Unit Strategic Planning Initial Report. Due to CALS Dean April 13, 2012

School/Department/Other Unit: School of Plant Sciences

1. Where is the Unit today? (Identify and use objective benchmarks.)

The School of Plant Sciences (PLS) is undergoing a transition, having experienced significant turnover in senior faculty and hiring a number of junior faculty in the past two years. Over the past 20 years, PLS has arguably been one of the strongest and most distinguished departments in CALS and the U of A. PLS has an international reputation for research in plant molecular genetics and plant stress adaptation. In 2007, PLS was recognized in the Chronicle of Higher Education as one of the top departments of its kind in the US, based on the number of faculty, number of research publications and research grant support. The PLS faculty have included three members of the National Academy of Sciences, two Regents Professors and one Distinguished University Professor, and four endowed chairs. For the past 12 years, PLS has led all academic units in CALS for extramural grant support with an average of $11.1 million per year (from FY2000 to FY2011.). PLS has a small, but active and effective group of extension faculty, who maintain well-supported applied research programs dealing with crop management and crop protection; these faculty teach extension clientele and, in many cases, undergraduates as well. PLS faculty teach a diverse spectrum of undergraduate and graduate courses on the following topics: introductory cell and molecular biology, microbiology and plant pathology, a variety of aspects of plant biology (genetics, physiology, cell biology, and development), and various aspects of horticulture including turf grass management and vegetable production in controlled environments.

With respect to its future research, teaching and extension goals, the PLS faculty envision continuing much of the School's traditional mission of enhancing sustainable agriculture in semiarid climates, which includes the following:

A. Basic research

1. Elucidate the physiological mechanisms by which plants respond to abiotic stress (i.e. drought, heat, salinity), biotic stress (i.e. microbes, insects, nematodes), and the physiological consequences of improving these traits via genetic selection.

2. Elucidate the metabolic basis for the nutritional and medicinal value of vegetable and agronomic crops and describe the physiological consequences of improving these traits by genetic enhancement.

3. Define the genomic, proteomic, and metabolomic foundation of plant stress adaptation, host-microbe interactions (pathogenic and symbiotic), and their physiological adaptations.

4. Determine how to reconcile environmental impact and societal benefits.

B. Applied Research and Extension.

1. Develop crops with increased value and nutritional content, medical applications, and that maintain yield and fitness in semiarid environments.

2. Provide farmers with predictive information for responding to biotic and abiotic stresses, and the means to maximize yields, profits, and sustainable benefits.

3. Identify ornamental plants and urban landscapes best suited for semi-arid environments that meet societal needs.

C. Education

Teach and enhance undergraduate and graduate programs that emphasize science relevant to 21st century agriculture and will generate a well prepared workforce.

D. Current Benchmarks

1. PLS undergraduate majors: 42 Plant Sciences and 23 Crop Production
2. PLS graduate students: 2 MS and 9 Ph.D in Plant Sciences
   2 MS and 9 Ph.D. in Plant Pathology
3. Grant proposals submitted 90 (annual average for the past 5 years)
3. Extramural grant support: $9 million (annual average for the past 5 years)
4. Research publications: 127 (annual average for the past 5 years)

2. Where do we want to be in the future so that we can differentiate ourselves from our competitors to give us a competitive advantage? (Includes specific values for the objective benchmarks selected in 1 and may include addition benchmarks)

Our goal is to continue to be one of the leading academic units that support research and extension in sustainable agriculture for semiarid climates and a center for basic and applied genetic and genomic research. This requires that the unit maintain a diverse, research-active faculty that is successful in acquiring research grants from a variety of sources. Indeed, this entrepreneurial spirit will be required of our extension and education missions as well. Because genetics, genomics and computational biology will be the foundation for future improvement of crops, it is essential that PLS continue to build upon its expertise in these areas, while having the capacity to transfer the results of this research to the field. However, it must also maintain quality research and teaching programs in plant-microbe interactions and areas of fundamental plant biology, including cell and molecular biology. To assure that knowledge gained from this research be utilized, it is essential that valuable traits be incorporated into crop plants through translational research.

3. ***What should we be focused on today to make it most likely that we will get where we want to go (<u>rank order</u> from most important to least; <u>annotate</u> as short term [1-2 years]; medium term [2-5 years]; long term [5-10 years])? Please use the following headings a-c and provide a justification for why each thing is placed where it is.***

    a. ***Existing areas to preserve, protect, or enhance.***

    If we are to continue to be recognized as a center for plant genetic and genomic research, we must maintain a critical mass of faculty who do research in this area. We have recently hired several faculty (Eric Lyons, Bryan Wang, Becky Mosher, Eliot Herman, and Monica Schmidt) whose research and teaching fit this area. We should be well positioned over the next 2-5 years, if not longer, providing of course they are able to secure a significant level of grant support and that our more senior faculty (Rod Wing, David Galbraith, Karen Schumaker, Ramin Yadegari and Ravi Palanivelu) continue to have well-funded research programs.

    It is essential that we maintain core competency in plant pathology, at least in plant disease diagnosis. PLS will have a number of retirements (4 most likely) in the area of plant pathology in the next 1-3 years. This includes two extension (Mary Olsen and Mike Matheron) and two research/teaching (Hans Van Etten and Mike McClure) appointments. Considering the critical nature of the extension appointments, it will be important that these individuals be replaced, and a strong case for replacing the McClure (nematologist) position as well. Van Etten's and McClure's retirements will negatively impact our ability to provide a graduate program in plant pathology, in that it leaves two plant virologists (Judy Brown and Zhongguo Xiong), one plant pathologist (Barry Pryor), and two mycologists (Betsy Arnold and Marc Orbach) and a bacteriologist (David Baltrus). Orbach's and, increasingly, Pryor's research is directed toward human pathogens, and Arnold, Baltrus, Orbach, and Xiong primarily teach in the undergraduate microbiology major.

    b. ***Areas where totally new activities or structures are needed.***

    We lack a critical mass of faculty who work on abiotic plant stress adaptation, i.e. salinity, heat, cold and drought stress, which should be a major focus of the department. Other than extension faculty (Mike Ottman, Dave Kopec, Ursula Schuch, and Bill McCloskey) who directly or indirectly deal with these issues, there is only one research faculty (Karen Schumaker).

    We would benefit by adding a plant biochemist, as this is both a teaching and research deficiency. This individual would help us integrate research in genetics/genomics/metabolomics and provide breadth and diversity to undergraduate and graduate teaching.

c. ***Areas to discontinue, de-emphasize, or modify.***

PLS has only two individuals that support turf research, teaching and extension. The extension specialist (David Kopec) expects to retire in a few years, and funds to support the non-tenure tract teaching position (Mohammad Pessarakli) will be exhausted in two more years. Thus, the future of turf research and extension and the Carsten Turf Center should be evaluated over the next two years to assess whether to strengthen or maintain or modify this activity.

Although horticulture is an important aspect of Arizona agriculture, e.g. field and greenhouse-grown vegetable production, fruit and nut crops, and the turf-related industry, we have only 4 teaching/research/extension faculty in this area (Chieri Kubota, Tanya Quist – teaching only, Ursula Schuch, and David Kopec). Serious consideration should be given whether to strengthen, maintain, or modify this aspect of the PLS teaching and research mission.

4. Other ideas:

There are currently 5 faculty who are at or near 60 years of age, and the potential retirement of these individuals in the next 5 years can create opportunities for PLS to strengthen current departmental missions, create a pool of funds that could be used to support graduate education, or develop new areas of research focus.

5. How do 3a-c align with/complement others CALS and UA units as well as other AZ higher education institutions?

I believe that 3a-c describe what are traditional core competencies (missions) of the School of Plant Sciences and do not significantly overlap other CALS or U of A units. There clearly are scientific overlaps with MCB and EEB. However, MCB and EEB do not consider basic plant biology as an area of responsibility. They divested themselves of it more than 20 years ago. Arguably, the teaching of general microbiology courses could be diverted to SWES or Vet Sci/Micro. Indeed, it might be worth considering the creation of a division of microbiology in one or another department.

6. Record of dissenting opinions:

I believe this vision aligns with most, though perhaps not all, of the PLS faculty. Considering the breadth and diversity of research and extension in the School, it would not be surprising that some individuals question the past and present focus of research, teaching and extension. It would be easy to justify why additional

resources would be well invested in the School, but I'm sure the same is true of other academic units in CALS.

7. ***Additional details (may not be strategic but are good ideas):***

   A major challenge facing PLS is the loss of base funding to support graduate education. For many years, PLS received between $200,000-$300,000 from CALS, which allowed us to recruit 5-10 graduate students each year. Using these funds and teaching assistantships, we were able to support graduate students for two years, which allowed them to do research rotations before selecting a laboratory for a MS or Ph.D. project. The loss of this base support severely limits our ability to recruit graduate students compared to peer institutions. This is a great disadvantage to Assistant and Associate Professors who are working to establish a research program, and it diminishes the output and the reputation of the School in general. In my opinion, this is one of the most critical problems facing PLS and CALS generally. If we are unable to train the next generation of graduate students, how are we going to cope with the challenge of feeding 9 billion people in another 30-40 years?

8. Appendices (only if needed).