**Strategic Plan for the School of Integrative Plant Science (SIPS)**

**College of Agriculture and Life Sciences - Cornell University**

**23-March 2015**

**Timeline for Development and Implementation of the SIPS Strategic Plan**

* 9 September 2014 to 2 February 2015 the SIPS Executive Committee met 16 times to work on general planning for SIPS and to develop a draft Strategic Plan. The planning process was informed by discussions with SIPS Section faculty, leaders of units and groups working with plants beyond SIPS, and other members of the wider SIPS community.
* 5 February 2015 discussion of the draft SIPS Strategic Plan began in the five Sections, as led by the Section chairs.
* 23 February 2015 the suggestions from the five Sections were integrated by the Executive Committee into a near-final draft.
* 27 February 2015 the near-final draft was distributed to the SIPS community with an invitation for further comment on the plan and its implementation.
* 6 March 2015 the comment period closed, and the (few) suggestions were integrated.
* 11 March 2015 from 2:00-3:00 PM a SIPS Town Hall Meeting was held in B25 Warren Hall (with connections to the Geneva campus and the Long Island Horticultural Research and Extension Center) to discuss (with general approval) the SIPS Strategic Plan and its implementation.
* 23 March 2015 the SIPS Strategic Plan is presented to Dean Boor and the CALS Leadership team.
* April 2015 formal implementation of the plan begins (as coordinated and documented through a newly developed SIPS intranet system), and the Vision and Grand Challenges sections of the plan are used as components of a completely revised SIPS website.
* 2017 the 2015 SIPS Strategic Plan is evaluated by the SIPS Executive Committee and the community to determine if any updates are needed based on the first two years of School activities.
* 2020 a new SIPS Strategic Plan is developed.

**Preface**

*In the coming decades, the world must arrive at solutions to the major challenges of feeding a burgeoning population, mitigating and adapting to climate change, and preserving biodiversity and essential ecosystem functions. Plants underpin all agricultural and natural ecosystems and environmental impacts on plant systems will cascade at local, regional, national, and international scales. But plants will also be the basis for solutions. Innovative approaches and revolutionary breakthroughs in plant sciences will be used to meet these challenges and help secure a sustainable future for coming generations.*

These words introduced the *Proposal for Creating the School of Integrative Plant Science in the College of Agriculture and Life Sciences*, a framework document for SIPS as it was formally launched 6 June 2014. That framework has now been strengthened with an Administrative Support Structure Plan, completed November 2014, and a variety of new operational links between the five Sections that compose the School: Horticulture, Plant Biology, Plant Breeding & Genetics, Plant Pathology & Plant-Microbe Biology, and Soil & Crop Sciences. Importantly, the framework has a new foundation in *Knowledge with a Public Purpose in a Changing World: CALS Strategic Plan 2014*, which describes an overarching mission, values, and goals in six thematic areas for the College, and the rationale for the creation of the School.

The SIPS Strategic Plan introduces a vision for the School and three sets of goals addressing the following interrelated questions:

* What are the most important local and global needs that Cornell plant scientists can address, and what grand challenges can focus SIPS efforts to meet those needs?
* What SIPS capabilities must be strengthened to enhance work on the grand challenges?
* What synergies between the operation of the School and its constituent Sections will improve our ability to serve CALS and SIPS goals?

**Vision**

*Discovery that connects:* From fundamental insights to better plants, sustainably grown, serving the world

The process of fundamental discovery underpins all work in the plant sciences: from the soils in which plants grow to the microbes and other organisms that interact with plants. At its core, plant biology explores the mechanisms that convert genetic information into functioning cells and full organisms and, ultimately, through evolution, into the diversity of plants that define the Earth’s terrestrial environments and support the human population. Revolutions in areas such as systematic theory, structural biology, cellular imaging, and “omics” (from genome to phenome) have unified all biology, yielding gratifying insights into molecular mechanisms and evolutionary processes but also revealing staggering levels of diversity and system complexity. Fundamental discoveries enlarge our understanding of the natural world, engender awe in students, reveal unexpected beneficial applications, and provide foundational knowledge for modern agriculture. Without continuing excellence and innovation in fundamental plant sciences, we will be limited to recycling previous advances in addressing societal needs involving food security and global sustainability. An operating principle of the School will be to affirm and nurture the creative potential of fundamental research on plant, soil, and interorganismal interactions that has made Cornell a worldwide leader in the plant sciences.

“Connectedness” is emerging as a property of the discoveries and activities that have the most explanatory power and beneficial impact, and it is a defining property of systems. Advances in fundamental biology, agriculture, communications technology, and food production highlight the importance of natural and human-made systems and the connections within them. An operating principle of the School will be to identify and maximize empowering connections – from molecules to ecosystems, plants to people, and scientists to citizens.

We envision fundamental insights as actuating three broad aims that can act sequentially: better plants, sustainably grown, serving the world. Regarding better plants, we anticipate that a growing queue for improvements will be generated by new insights into plant cellular systems, plant interactions with emerging pests and pathogens, stresses of a changing climate, better-understood human nutritional needs, culinary preferences, and other uses for plants. Similarly, novel and precision agriculture methods will have the potential to dramatically alter agroecosystems in favor of environmental sustainability and prolonged productivity. All of these advances will have the potential to improve human health, economic activity, and well-being in New York State, the US, and internationally. However, it is important to note that these three broad activities are interdependent. For example, the full success of advancing agricultural practices may depend on plant breeders appropriately optimizing plants, and crops with improved nutritional properties may not benefit many people without appropriate marketing and engaged communication with the public. Thus, an operating principle of the School will be to maximize information flow in all directions across the broad activities aimed at “better plants, sustainably grown, serving the world.”

**I. Grand Challenges Aimed at Plant-Related Local and Global Needs**

We see five local and global needs for the SIPS community to address:

* Foundational knowledge of the structure, function, and evolution of plants, the soils in which they grow, and the microbes and other organisms with which they interact
* Empowered students and engaged and informed societal leaders and citizens
* Informed and engaged growersand consumers: from New York State, to the US, to developing countries
* Food security and human nutrition, health, and economic vitality in the face of climate, population, and resource limitation pressures
* Environmental conservation and sustainable landscapes in the face of climate change and urbanization

We envision the grand challenges as organizing tools with several properties: (1) meet a local or global need; (2) build on strengths within Cornell regarding research, education, and land-grant missions; (3) guide the development of new faculty positions and help attract top candidates; (4) coordinate activity at multiple levels of project engagement among faculty across Sections; (5) attract philanthropic and large-project competitive funding; (6) be understood and supported by the public and stakeholders; (7) inspire and foster global collaborations on global problems. The grand challenges are presented below in association with the needs they serve.

*Foundational knowledge of the structure, function, and evolution of plants, the soils in which they grow, and the microbes and other organisms with which they interact*

1. Investigate plants as model organisms for understanding basic biology, as evolving systems displaying both the unity and diversity of life and as living systems that scale from genome to organism to biosphere.
2. Understand the physical-chemical properties of soils and the basis for soil impact on plant productivity and microbial communities, as well as carbon, nutrient, and related fluxes.
3. Understand the diversity of plant-associated microbes and the rapidly evolving molecular/cellular contacts between microbes and plants that explain interactions ranging from beneficial to pathogenic.

*Empowered students and engaged and informed societal leaders and citizens*

1. Attract and educate undergraduate and graduate students who can connect disciplines, creatively solve problems, integrate complex systems, pursue diverse careers, engage the public, and become professional and societal leaders.
2. Engage policy makers, alumni, philanthropists, and other leaders in society with empowering awareness of advances in plant and soil sciences and the benefits of healthy agricultural and natural ecosystems, using media and direct interactions.
3. Reach out to K-12 students, citizens, and consumers to enhance their appreciation and enjoyment of plants and promote their informed decision making.

*Informed and engaged growers and consumers: from New York State, to the US,* *to developing countries*

1. Work with all members of the farm-to-consumer continuum and extension partners to maximize two-way knowledge flow to improve economic vitality, ecological sustainability, and human health in New York State.
2. Engage growers and landscape managers as research partners to utilize their expertise and ensure relevance to local needs.
3. Extend research advances and outreach internationally through partnerships, internships, international courses, and training of students interested in international research/service.

*Food security and human nutrition, health, and economic vitality in the face of climate, population, and resource limitation pressures*

1. Develop and deploy crop systems that use resources efficiently and have greater tolerance of abiotic stresses, particularly flooding, acid and nutrient-limited soils, drought, and heat.
2. Manage biotic interactions with plants for improved productivity, sustainability, and food safety and security.
3. Discover plant taxa with beneficial attributes, and improve cultivated plants with value-added traits to benefit human health, well-being, and income generation: from aesthetics to plant products.
4. Develop resources, such as improved varieties and management practices, that contribute to economic development in New York State and beyond and enhance well-being and ecosystem services.

*Environmental conservation and sustainable landscapes in the face of climate change and urbanization*

1. Characterize and preserve diversity in natural ecosystems to promote system stability and protect genetic resources for agriculture and human health applications.
2. Develop and deploy sustainable agroecosytems and urban landscapes that are productive, climate-friendly, and feature soil management approaches that increase resource use efficiency, contribute toward mitigation of climate change, and improve soil health.
3. Contribute to enhanced well-being and enjoyment of life by enriching the connections between plants and human experience.

**II. Goals Aimed at Enhancing Work on the Grand Challenges**

1. Promote School-wide expertise, basic competency, and supporting resources in three critical skills:
   1. bioinformatic tools for genomics and other “omics” views of living systems – from organismal systems to the genomics/phylogenetics interface
   2. “big data” computer/mathematical modeling of systems – from systems biology to natural ecosystems to geospatial systems to agro/eco/food systems
   3. engaged communication that more effectively connects people – for education, problem solving, and public benefit
2. Develop infrastructure for technologies that enable critical new directions for SIPS research:
3. “omics”: genome > transcriptome > proteome > metabolome, including needed instrumentation and supporting expertise to study chemical diversity in plants and plant-associated microbes
4. infrastructure for high throughput phenotyping
5. infrastructure for genome editing and associated tools
6. Plant Transformation Facility and other Biotechnology Resource Center tools
7. access to natural areas and cutting-edge field research resources and facilities that efficiently support problem-solving research and interrelated studies on pathogen evolution, diversity, ecology, soil dynamics, and other fundamental issues uniquely addressable in agroecosystems and which support the concepts of “nature and agriculture as a laboratory”
8. Maximize utilization of our unique herbaria and other biological collections and our extensive document and image archives for synergistic research and outreach
9. While embracing established plant model systems, promote the value of domesticated plants as model systems for fundamental biology and improve translational pipelines for a few targeted crops through the collaborative effort of multiple groups
10. focus crops: tomato, apple, grape, berries, maize, wheat, rice, potato, cassava (list to be under ongoing review)
11. genotype to phenotype challenge
12. Enhance the sustainability of funding for SIPS research, extension, and outreach projects through entrepreneurial activities and better alignment with big-problem oriented government and philanthropic funding sources
13. include sustained fundability as a component in the design of projects
14. broaden sources of income for projects through educating SIPS members about intellectual property and commercialization opportunities and resources supporting the translation of discovery into application
15. educate regulators and the public about the benefits of plants with genomes that are edited with Generally Recognized As Safe (GRAS) principles as a source of improved varieties that will enable land-grant institutions to support many special needs of stakeholders
16. measure and better publicize the economic impact and scientific advances of SIPS and the general importance of plants in the world
17. Optimize SIPS operations:
    1. to promote success and connectedness of constituent Sections, administrative staff, academic and technical staff, postdoctoral scientists and visiting fellows, and graduate students
    2. improve logistical connections within SIPS between the Ithaca and Geneva campuses and other locations in New York State, such as the Long Island Horticultural Research & Extension Center, the Hudson Valley Research Laboratory, and the Cornell Lake Erie Research & Extension Laboratory
    3. strengthen collaborations with affiliated institutions: BTI and USDA/ARS
    4. strengthen collaborations with relevant Cornell units and groups: IP CALS, Plantations, Landscape Architecture, Atkinson Center, Chemical Ecology, Cornell Center for Comparative and Population Genomics
    5. strengthen collaborations with relevant faculty programs in the basic biological sciences, the Departments of Entomology, Food Science, Microbiology, Natural Resources, and Nutrition, the Hotel School and Dyson School, and elsewhere in Cornell
    6. coordinate utilization of resources such as farms, greenhouses, growth chambers, and Cornell natural areas
    7. strategically prioritize, advocate, and plan for consolidations and/or major upgrades to facilities that are expensively energy inefficient, obsolete, or out of compliance with current standards for work spaces with natural light
18. Attract and hire the next generation of faculty leaders in the plant sciences for SIPS and its affiliates at Cornell

(III and IV) **Synergisms between the School and Its Constituent Sections**

As noted in *Knowledge with a Public Purpose in a Changing World: CALS Strategic Plan 2014*:

“The five current plant-science related departments in CALS have been consolidated into the School of Integrative Plant Science (SIPS). This consolidation will result in a School that:

* Provides a unifying framework to integrate and coordinate key administrative functions across the current plant science units, while preserving their unique character and purpose;
* Enables these units to work together in a more strategic and cohesive way on matters related to faculty hiring, curricular development and resource allocation;
* Creates a new face for plant science at Cornell, increasing its prominence to a level equal with its scientific and educational importance, and raising its profile to encourage greater student interest in pursuing study in the plant sciences.”

**III.** *Benefits of maintaining identity, prominence, and "unique character and purpose" of the five discipline-based Sections*

1. Represent disciplines with irreplaceable historical traditions (maintained despite name changes over the years)
2. Align with established, recognizable graduate fields
3. Have links to alumni, donors, and stakeholders who relate to specific disciplines
4. Have links to scientific societies with special opportunities for student presentations, networking, leadership, and awards systems
5. Are recognized units for various national rankings (especially the graduate fields)
6. Represent groups with closely interrelated knowledge and activity
7. Enable SIPS to launch "interdisciplinary" initiatives based on internal collaborations
8. Represent "family sized" functional social and supervisory groups

**IV.** *Benefits of the School to the Sections*

1. Strategic planning for sustainable activities of maximum impact, including infrastructure development and farsighted, coordinated hiring of faculty with strong internal and external leadership potential
2. Streamlined interactions with the CALS Communications Office, which can raise both public and institutional awareness of our accomplishments and is an important resource for internal communication with students and other groups
3. Improved web-based extension/outreach (and recruitment) by attracting a broader audience and then providing more coordinated and useful information
4. Better ability to attract support from alumni, philanthropists, foundations, training grants, and various government sources because we are a bigger group capable of addressing grand challenges
5. More efficient negotiation for various resources, such as fellowships, infrastructure, and biological collections, through representation by a large and coordinated group of users
6. Enhanced performance in college metrics through bonuses resulting from the collective activity of SIPS
7. Enhanced best practices for Sections, for example, in faculty and staff mentoring and interactions with scientific societies, alumni, and potential donors, etc.
8. Better coordination of activities that are common across Sections, such as administrative services, seminar announcements, social events, award nominations, etc.
9. Streamlined management of information flow to students, staff, and/or faculty across Sections
10. Development of more connections and collaborations through awareness of research and other activities in different Sections and through socializing and working with colleagues in SIPS-wide activities
11. Coordinated approaches to curriculum development and student services, such as a web-based concept- diagrammed and searchable system for connecting undergraduates to the diverse research programs in SIPS
12. Strengthened education of graduate students in the five graduate fields through an integrated seminar system, development of shared courses addressing laboratory and professional skills, an undergraduate mentoring program with associated fellowships, and SIPS-wide educational/social events
13. Enhanced recruitment of undergraduates to the Plant Sciences major and graduate students to the five graduate fields in SIPS
14. Better coordinated development, use, and support of common resources, from photo archives to instrumentation to farms

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