdue University. An equal number of U.S. and international students make up the graduate student body, indicating a decline in the domestic student numbers since the last review. The number of minority students increased from an average of one to four since 2002; this reinforces the challenge of creating cultural diversity from domestic student populations.

Departmental priorities for graduate education include the need for more graduate-level course work, uneven distribution of graduate advising among faculty (a hold-over concern from the 2002 review), and declining student enrollment. Another concern from the last review included the expressed need for a systematic program for sharing and learning about the breadth of discovery underway in the Department. Although Purdue Agronomy established a departmental seminar, it emphasizes outside speakers with little opportunity for students to understand the breadth of departmental activities and their graduate colleagues work.

Agronomy faculty propose to conduct a comprehensive review of the curriculum focused on 500-600 level courses coordinated with a review of 100-400 level courses to provide seamless and logical linkages between the undergraduate and graduate courses that meet student needs. Declining graduate student numbers and unevenness of graduate student advising appear to be related to fee remissions and other costs that make the expense of graduate education on par with post doctoral fellow employment. Post-docs have increased in number as student numbers have declined. The Department is evaluating alternatives to increase the number and duration of student fellowships and assistantships—current fellowships actually make it more difficult to support graduate education (e.g., the Ross Fellowship, see Agronomy Self-Study). The Agronomy faculty is moving forward through newly designed learning outcomes, activity schedules and rubrics for both MS and PhD degree programs. Faculty members are in the process of reviewing PhD credit requirements and evaluating a competency-based PhD program in response to graduate student discussions.

Strengths:

- The Department works well together in terms of graduate education. The faculty is friendly and helpful, “a great group of folks”.
- State-of-the-art-facilities.
- Well articulated and relevant learning outcomes.
- The Integrated BS/MS 3+2 Program in the College of Agriculture.
- Depth and breadth of faculty.
- Faculty is strongly committed to graduate training and education.

- Students overall feel they have a voice that is heard and respected in the Department.
- Students appreciate available opportunities to interact with staff, and the support they receive from the staff.
- Availability of a dedicated analytical chemist and other support personnel to maintain the analytical equipment, and train graduate students.
- Availability of funding for teaching assistantships (TAs) and graduate assistantships for research (GAs) at the departmental level for new faculty, as well as bridge funding across projects.

Challenges:

- Reverse the declining graduate student enrollment.
- Overcome unequal faculty participation in graduate training.
- Alleviate insufficient funding.
- Offer more classes at the 600 level.
- Revise the current curriculum.
- Recognize that flexibility is needed to embrace the specific requirements of the diverse disciplines within the Department.
- Work with the Statistics Department to ensure its curriculum meets topical needs and accommodates student research schedules.
- Not all graduate students have access to adequate office space.
- Provide opportunities for students to meet and interact with other students in the Department.
- Difficult to get adequate statistical analysis (consulting) support for graduate students from the Statistics Department.
- Time and attention from some major professors is limited.
- No seminar exists that permits graduate students to present their own work to their peers.

Recommendations:

- Workshop to bring students from different disciplines/buildings within the Department together to present their work and coordinate across the Department.
- Maintaining data is necessary to evaluate the performance of the graduate program over the long-term. Such information includes student qualifications, student origins, student placement, and employer satisfaction with the students they hire.
- A critical core of faculty in each area of emphasis is important for student recruitment. When it comes to plant genetics and plant physiology, Purdue has outstanding faculty, but they are distributed over several units, so the critical core, while there, is not easy to discern:
 - Create over-arching centers or institutes that can give national visibility to groups of faculty within specific disciplines in plant genetics and plant physiology.

- Facilitate discipline-specific retreats for these centers/institutes to foster a greater group identity and greater group interactions and collaborations
 - Use the retreats as opportunities where graduate students can present talks/posters and find out about the research of others.
 - Provide web 'portals' that provide one-stop-shopping for students to find out all the opportunities in these disciplines.
- The Department of Agronomy embraces a wide range of disciplines; this range does not necessarily lend itself to a common set of standards.
 - Each or some of the 4 areas of emphasis should be split off into independent majors with their own requirements.
 - As these majors are established, some should be established as interdisciplinary majors, for example, genetics or plant physiology.
- Getting away from the 'agronomy' name may help with student recruitment. Continue to emphasize the departmental tag lines.
- Provide opportunities for teaching experience beyond teaching assistants for labs (for example, offering Introductory Soils and Genetics during the summer where a graduate student would serve as the instructor).
- Graduate-only courses are important to reach the necessary depth of understanding expected from a graduate curriculum, so having a dependable offering of 600-level courses is essential. Having a solid course selection is also important to help recruit students:
 - Each graduate major should establish a minimum number of 600-level classes required for students.
 - Develop more interdepartmental or more cross-listed classes, to share teaching load with other departments.
- Take advantage of opportunities to distribute the teaching load when available—for example, if genetics can be taught by the Biology Department, then the faculty currently teaching introductory genetics in Agronomy would be freed to teach upper-division courses in the Agronomy Department.
- Consider non-traditional approaches for courses with low enrollment such as directed studies and assigned readings.
- Partner with other states to offer and receive courses via Adobe Connect or a similar product.
- Encourage interdisciplinary projects that pair difficult-to-fund areas with better funded disciplines. The result should open new areas and funding sources and new avenues of research for graduate students.
- While most students are very satisfied, not all have sufficient access to their major professors. Set guidelines for recommended access to faculty. Regularly scheduled lab meetings need to be a standard practice throughout the Department.
- Provide more opportunities for graduate students to meet and interact with departmental students in other disciplines/buildings—establish an agronomy graduate student association.
- The department head of Agronomy should try to communicate issues to the head of Statistics and collaborate on a solution to the issues with statistics courses. Ensure SAS training is adequate.

- Provide a system whereby GAs can ‘apprentice’ with a faculty member, developing upper level coursework and writing and grading exams, under faculty supervision. Such a ‘teaching practicum’ could be a course for credit.
- Ensure students are aware of and can participate in services offered by other offices at Purdue such as the Teaching Program Certificate, interview and proposal writing skills.
- Ensure all graduate student offices meet minimal standards.
- Allow industry partners to serve as non-voting members of the graduate student’s advisory committee.
- Must have advanced plant breeding and quantitative genetics taught at the 600 level to have a complete program.
- Establish a plant breeding practicum at the 500 level (stand alone, as opposed to part of existing 500 level breeding courses).
- Increase the opportunities for PhD level students to succeed in the role of an agronomist—even though the money is currently focused on genetic manipulation.

VI. Extension Education and Advisory Council/Stakeholders

Extension and engagement at Purdue Agronomy seeks to serve as the definitive source of nonbiased, science-based information and maintain and expand proactive and relevant applied research programs. Agronomy's extension program mission is stated as:

Develop, integrate and extend agronomic information and technology that is timely and relevant to the agricultural and environmental concerns of the residents of Indiana, the nation, and the international community.

Extension faculty FTEs remained stable since the last review with 7.68 FTEs in faculty extension positions. However administrative/professional FTEs dropped significantly since 2002 from 11.60 to the current 5.52 FTE (loss of 12 staff). The Department added one additional faculty member with a primary extension appointment since the last review. The program contains two open positions, one for a soybean extension specialist (0.65 FTE, a holdover from the 2002 review) and the other to replace the land use specialist position. Eight faculty with greater than 40% extension appointments mentor graduate students, conduct applied research, and teach courses.

Priorities for the extension program include improving the efficiency of program delivery, identifying and proactively addressing new areas for extension, acquiring resources for applied research efforts (a holdover from the 2002 review), educating the next generation of extension faculty, and improving extension's visibility. To address some of these priorities faculty plan to increase their clientele base, take advantage of emerging distance education technologies, deliver more proactive and curriculum-driven educational events, and maintain program balance. Faculty and staff will identify, prioritize and tackle more complex issues such as climate change, biofuel crops, etc., and align with the grand challenges. They plan to proactively address federal requests for proposals that are integrated across research and extension and utilize customer advisors to help focus research needs then grow funding. Faculty and staff will work to attract additional graduate assistantships in extension and include extension-related experiences in selected courses. Agronomy extension are excited to welcome their new extension director who could assist with improving collaborations with county and field staff (another holdover from the 2002 review), identify issue-based action teams, develop both marketing strategies and outcome-based assessment tools.

The Department inaugurated the Agronomy Advisory Council in 2004. The council consists of external stakeholders advising Purdue Agronomy about program delivery and development. Advisory Council members meet twice per year in different locations to take advantage of faculty and staff activities occurring throughout Indiana.

Extension Education

Strengths:

- Extension faculty are highly regarded within the state, regionally, and nationally for their work in the following areas:
 - Agricultural meteorology and climatology
 - Crop and soils management systems
 - Turfgrass management systems
 - Water and environmental quality.
- The extension program works across all areas of transformational extension education programming, such as:
 - Websites
 - KingCorn.org
 - Turfgrass program
 - IClimate.org.
 - Conferences
 - Indiana Green Expo
 - Certified Crop Advisor (CCA) Conference.
 - Field- and classroom-based workshops
 - Crop diagnostic training
 - Turfgrass short course.
 - High impact publications
 - Corn field guide
 - Soybean field guide
 - Forage field guide
 - Many other publications new since 2002.
 - Education
 - K-12 education (high school soils and crop judging)
 - Undergraduate and graduate education, including 5 courses and guest lecturing in others.
 - Community involvement
 - Network of volunteers who record precipitation data and report to IClimate.org.
 - Policy change
 - Manure management software
 - Septic system database.
- The Diagnostic Training Center (DTC) attracts state and regional clientele and impacts significant acreage in the region.
- The extension faculty has strong involvement with the (Certified Crop Advisors (CCA) program educational needs through the CCA Conference, the DTC, workshops, field guides, and crop variety performance trials.
- The turfgrass program crosses state lines and influences management systems used by professional turfgrass managers on a state and regional basis through its Indiana-Illinois Turfgrass Short Course and Midwest Regional Turf Field Day.

- The Indiana Green Expo is one of a few of its kind in the nation that brings educational programming to all aspects of the green industry.
- Agronomy extension specialists are sought out for their expertise on a local, regional and national basis.
- There is a strong and an apparent atmosphere of cooperation among extension specialists and between specialists and research colleagues within the Department as well as on a regional basis.
- Field facilities, such as the Agronomy Farm, Purdue Agricultural Centers (PACs), water quality field study sites, and the Beck Agricultural Education Center strengthen the quality of educational programming opportunities.

Challenges:

- Meeting the increasing demands for extension specialist's time and expertise with potentially stable or declining FTE in extension.
- Improving efficiency of extension program delivery.
- Identifying new areas of extension education needs, and prioritizing resources to address these emerging areas and on-going needs.
- Partnerships with state and other agencies, such as the Indiana State Department of Agriculture, and Natural Resources Conservation Service.
- Exploring and developing mechanisms for a fee structure that is more realistic regarding costs associated with extension educational program delivery.
- Maintaining and expanding relevant applied research programs that support extension education activities.
- Developing and training the next generation of extension specialists.

Recommendations and Opportunities:

- Continue to seek and implement ways to decrease traditional one-on-one contacts, single topic presentations, and in-depth presentations at county or company grower meetings scattered across the state. Use current and emerging technologies where appropriate and feasible to enhance web-based information transfer and distance educational tools where appropriate and feasible. Find ways to incorporate PACs more effectively in interfacing with your educational programming activities and networking with extension educators and CCAs on a statewide basis. Strengthen those extension educators who express an interest in developing technical expertise in areas emphasized by the Agronomy Extension Program, and seek ways to facilitate this approach on statewide basis.
- Identifying new areas of extension education opportunities, and prioritizing resources to address these emerging areas and on-going needs
- Utilize existing strategic plan and identified grand challenges developed during the CSREES review process to prioritize existing program activities and new areas of opportunities. This is an excellent time to let go of areas that may have an identified need, but resources should be realigned to new and emerging opportunities. For example, the Department would like to replace their land uses

- Where ad hoc or one-on-one approaches were used in the past when interacting with state and local agencies, the Department must formalize efforts to develop partnerships and linkages with these agencies. Build bridges and partnerships where appropriate and feasible, and develop conduits for exchange of communications and ideas. Such approaches may go a long way to foster improved relationships and minimize damage control needs.
- Fee structures may already exist, but these seem to be inadequate to meet the resource needs for current and emerging extension programs. Explore ways to expand fee structures to more realistically address educational programming costs, using a more entrepreneurial approach.
- Focus on high priority research needs and partner with research colleagues to expand funding opportunities where feasible, particularly with federal agencies requiring outreach deliverables. Work with the limited state check-off funding sources to identify mutual areas of research interest. Work with the Department's Advisory Council and stakeholders to identify potential sources of endowed research funding, and look for opportunities to develop a similar model as the Midwest Regional Turf Foundation for industry and clientele support for pertinent applied research. Critically address where current applied research funds are used, and identify if these expenditures address the highest priorities for this source of funding.
- Collaborate with colleagues in the Department to incorporate extension education opportunities into the existing graduate program, and graduate courses. Develop undergraduate extension scholarship program to facilitate students working for a summer with an extension faculty member, expand the current Agronomy Extension assistantships to expose interested graduate students to the extension education experience.
- Retain the ownership and identity of its extension materials. The Creative Commons license could be used to solve the problem, by allowing the materials to be freely available to the public, while requiring that the source of the materials must always be acknowledged
- Place RSS feeds on all extension websites to push information towards engaged stakeholders.

Advisory Council/Stakeholders

Strengths:

- The Department continually reaches out to create opportunities for alumni to keep connected.
- Implementation of an Advisory Council with rotating membership.

Challenges:

- The Advisory Council needs to reflect the diversity throughout Indiana.

- Reflect other perspectives from backgrounds in addition to those obtained through the Purdue experience.
- Help to formulate and implement the grand challenge concepts and how they will be delivered to clientele.

Recommendation:

- Seek Advisory Council members that can provide diverse perspectives and involve them in formulating and implementing the grand challenge concepts.

VII. Research and International Programs

Earth Systems Sciences (ESS)

Since the 2002 review, the Soil and Environmental Sciences (“Soils Group”) changed to the Earth System Science group focused on developing intellectual resources to address major ecological and environmental concerns at the kilometer scale and larger, obtain state-of-the-art equipment and technologies for conducting progressive research, enhancing linkages within the Department and across campus and enhancing soils education and outreach. Retirements with concomitant hiring of new faculty provided for a transformation to a program that combines traditional soil science with hydrology, weather and climatology, remote sensing and geospatial technologies, and biogeochemistry. The group enhanced linkages through collaborative research projects and four of the seven professors hired now have joint appointments in other departments. These new hires provided novel expertise in modeling at coarser scales and in earth observation using new remote sensing technologies.

The Earth Systems Science group has disciplinary and working scale depth and breadth. Nineteen disciplinary areas are represented in the Group, with faculty working in more than one disciplinary area, and many areas are considered a primary focus by three or more individuals. Collectively, their work spans all scales of terrestrial measurement. Self-identified programmatic themes can be broadly categorized as anthropogenic contaminants, greenhouse gases, land use/sustainability, nitrogen, phosphorus or potassium in soil and water, soil management, and watershed hydrology. They have succeeded in transforming themselves relative to faculty composition. They are in the process of identifying a high level cohesive and strategic vision. The mission of the Earth System Science group is:

To address significant societal needs by offering innovative and relevant teaching, research, and outreach programs in the soil, hydrologic, atmospheric, earth observation, and environmental science, in collaboration with public and private partners.

Their priorities in 2009 involve developing a new corporate identity, developing a conceptual research framework, enhancing their undergraduate and graduate education program, and acquiring additional faculty expertise (primarily soil physics and microbiology). Though the Grand Challenge Initiative, the group made significant strides towards developing the research framework—to sharpen their focus, increase their visibility and lead them into productive new areas for research.

Strengths:

- The proposed new initiative in “Earth System Sciences” is intended to merge the efforts of two current departmental groups (“Soils” and “Earth Systems”) into a more unified effort that will focus on contemporary questions in the soil and earth sciences across all spatial scales. This initiative fits well with all of the “Grand

Challenge” areas the Department is considering for the future. It should also help faculty working in these areas to engage new collaborators.

- The Department has made remarkable progress in the ESS area in the past 5-7 years and has responded very well to the major suggestions in their 2002 CSREES review. They have added intellectual capacity and breadth in very appropriate scientific areas that are enhancing their research programs and stature; significantly upgraded the instrumentation needed to accomplish their mission; and built upon long-standing linkages with other scientific disciplines not only at Purdue, but at other universities and research centers around the world.
- Their research contributes to a nationally recognized undergraduate education in soil and earth science and a strong Extension soils program that addresses matters of importance.
- The ESS faculty is highly dedicated and motivated and has done an excellent job in securing extramural funding in important research areas.
- The ESS mission is well stated.
- The Department has great coverage (e.g., a critical mass of faculty) for subject-matter areas and “length scales”.
- Collegiality and sharing of instrumentation among ESS faculty appear to be at a very high level.
- Emphasis on emerging contaminants, soil-plant interactions, biogeochemistry, and landscape processes has modernized the Department regarding societal-research needs.
- Joint appointments in Civil Engineering and Earth and Atmospheric Science allow interdisciplinary research and sharing of resources.
- The ESS faculty has great interaction with their stakeholders.
- The ESS mission fits very well with 5 out the 6 grand challenges.
- As noted in their self-study, the ESS group, in cooperation with their colleagues in Crop Science, has “...the depth and breadth to address almost any aspect of the crop-soil-water-climate continuum”.

Challenges:

- It was unclear how research and teaching programs in Turf Science, a major departmental area of emphasis, interact now with the Earth Science Systems group.
- Maintain the momentum to develop the ESS program.

Recommendations:

- The highest priority is for a new extension specialist who can address a wide range of contemporary environmental issues of importance to most, if not all, of the Grand Challenge areas (e.g., climate change and bioenergy, emerging contaminants, nonpoint source pollution in mixed land use watersheds).

Crop Sciences

The Crop Science group set as its goal to become the premiere research and academic program in crop sciences by distinguishing themselves in the education of undergraduate and graduate students and in the pursuit of excellence in crop research. The group's research and educational interests span several scales from basic cell biology, genomics and proteomics to applied plant science at the farming and turf systems scale. The crop science group's research mission is:

To conduct and disseminate results of innovative and relevant research that addresses important biological and environmental problems in crop sciences to serve the future needs of agriculture and society.

They are a multidisciplinary and collaborative group with new priorities that include advancing the knowledge base, developing a systems approach for greater impact, addressing emerging societal concerns, and strengthening their learning, engagement, and international efforts.

Since the last review, the crop sciences group reinforced the turf program through two new positions and sustained strong turf industry support and service, strengthened the maize breeding and genetics program, strengthened ties with the seed industry, assumed greater leadership in genome sequencing, committed to placing an emphasis on translational genomics, and embraced atmospheric interactions and the tools of remote sensing.

The crop sciences group plans to move forward through sustaining a productive work environment, pursuing opportunities that could create new initiative, enhancing their competitiveness for extramural funding, strengthening their international linkages, and recruiting and retaining quality staff.

Cropping Systems (CS)

Strengths:

- Breadth of disciplines with national recognition.
- Ample research opportunities to adapt agronomics as they change due to genetics, resource limitations (e.g., water, fuel), and climate change.
- Farm facilities are easily accessible from campus. Staff at the farm facilities is supportive of research, education and outreach. Support from the Department for farm facilities is excellent.
- The use of the water quality treatment field station provides an excellent opportunity to connect production and environmental issues.
- Faculty and administration persisted in the construction of the Beck Center, which can be used for educational activities.

- Off-campus facilities (Purdue Agricultural Centers) are accessible and staff is amenable.
- Good relationships with stakeholders (producers, Certified Crop Advisors).
- Good balance between addressing local (Indiana), national, and international issues.
- Good multidisciplinary collaboration.

Challenges:

- Perception that funding for graduate education is unavailable, difficult to obtain and maintain.
- A lack of training in whole-plant physiology in the 90s has reduced the pool of plant physiologists.
- Need to scale-up from the field scale to the landscape scale which can be expensive and logistically challenging.
- Many of the faculty who identified physiology/cropping systems as their primary or secondary discipline area has major extension or teaching commitments.

Recommendations:

- The group should meet with stakeholders (including urbanites) in order to identify the issues.
- Forge broad-based teams to develop a systems approach to investigating the problems.
- Include graduate students in the systems approach in order to begin to train the future agronomists to view issues holistically.
- A program in Agroecology defined as the relationship between the biological, physical, and human components of an agricultural system should be investigated. It could be an “umbrella” for the multidisciplinary research that is already in progress. It would provide the impetus to include the human, anthropogenic components to the system, i.e. economics, policy, urban-rural interface issues, stakeholder engagement.
- Add faculty in the area of plant/crop physiology in order to have a continuum from the more basic to the applied plant/cropping system issues.
- Investigate the group’s role in the passionate, small but growing, interest in alternative production systems (organic, grass-fed, value-added, local foods).
- Prepare for urban agriculture as an emerging need in Indiana.
- Become actively involved in the development of the sustainable food systems minor.

Turfgrass Management Systems and Physiology (TM)

Strengths:

- The turfgrass research program is recognized for its strengths on a state, regional and national basis.

- The research faculty is sought out by industry and peers for their expertise, and members are actively involved in professional societies and trade organizations.
- Strong cooperation with other departments.
- Excellent interaction on a regional basis with faculty from the University of Illinois.
- Important interface with urban clientele for the Department.
- Ability to garner funds from industry for applied research needs.

Challenge:

- Developing turfgrass management systems that truly reduce inputs, such as water, fertilizer, pesticides and energy, while maintaining turfgrass quality and use.

Recommendation:

- Actively seek ways to become involved in departmental grand challenges and develop leadership roles in appropriate areas associated with these identified challenges.

Breeding and Genomics (BG)

Strengths:

- Plant breeding, genetics and genomics have been recognized as a national needs area by the USDA-CSREES National Needs Fellowship program. Seed companies generally indicate that U.S. universities are not training enough students in these areas. Furthermore, plant breeding is expected to be an important component of sustainable systems that get implemented in the future, and thus, become one of the grand challenges.
- Availability of skilled faculty that spans the range of subject matter areas from field breeding to genomics, with the capacity to train students in the continuum from basic to applied genetics.
- Excellent laboratory and field facilities.
- Wide breadth and depth of faculty.
- Faculty range from genomics to applied breeding in the major commodities, thus facilitating translational genomics in these crops.
- Good course selection to support the basic end of the genomics-to-breeding continuum.

Challenges:

- Advisory Council members suggested that graduate students need a blending of laboratory genomics and field-based plant breeding to make them more attractive to the job market.
- Insufficient coursework for a well rounded graduate program on the breeding end of the continuum.

- Supporting departments cancel needed upper level courses due to low enrollment.
- Difficulty in funding the more applied part of plant breeding.
- Lack of a tenure-track soybean breeder.

Recommendations:

- Strengthen the germplasm and variety release programs to more aggressively patent and license germplasms and varieties to generate a revenue stream to help fund student training and applied breeding research.
 - Take advantage of Purdue's intellectual property (IP) policy to negotiate greater royalty returns.
 - Develop a grant policy for the distribution of these funds.
 - Follow models from other universities.
- Given the importance of soybeans to Indiana, there must be a soybean breeder hired as a tenure-track faculty.
- As biofuels become more important, it will be necessary to start a breeding program. Consider a biostock breeder that also works on turf or forage grasses. Such a hire will also increase the critical mass in breeding and increase teaching opportunities.
- Ensure there are enough courses on the applied end, including separating out the laboratory components of the plant breeding course, and expanding it into a separate course.

International

Purdue Agronomy strongly supports international involvement of their faculty and staff. Faculty and staff work to strengthen institutions of higher learning and research in agriculture among several developing nations, and provided leadership towards campus-wide globalization of programs and mission of Purdue University through their efforts in teaching, research, engagement and collaboration. International exchange among scientific and outreach colleagues and international scholarship involve half of the faculty and many students in study abroad programs. Many international educational and research institutions include graduates of Purdue Agronomy.

Issues in the international activities of the Department include scattered and decentralized programs—a more coordinated effort would encourage new faculty to engage earlier in their careers leading to continued involvement, improve visibility, and may promote additional opportunities. Other challenges to the Department include: 1. few chances for new faculty to be mentored about international opportunities, 2. a lack of credit for international efforts towards promotion and tenure, 3. few incentive grants available for overseas assignments, 4. the potential impact of an overseas assignment on professional

careers, 5. family issues (e.g., schools) associated with overseas assignments, and 6. a growing national perspective of “Societal Inward.” A key question is how much internationalization does the Agronomy Department need or take?

Strengths:

- Faculty with significant international experience.
- Faculty who appreciate and value the need for international activities.
- Outstanding international representation in the Department.
- Established collaborations in Africa and Latin America.
- A commitment to internationalize the curriculum.
- A campus and departmental commitment to study abroad.
- A student pool that is aware of and values international experience.
- Funds to assist with study abroad.

Challenges:

- Determining the Department’s next course of action.
- Ensuring that all students are aware of financing opportunities for study abroad.

Recommendations:

- Cater to strengths--build upon existing collaborations prior to expanding into new areas.
- While undergraduate students are aware of study abroad opportunities, they may be dissuaded from pursuing study abroad due to a lack of awareness of the funding opportunities--make sure they know the funding opportunities are there, without having to apply to study abroad first, before they can find out about the funding opportunities.
- Continue to ensure there is international content in all courses; as many research projects as possible should have international components.
- Investigate industry offers for winter/summer international exchange programs to provide networking opportunities for graduate and undergraduate students with their global counterparts.

VIII. Grand Challenges

Through integrated and frequent strategic planning in the Department, faculty recognized the need to integrate their expertise with other disciplines to address complex, large scale problems such as climate change, waste management, natural resource conservation, and water, food, and energy security. Faculty established the grand challenges initiative to focus their collective expertise over the next ten years. These grand challenges will require multidisciplinary approaches, a long-term commitment and investment (financial, space, and equipment). The Department provided concept papers for each of the six grand challenges describing the faculty's shared vision to address each (not prioritized):

- Bio-feedstock Production and Development
- Chemical and Biological Constituents in the Environment and their Impact on Human and Ecosystem Health
- Climate Change—Impacts on Agriculture and Natural Resources
- Harnessing Plant Breeding and Genetics to Identify and Develop Economically Important Crop Traits
- International Agriculture Research and Engagement
- Landscape-scale Management for Sustainable Plant Production and Ecosystems

Strengths:

- The Department collectively looked at their future and attempted to address the issues they thought were important.
- The overall concept of the grand challenges is exactly what the Department of Agronomy should be doing.
- Identifying these challenges represents a new and forward-looking culture for the Department of Agronomy that is a definite break from the past and has energized the faculty.
- Grand challenges will lead to new knowledge, solutions, and educational opportunities.
- The grand challenge concept provides a venue where each faculty member can utilize their strengths as part of a team.

Challenges:

- Accomplishing six grand challenges will be a daunting task. Merge the International grand challenge into the other challenges (globalize all of them).
- The grand challenges need to be incorporated into the teaching and outreach programs.
- Recognizing what are actually “challenges” rather than “processes or tools” will require faculty scrutiny.
- Deciding not to do something because it is not one of the grand challenges will necessitate serious consideration. Some programs may have to be eliminated so as to foster the grand challenges.

Recommendations:

- Need to focus the grand challenges and reduce their number and while establishing metrics for assessing progress and success.
- The Department should state more explicitly how and where resident and extension education and international programs fit into the grand challenges.
- Regularly communicate to the stakeholders and public what the grand challenges are and how they are progressing.
- Encourage and support one another to “dream big”; break down the grand challenges into “doable pieces”; and prepare to stay the course over the long haul.
- Faculty in the Department should broaden the base for developing the grand challenges by actively involving colleagues from other units and using the Advisory Council.
- Include graduate students and staff in the process. Communication of progress and changes is important. It is easy for everyone to lose sight that they are part of a Department that has a broader focus than individual programs.

IX. Facilities and Development

Facilities

Strength:

- Agronomy has very good laboratory and field facilities for research and teaching that are well maintained and seem to meet most of the current needs of faculty, staff, and students. Faculty and graduate students also have regular access to equipment in other departments and centers on the Purdue campus.

Recommendation:

- The Department is encouraged to develop a strategic plan for the acquisition, management, and maintenance of key analytical equipment, high performance computing, and field instrumentation. There is no clear departmental (or major research group) plan for the prioritization of major equipment purchases. Too much faculty energy is directed towards maintaining the operation of current analytical equipment. Directly related to this is the need for a facilities review to determine if one or more core facilities, with an appropriate fee structure, should be established for key instrumentation that is widely used by faculty not only in the Department but by others throughout the University. A fair fee structure that covers operating and maintenance costs and that contributes to a fund to cover eventual replacement of key instruments should be implemented.

Development/Financial

Strengths:

- During the period since the last review, the Department has diversified their faculty, adding 5.05 FTE, accomplishing 14 faculty hires including 10 assistant professors, one associate and three full professors.
- The Department has developed a salary savings program from extramural funding sources that generated more than \$60,000 since implementation. Some of these salary savings return to support the principal investigator's program.
- Purdue Agronomy effectively combined their resources with outside support to convert and build facilities for state-of-the-art laboratories, improved seed and sample storage space, and field facilities for teaching, extension and field research.
- Impressive increase in private giving since the last review in 2002.
- The Department has a State of Indiana budget line item that pays the hard dollar support for the director of the Purdue Crop Diagnostic Training and Research Center (DTC) and associated extension graduate assistantships.
- Faculty members and staff are given special merit awards for exemplary efforts to the Department.

Challenges:

- Reduction of the percentage of expenditures allocated as salary and wages to not exceed 80% of total expenditures.
- Much of the angst that exists in the Department revolves around the non-appropriated financial support of graduate tuition remission.
- If you had to reallocate resources, what would be cut?

Recommendations:

- Continue to work with the Office of Development (ODO) to coordinate and expand private gifts for graduate student support, space renovation, relevant applied research and discretionary funds in the Agronomy Department.
- Work to improve internal funding capabilities to stimulate collaborative activities around the grand challenges, and grow merit increases and merit awards.
- Strategize to determine if the Department should hire more faculty or just add resources to the one's they already have?

X. Appendix—Final CSREES Review Agenda

Department of Agronomy Purdue University CSREES Review – February 2-6, 2009

Monday, February 2, 2009

Time	Subject	Participants	Location
Afternoon 5:00 pm	Team Arrives Meet with Department Head	Review Team Team with Craig Beyrouty	Purdue Memorial Union PMU Lobby
6:00 pm	Dinner	Team Members and Ag Administration	Holiday Inn City Centre Shambaugh Room
8:00 pm	Organizational Meeting	Review Team	PMU 103

Tuesday, February 3, 2009

Time	Subject	Participants	Location
7:00-8:15 am	Breakfast	Review Team/Review Steering Committee	Sagamore Room/ Lafayette Room
8:30 am	Welcome Gathering	Departmental Faculty/Staff	Lilly 2-425
9:00 am	Department Overview	Craig Beyrouty	Lilly 2-425
9:45 am	Undergraduate Programs	George Van Scoyoc	Lilly 2-425
10:45 am	Break		
11:15 am-12:15 pm	Graduate Programs	Jeff Volenec	Lilly 2-425
12:15 pm	Lunch	Undergraduate Students	Lilly 3-117
1:30 pm	Tour Educational Facilities	John Graveel	
2:15 pm	Extension	Brad Joern	Lilly 2-425
4:15-4:30 pm	Break		
4:30-5:00 pm	Slides of Field Facilities	Jerry Fankhauser and Yiwei Jiang	Lilly 2-425
5:00 pm	Return to Union Club	Review Team	Drive Team to Union Club
5:30 pm	Pick-up from Union		
6:00-7:00 pm	Drive by tour of WSLR, SOILS, Daniel Center Reception - Foyer Beck Center	Review Team/Faculty/Staff/ Stakeholders	Craig Beyrouty escort to ACRE
7:00-9:00 pm	Dinner – Multi-Purpose Room	Discussion with Agronomy Advisory Council and Indiana Stakeholders	Beck Center, ACRE
9:00 pm	Return to PMU	Review Team	PMU

Wednesday, February 4, 2009

Time	Subject	Participants	Location
7:00-8:15 am	Breakfast	Graduate students (Laurel Royer coordinator)	Lilly 2-407
8:30-9:45 am	Tour of Research Facilities	Paul Schwab, Joe Anderson	Lilly 2-425
9:45-10:15	Break	Review Team	2-426
10:15 am-12:15 pm	Earth System Science	Darrell Schulze	LILY 2-425
12:15-1:45 pm	Lunch - <i>Alan Grant to escort to Union and back to LILY</i>	College of Agriculture Department Heads	Sagamore Room/Wabash Rm.
2:00-4:00 pm	Crop Sciences	Gebisa Ejeta	Lilly 2-425
4:00-4:30 pm	Break	Review Team	Lilly 2-426
4:30-5:15 pm	Informal Discussion Appointments with Faculty	Faculty and Staff	LILY 2-425 LILY 2-426
5:30-6:30 pm	Reception	Review Team/Faculty/Staff	West Faculty Lounge
6:30 pm	Dinner on Own	Review Team	

Thursday, February 5, 2009

Time	Subject	Participants	Location
7:00-8:00 am	Breakfast with Review Team	All A/P Staff invited (Ed Stath coordinator)	Lilly 2-407
8:30-10:00 am	Grand Challenge Presentations Biofeedstock Environment Climate Change Plant Breeding and Genetics International Agriculture Landscape-scale Management	Review Team/ Faculty/Staff	Lilly 2-425
10:00-10:30 am	Break	Review Team	Lilly 2-426
10:30 am-12:30 am	Grand Challenge Discussion	Review Team/Faculty & Staff	Lilly 2-425
12:30-1:30 pm	Lunch with Review Team All Clerical & Service Staff	(Eileen Mallery, Cindy Boone coordinators)	LILY 2-407
Afternoon	Team Work Session	Review Team	PMU
6:00 pm	Dinner on own	Review Team	

Friday, February 6, 2009

Time	Subject	Participants	Location
7:00 am	Breakfast on Own	Review Team	PMU
8:00-8:45 am	Exit Interview	University Administration: Randy Woodson, Provost; Christine Ladisch, VP for Academic Affairs, Vic Lechtenberg, VP for Engagement, Richard Buckius, VP for Research	HOVD 119
8:45-9:00 am	Walk to Ag Admin	Review Team	AGAD 128
9:00-10:30 am	Exit Interview	College of Agriculture Administration, Jay Akridge, Dean, Sonny Ramaswamy, Dir, ARP; Dale Whittaker, Dir, OAP; Chuck Hibberd, Dir, CES, Pamala Morris, Dir, OMP; Jess Lowenberg-DeBoer, Dir, IPIA	AGAD 128
10:30 am	Walk to Lilly	Review Team	Lilly 2-425
10:45 – 12:00 pm	Exit Interview	Review Team and all Agronomy Faculty/ Staff	Lilly 2-425
12:00 pm	Depart	Review Team	

