SCHOOL OF PLANT SCIENCES 2025 STRATEGIC PLAN

Context and Opportunities: Our ability to maintain an agricultural system capable of supporting the ever-increasing global population faces major challenges as a result of climate change, increasing degradation of arable land, rapidly expanding urbanization, limited natural resources, and increasing environmental pollution. These challenges will require us to rethink how we sustainably produce food, feed, fiber, and fuel with limited water, high temperatures, and poor quality soils, while simultaneously improving plant, human and environmental health. SPLS is positioned to address these challenges using approaches inherent to the 4th Industrial Revolution (4IR) and contribute to the strategic goals of the university in shaping a resilient natural and built environment. We are specially positioned to address challenges associated with agricultural ecosystems in arid and semi-arid environments, as we possess a highly impactful research and training expertise in fundamental plant and microbial sciences, and a highly effective applied research and extension/outreach programs with strong stakeholder networks in Arizona and the southwest.

Purpose: Increase productivity and sustainability of plant systems in agricultural and urban environments, especially in semi-arid and arid environments. Specifically, we will:

- Build instructional programs that prepare students to address current challenges in plant and microbial systems and to foresee disruptions and opportunities arising from the Fourth Industrial Revolution (4IR). These programs will align with our current and future research expertise to ensure students have a solid academic foundation as well as essential experiential learning opportunities that develop interdisciplinary problem solving.
- Generate fundamental knowledge about plants and their associated microbial communities at the molecular, cellular, organismal, population, and community levels, communicate this knowledge to our students and engage graduate and undergraduate learners in discovery and active-learning.
- Integrate basic and applied research with technological and informatic advances to improve growth, development, and adaptation of crop and urban plants in varied and changing environments.
- Disseminate our discoveries through extension and outreach activities for stakeholders locally, regionally, nationally, and internationally.

2025 Vision: We envision a leadership role for the School of Plant Sciences in generating and disseminating knowledge needed to address looming crises in productivity and sustainability of agricultural and urban plant systems in arid environments. We will provide leadership both through research discovery, publications and undergraduate and graduate instruction and training. Outcomes of our vision will include: a broadly trained, job-ready workforce prepared to meet future challenges to agricultural and urban plant systems; robust research and extension programs that support plant improvements through genetics, create novel strategies for mitigating plant disease and improving food safety, and develop innovative land management strategies to optimize plant growth.

Mission: Achieving our vision will require us to:

- Capitalize on our research diversity, cyberinfrastructure, and strategic resources.
- Develop strong communication among faculty and with stakeholders.
- Continually identify strategic opportunities in research, instruction, and outreach.

Shared Values: Importance of combining and maximizing our strengths in basic and applied plant and microbial science to combat obstacles to agricultural production and urban plant use.

Summary: This document represents faculty-generated goals, priorities, and associated activities that will position us as leaders in meeting the challenges facing plant and microbial science in arid environments. Included are plans for strengthening our educational activities (expand/enrich undergraduate experience and success and enhance graduate education), and for integrating fundamental, applied, and extension research into novel strategies for our diverse stakeholders (increase research funding and productivity and meet challenges in plant and microbial science in arid environments).

All members of the SPLS faculty were given the opportunity to participate in the preparation of this document and to comment on its content. As much as is possible, the goals presented represent the general consensus of participating faculty. However, we are a diverse faculty and there is dissent and debate on aspects of this strategic vision. Alternative viewpoints will continue to be considered as faculty in the School works towards these goals.

STRATEGIC GOAL ONE:
Expand/enrich Undergraduate Experience and Success

A. Current situation and gap between current situation and desired situation

The number of SPLS undergraduate majors (Plant Sciences (PLS) and Sustainable Plant Systems (SPS)) tripled from 37 to 108 in the six years preceding 2019. As of March 2019, there were 67 SPS majors and 41 PLS majors. The growth in number of undergraduates requires adjustments to ensure quality instruction, effective mentoring, and efficient advising. Additionally, we want to further increase the number of students in our majors. To these ends, we **Aim** to:

1. Increase the number of students in SPLS majors while maintaining exceptional mentoring and advising.

   Present and target enrollment numbers:

   FY19: 108 undergraduate majors
   FY21: 125 undergraduate majors (SPS 78; PLS 47)
   FY23: 130 undergraduate majors (SPS 81: PLS 49)
2. Expand and enhance our curriculum to provide cutting-edge knowledge and interdisciplinary training necessary for Fourth Industrial Revolution (4IR) transitions in areas such as biotechnology, crop improvement, innovative production systems, precision agriculture, and plant health.
3. Provide student-centered active and collaborative learning approaches in all courses offered by the School for our majors, and integrate our research expertise into classroom teaching.
4. Prepare students for employment by facilitating internship and training opportunities, and by focusing on data competencies required for jobs in the 4IR.

B. Strategies to achieve goal

1. Ensure that the CALS recruitment team conveys an appropriate, effective message about our SPLS majors as they work to promote CALS majors, career opportunities, and courses to prospective students. [Aim 1]
2. Support the CALS Recruitment team by interacting with prospective students directly at targeted events. [Aim 1]
3. Ensure that the required courses we offer promote the acquisition of 4IR-appropriate skills, such as collaboration, leadership, data-engagement, digital and technical competency, problemsolving, and creativity. [Aims 2, 3 and 4]
4. Develop special activities (e.g., posters, arts, panel discussion, research symposia) and incorporate additional research-based teaching practices to promote personalized, collaborative and interactive learning. [Aim 3]

C. Actions

1. Establish workflow between unit head and curriculum, recruitment, and website committees to identify and promote our ‘brand’ and strengths. [Strategy 1]
2. Meet with CALS recruitment periodically to convey our desired recruitment message. [Strategy 1]
3. Review recruitment materials (*e.g.* brochures) annually, to ensure that the information is current and that they convey accurate messaging. [Strategy 1]
4. Provide table displays and faculty/student representatives at select CALS recruitment events. [Strategy 2]
5. Provide presentations and promotional materials relating to SPLS programs to University Professional Advisors. [Strategy 1]
6. Mentor and advise student researchers in laboratories. [Strategies 3 and 4]

7. Emphasize project based and experiential learning in all courses offered by the School as part of the PLS and SPS majors. [Strategies 3 and 4]
8. Identify and facilitate internship and practical training opportunities for undergraduate students. [Strategy 4]
9. Participate in SCI 295b (Research Readiness for underrepresented minorities) [Aims 1 and 3]
10. Continually improve and update an interactive, content-rich, and easy to navigate SPLS website that effectively recruits PLS and SPS majors. [Strategy 1]
11. Integrate 4IR-consistent skills into student assessments into SPLS courses for our majors [Strategies 3 and 4]
12. Employ active or applied teaching and aim to meet or exceed the UA Strategic Plan goal of 20% by 2020 and 40% by 2025. [Strategies 3 and 4]
13. Track student progress after graduation by maintaining records and contact information for SPLS alumni, possibly by annual post-graduation surveys that ask for updated contact information and current employment status. [Strategy 1]

D. Inputs needed to achieve the goal

1. Engaged and coordinated curriculum committees, faculty instructors and unit leadership to drive program improvements. [All aims; Action 1]
2. Undergraduate recruitment committee member to coordinate SPLS recruitment with CALS recruitment and marketing. [Actions 2-4]
3. Program coordinator to provide the following functions:
   3.1. Promote SPLS programs to University Professional Advisors [Action 5]
   3.2. Liaise with industry and government to help identify student training and employment opportunities [Action 8]
   3.3. Update and improve recruitment-related pages of SPLS website by, for example, highlighting current and past student successes [Action 10]
   3.4. Monitor inclusion of 4IR-consistent skills, active learning strategies, and applied experiences in our courses [Actions 11]
   3.5. Track and engage SPLS alumni after graduation, including by obtaining and processing data from CALS exit surveys of graduating students [Action 13]
   3.6. Obtain objective metrics, as listed in section E, below, to track progress [Section E, below]

E. Objective metrics that will be used to track progress towards attaining goal

- Student enrollment in SPLS majors.
- Number of student credit hours.
- Number of students placed post-graduation.
- Number of presentations to biology classes and minority groups.
- Number of student researchers.
- Number of interns and practical trainees.
- Number of visitors to SPLS website and inquiries into SPLS majors.

STRATEGIC GOAL TWO:

Participate Collaboratively in the Administrative Leadership of the Microbiology Undergraduate Major

A. Current situation and gap between current situation and desired situation

- In recent years, the undergraduate major in Microbiology has been overseen by diverse leaders (the Microbiology Commission, the Associate Dean of Academics, and the Department Heads/Directors of Veterinary Sciences and Microbiology, Plant Sciences, and Soil, Water and Environmental Science). Thus, Microbiology has had no single person focused full time on its oversight and for many years it had no official, standing committees.
- In Fall 2012, Associate Dean Joy Winzerling proposed a cross-unit committee to oversee the curriculum, recruitment, and related operations of the Microbiology undergraduate major. This committee was active from that point forward, and several years ago changed its format to be more representative and inclusive of those teaching actively in the Microbiology major.
- The committee is chaired by a member of one of the most active teaching units in the major (either the School of Animal and Comparative Biomedical Sciences or the School of Plant Sciences); vice-chaired by a member of the other of those units; and consist of a core group of faculty from those units who teach actively. This committee interacts with a larger community of actively teaching faculty whose courses serve Microbiology majors. The committee currently is overseen by the Director of ACBS, who interacts in a collegial fashion with the Director of SPLS.
- The principles that guide the aims of this committee are as follows:
    - The undergraduate microbiology major is one of the largest in CALS (~300 students), one of the larger biology-based undergraduate programs in the University, and one with exceptional potential to grow.
    - To enhance undergraduate programs in Microbiology, we should develop coordinated efforts to adapt them to 21st century technologies and recruit students using a facultyinspired approach.
    - There is a great need for trained microbiologists in diagnostics, food safety, quality control, environmental microbiology, plant and animal health, bioremediation, alternative fuel production, health care, and clinical laboratories. ○ Partnerships among the active instructors' units and a clear plan for leadership and growth will improve the major and faculty involvement.
- To best serve students and the state, a strong program in Microbial Sciences must be maintained in CALS. We propose that our microbiology-related faculty participate contribute to charting the future of the Microbiology Program by: (a) participating collaboratively in the crossunit microbiology committee; (b) considering joint appointments in the School that will house the program, if relevant; (c) continuing to teach the core courses in Microbiology for which we are responsible; and (d) working to strengthen ties with other microbiology-oriented units in CALS and across the UA.

B. Strategies to achieve goal

- Participate in cross-unit Microbiology committee to help chart the future of the Microbiology program.
- Continue our strong tradition of teaching in microbiology.
- Encourage SPLS faculty to seek joint positions in the School of ACBS.
- Continue to cultivate appreciation of microbiology-related sciences and personnel in SPLS.

C. Actions

1. Participate in cross-unit committee and leadership roles therein.
2. Investigate joint positions in ACBS.

3. Encourage SPLS faculty whose work relates to microbiology to continue to participate actively in SPLS activities.
4. Explore cross-campus and college-wide collaborations for outreach, research, and related activities that will enhance Microbiology presence on campus.

D. Inputs needed to achieve the goal

- Cohesion among CALS Microbiology faculty with a common goal: enhancing the major and, in future efforts, the graduate program.
- Continued integration of SPLS faculty interested in Microbiology with efforts underway in other units.

E. Objective metrics that will be used to track progress towards attaining goal

- Increase in applicants, enrollees, and graduates of the Microbiology undergraduate program.
- Development of a privately sponsored cross-university Microbiology seminar series.
- Development of internship programs and corporate/private sponsorship for program enhancements.
- Increased recognition of Microbiological research excellence in SPLS and CALS via coverage by the school and CALS websites, faculty honors, and student achievements.

STRATEGIC GOAL THREE:
Enhance Graduate Education

A. Current situation and gap between current situation and desired situation
Our goal is to provide a nationally recognized graduate program, providing training at the highest level for a broad array of careers in plant and microbial sciences.

Metrics that reflect our current situation and our five-year goal:

- Enrollment in PLS + PLP programs (MS and PhD) ○ FY19: 25 students in 11 labs ○ FY24: 30 students in 15 labs
- Time to PhD degree (three-year average):
  ○ FY19: 6.05 yrs ○ FY24: 5.50 yrs

B. Strategies to achieve goal

- ***Recruitment***: Attract nationally competitive applicants directly, as well as through the umbrella recruitment program ABBS.
- ***Financial support*:** Standardize and stabilize funding expectations for 12-month support at nationally competitive levels.
- ***Training***: Enhance student and advisor training opportunities and outcomes in the context of a broad range of careers, technological advances, and societal transitions.
- ***Community building***: Provide an inclusive, supportive environment with clear expectations of tolerance and respect.
- ***Program expansion****:* Consider new degrees, including applied or accelerated MS or dual degrees.

C. Actions

- *Recruitment:*
  - Update Graduate pages in School website annually ○ Maintain active involvement in ABBS recruitment
  - Actively engage with Graduate College recruitment system (Slate)
  - Actively engage in campus summer and winter research institutes (e.g., Latin American Research Program) ○ Ensure funding is available for in-person interviews for top candidates ○ Issue offer letters within one week of the interview
- *Financial support:*
  - Continue to encourage summer support for every student
  - Support faculty to convert off-semester teaching revenue to grad support ○ Provide institutional support for rotations in year one ○ Maintain or expand number of students supported on external fellowships ○ Continue to grow our donor base, prioritizing graduate scholarships ○ Standardize stipends at nationally competitive rates
  - Actively support faculty groups to self-identify and apply for domain-specific training grants; seek program-wide training grant opportunities
  - Actively seek corporate, non-profit, and agency participation in student support
- *Training:*
  - Actively promote student participation in CyVerse and other data training opportunities ○ Actively promote student participation in scientific communication training opportunities ○ Expand available travel funds and promote visits to off-campus labs, participation in

workshops, or other enriching experiences ○ Actively cultivate opportunities for corporate, non-profit, and agency careers
    - Continuously expand curricula to anticipate future areas of need and growth, including relevant aspects of the fourth industrial revolution
    - Support a strong seminar program as a key component of graduate education and experience
    - Improve assessment metrics and procedures to ensure accurate evaluation of training efforts
    - Provide faculty training for successfully mentoring students with diverse career goals in a rapidly changing employment environment
- *Community building:*
    - Actively promote diversity and inclusion among students. ○ Provide faculty training for successfully mentoring students from diverse backgrounds ○ Actively support the Grad Club and their activities with the aim of enhancing professional development and student well being
    - Reward high-achieving students with available scholarship funding after recruitment is complete
    - Enhance interactions with related programs, including Microbiology, Molecular and Cellular Biology, Ecology and Evolutionary Biology, Soil, Water and Environmental Sciences, and others ○ Track graduates of our programs for inclusion in events, mentoring/internship opportunities, and to keep records, which are essential for grant opportunities. ○ Hold yearly faculty retreats to focus on graduate education
    - Encourage student involvement in outreach events, to positively impact the broader community and to reinforce the principle for the students
- *Program expansion:*
    - Develop new fast-track MS and/or BS-MS programs as feasible
    - Initiate and support dual degree programs with partner institutions abroad as feasible

D. Inputs needed to achieve the goal

- Faculty participation in all aspects of the graduate program.
- Centralized funding for TAs, for GenEd, service, and all lab courses.
- Centralized funding for rotations.
- School support for seminar series.
- School support for recruitment “weekend”.
- Prioritization of grad program support in development activities.

E. Objective metrics that will be used to track progress towards attaining goal

- *Recruitment*:
    - Number of applicants
    - Number of top-tier applicants that accept our offers
    - Number of students matriculating into our programs, directly and through ABBS
- *Finances*: ○ Scholarship funds available for first-year program ○ Proportion of students supported on external awards
- *Training*: ○ Number of students participating in internships, workshops, and other professional development activities
    - Number in PhD programs that leave with an MS
    - Publications ○ Years to degree

    - Number of students in professional positions within one year of graduation
- *Community*:
    - Proportion of STEM underrepresented students ○ Number of faculty participating in training opportunities ○ Number of outreach events and number of student participants
- *Program expansion*: ○ New grad courses
    - New grad programs

STRATEGIC GOAL FOUR:
Increase Research Funding and Productivity

A. Current situation and gap between current situation and desired situation

World challenges relevant to agriculture and plant and microbial science include an increasing population and rapidly expanding urbanization, limited natural resources, and increasing environmental pollution. These challenges will require us to rethink how we sustainably produce food, feed, fiber, and fuel in arid environments with limited water, high temperatures, and poor quality soils, while simultaneously improving plant, human and environmental health. SPLS has high-impact fundamental research programs in plant and microbial science with increasing emphasis on 4IR approaches and technologies, effective applied research and extension/outreach programs with strong stakeholder networks, and access to strong and diverse campus entities for partnering (e.g., CyVerse, the Controlled
Environment Agriculture Center, the Department of Veterinary Science and Microbiology, the Department of Soil, Water and Environmental Science, and the Karsten Turfgrass Research Facility). Our goal is to position ourselves as leaders using plant and microbial science to overcome challenges to agriculture in arid environments.

Annual averages for the past 5 years: 41 grants awarded; $6.7 million in research expenditures; 90 peer-reviewed research publications.

- 2019: 42 grants awarded; $7 million research expenditures; 95 research publications.
- 2020: 45 grants awarded; $7.25 million in research expenditures; 100 research publications.
- 2021: 48 grants awarded; $7.5 million in research expenditures; 105 research publications.

B. Strategies to achieve goal

- Support and strengthen research programs of current faculty by increasing communication and collaboration.
- Hire new tenure-track faculty to replace those retiring or leaving the unit, and to expand our research portfolio in areas of strength.
- Increase interdisciplinary and/or intramural collaborations within the School, College, and University to enhance funding from traditional and non-traditional extramural sources (local, state, national, international, industry, commodity, foundations, private investors, and philanthropic organizations).

C. Actions

1. Form consortia of faculty working in focused areas (such as genomics, reproductive biology, microbial ecology, etc.), with increasing emphasis on 4IR initiatives to establish research collaborations for extramural funding opportunities.
2. Continue to enhance interdepartmental communication by conducting annual/semi-annual School research retreats.
3. Participate in joint seminar series with other CALS (including YAC and MAC) and non- CALS units to foster inter-departmental collaborative interactions (e.g. training grants, Science and Technology Center grants, etc.).
4. Focus new faculty hires to enhance the development of theme strategic goals (e.g., arid lands agriculture, data-intensive plant research, digital agriculture) to develop centers of excellence within SPLS/CALS.
5. Initiate SPLS/CALS-wide working groups to identify research infrastructure needs and submit applications, both grant proposals and donor, to acquire said infrastructure

D. Inputs needed to achieve the goal

- Hiring of research-focused, tenure-track faculty to expand our areas of strength and replace retiring faculty members.
- Research consortia/centers in areas of emphasis.
- Joint seminar programs.
- Funds for retreats and workshops.

E. Objective metrics that will be used to track progress towards attaining goal •

Number and dollar value of funding proposals submitted.

- Number and dollar value of funding awards granted.
- Number of outreach and extension events and presentations at scientific meetings (posters, oral).
- Number of peer-reviewed publications.
- Number of research consortia/centers created, number of faculty participating, and number of activities for each consortia.
    - Attendance at and feedback on School research retreats.

STRATEGIC GOAL FIVE:
Support the Land Grant Mission in the School of Plant Sciences

A. Current situation and gap between current situation and desired situation

Arizona agriculture is a $23.3B industry that creates more than 138,000 jobs. Arizona is a leading state in commercial agriculture, producing fresh market vegetables, fruit and nut crops, wheat, alfalfa and cotton that are exported across the US and to more than 70 nations. Urban agriculture is also important in the state and includes nursery and landscape and turf. SPLS Extension Specialists support the industry by conducting applied research and taking the science of the University to the people of Arizona through programs, publications, classes, events and one-on-one teaching.

The ability of SPLS Extension Specialists to support the growing industry is becoming more difficult due to recent retirements and unfilled vacancies. In addition, positions such as a Vegetable Horticulture Specialist, a Tree Nut and Winegrape Specialist, and a Nematology Specialist have been eliminated. The changing Arizona agricultural industry suggests that future extension specialist positions might be modified to reflect new issues. Increased population, urban encroachment, drought, climate change, and diversification of agriculture into new crops, including industrial hemp, all might lead to a re-assessment of the duties of new Specialists. Extension specialists are and can continue to be valuable teachers for SPLS courses taught both on Main Campus and at UA-Yuma.

Therefore, we aim to: continue to support the land grant mission of the School of Plant Sciences and to educate agricultural and horticultural producers in Arizona. Also, we will continue to address non-ag stakeholders such as homeowners and other urban clientele, and managers of rangeland, wildlands, roadsides, and other landscapes containing plants.

B. Strategies to achieve goals

1. Support Extension Decision Making Package to increase funding for extension specialists
2. Improve communication and collaboration between extension specialists and other research-teaching faculty within SPLS.
3. Increase interaction with stakeholders to guide the future of Extension in SPLS and promote Cooperative Extension to stakeholders
4. Hire new Extension Specialists and provide them with adequate start-up funding.
5. Encourage Extension Specialists who have gained continuing status to teach

C. Actions

1. Actively and regularly communicate the importance of extension specialists with administrators and others at faculty meetings and at other opportunities. [Strategy 1]
2. Work with administrators and others to document Extension impact [Strategy 1]
3. Establish Extension Advisory Committee [Strategy 2]
4. SPLS director should meet with stakeholder advisory councils to discuss future of Extension within the School. [Strategy 3]
5. Fill current and upcoming vacant positions quickly, including an Agronomy Specialist at MAC, a Plant Pathology Specialist position at YAC, and a Turf Specialist position [Strategy 4]
6. Increase Extension faculty by at least one Specialist following consultation with stakeholders and SPLS Extension Advisory Committee. [Strategy 4]
7. Encourage specialists to teach using salary increases [Strategy 5]
8. Promote specialist-taught distance learning and online courses [Strategy 5]

D. Inputs needed to achieve the goals

1. Video conferencing available at on-campus faculty meetings and other meetings
2. Funding for hiring and adequate program support packages.

3. Continued Hatch and Smith-Lever funding
4. Additional classrooms with video-conferencing equipment on main campus, remote campuses and at agricultural research stations.

E. Objective metrics that will be used to track progress towards attaining goal

- Legislative approval of Extension Decision making package(s) [Actions 1, 2]
- At least three Extension Advisory Committee meetings per year [Action 3]
- At least one annual meeting between Director and stakeholder advisory councils [Action 4]
- Filled extension specialist positions – compare 2018 with 2025 [Actions 5, 6]
- Main campus and remote campus student numbers for classes taught by extension specialists [Actions 7, 8].