The need for fruit and vegetable research and extension abounds, offering opportunities for economic development and agricultural innovation that are crucial locally, regionally, nationally, and internationally. Broadly, a larger human population will put unprecedented demands on our food system. This increasing demand coupled with the impacts of climate change will require advanced crop development that takes full advantage of genomics, bioinformatics, synthetic biology and systems biology. Management systems must be devised and delivered to stakeholders that maximize these new technologies and provide safe and secure food. While increasing yield is essential, it is also critical to simultaneously reduce the environmental impacts of agriculture and to devise and implement safe and sustainable approaches to disease and pest management. We must develop better cultural practices, including soil and water management, planting systems and the ability to predict how crops will perform under a variety of environmental and management conditions. In addition, we must contribute to training future scientists and the broader agricultural workforce to maximize our ability to address future challenges and opportunities. These immense possibilities contrast with the current public financial support for food and agriculture research, at a time when significant investments in faculty and infrastructure renewal are critical.

Cornell University’s New York State Agricultural Experiment Station (NYSAES) is uniquely positioned to aid growers, producers, food entrepreneurs, policy makers, and other stakeholders through the strength of its faculty, extension staff, and 132-year legacy of scientific advancement in food and agriculture.

Given this context, programmatic direction for NYSAES must be prioritized in strategic areas with opportunities to build on existing strengths. This strategic plan describes how to leverage this rich history to evolve NYSAES to become Cornell’s focal point for mission-focused research and extension on fruit, vegetable and specialty crop development, management and use.
NYSAES is a preeminent center of research and extension excellence and an integral part of Cornell University’s College of Agriculture and Life Sciences (CALS). The plan presented here specifically contributes to three key objectives of the CALS Strategic Plan 2014: 1) to propel discovery and promote the synergy of disciplinary knowledge in the agricultural and biological sciences; 2) to extend scientific knowledge to sustain agricultural and economic development; 3) to build, maintain and operate facilities that support and reflect the excellence of CALS programs and people.

Faculty, students and staff at NYSAES and the associated Hudson Valley Laboratory and Cornell Lake Erie Research and Extension Laboratory conduct integrated research and extension programs on specialty crops to benefit farms, businesses and consumers while contributing to scientific advancement. The collaborative and integrated focus over a range of disciplines, strong industry relationships, and access to laboratories, fields, orchards and vineyards collectively foster the development and integration of knowledge for meeting the needs of producers and consumers. Geneva-based USDA scientists collaborate with NYSAES faculty on fruit and vegetable crop research and provide access to their germplasm collections. The New York State Integrated Pest Management Program (NYS IPM) extends research and extension capabilities. The Pilot Plant and Vinification and Brewing Laboratory are essential resources for economic development.

NYSAES is considered “a one-stop shop” by clients due to the continuum of research from breeding, physiology, protection and production of these crops to the development of value-added products—and the delivery of research-based information to stakeholders through extension programs. The faculty and staff base, geographical location, field and laboratory facilities and rich history of NYSAES make it a logical choice as a center for fruit and vegetable innovation in New York.

NYSAES faculty and staff will contribute significantly to meeting the needs articulated in this plan. On local and regional scales, the interplay of several factors are elevating the importance and need for the research and extension provided by NYSAES. The burgeoning interest in local food production and specialty crops coupled with proximity to large markets is creating unprecedented opportunities for New York producers. New York farms, with an abundance of water, favorable soils and climate, and available transportation infrastructure can capitalize on these opportunities and, in so doing, contribute significantly to the economy of New York.

Through this focus on fruit and vegetable breeding, management and use, NYSAES contributes to CALS’ Land-Grant Mission, complements Ithaca-campus priorities, and fosters strong interactions between the two campuses. Geneva-based faculty are members of the School of Integrated Plant Sciences [the Sections of Horticulture, Plant Pathology and Plant-Microbe Biology, and Plant Breeding and Genetics (via joint appointments)] and the Departments of Entomology and Food Science. We are active members and collaborators with our colleagues in Ithaca and that will continue.
Food and agriculture in New York adds over $96 billion annually to the state economy. Research is essential to the success of these industries, and NYSAES provides critical information to the fruit and vegetable production and processing sectors. NYSAES is recognized globally for research and extension in plant protection, development of new varieties, optimum plant production systems, systems for food and beverage processing, fermentation technologies and strategies for detecting and mitigating microbial food contaminants. Opportunities for enhancing food and agricultural businesses across New York State abound, and NYSAES is strategically positioned to play a lead role in research and extension on fruits and vegetables.

Major impacts of NYSAES to New York stakeholders will continue to be realized through:

1. Breeding and release of high quality fruit and vegetable varieties that are particularly suited to our regions and provide business advantages to New York growers. New varieties and products from them foster partnerships with agricultural and food industry stakeholders in New York, the United States and internationally.

2. Development of fruit, vegetable and other specialty crops pest management along with cropping system technologies that maximize production, preserve resources, and foster a healthy environment.

3. Support for and partnerships with the value-added plant-based food and beverage product sectors that enhance the prosperity of farm and food businesses.

The quality of NYSAES research, teaching, training and outreach “products” mirrors the strengths of the Station’s relationships with entrepreneurs, business owners, government and industry leaders and organizations that comprise and support the food and agricultural sector in New York State and beyond. Successful implementation of the research, extension and education priorities identified in this strategic plan will have far reaching effects on the New York economy and strengthen the outreach of the CALS and Cornell University.

CALS has the responsibility to steward the resources provided to operate NYSAES and to best use these resources to contribute toward the college’s mission. This requires a strategic plan that is specific to the unique resources, location and opportunities afforded by the NYSAES campus and its faculty, staff and students. This plan by necessity will stress activities at Geneva, but that does not minimize the value we place on our many interactions across our campuses.

While there are clear needs and abundant opportunities for the research and extension that NYSAES provides, there are also three significant challenges that must be met.

1. Over the last decade, nearly a quarter of the faculty at NYSAES have retired or entered into phased retirement, and many more faculty may retire within the next 5 to 10 years. This presents a challenge as well as an opportunity: new scientists will contribute strongly to the innovation that must occur in agriculture, but the resources to enable faculty hiring must be identified. Fundamental and applied research must be retained.

2. Older, antiquated facilities must be renovated to support the research and education envisioned at NYSAES.

3. Faculty and facility renewal are needed at a time when public support for food and agricultural research is in decline. This necessitates development of alternative funding models that include strengthening of public-private partnerships, greater emphasis on educating the public on the importance of agricultural research and extension, and prioritization of resource use so that the college can meet its mission most effectively in the agricultural and food arenas.
Our Vision

As the preeminent institution at Cornell for research, extension, and engaged and participatory learning on fruits and vegetables, we sustain and grow New York-based industries and contribute to food safety, nutritional security and improved human health throughout our state and beyond.

Our Mission

1. Conduct research on the development, protection, production, and use of specialty crops, emphasizing fruits and vegetables, to improve farm viability, benefit consumers, enhance economic growth and create jobs.

2. Advance knowledge in entomology, food science, horticulture, plant pathology, and plant breeding and genetics, as each relates to the above, through interdisciplinary collaborations among researchers, producers, private sector advisors, and Cornell Cooperative Extension.

3. Communicate advancements in developing, producing and protecting specialty crops, to farms, businesses, elected representatives, regulators and consumers.

4. Use the unique combination of facilities, faculty, and staff of NYSAES to provide participatory and engaged learning opportunities to a variety of clients and compliment educational programming at Ithaca to help train the next generation of industry and academic leaders.
A. Research

Goal 1: Breeding & Production. Develop and introduce new fruit and vegetable cultivars and germplasm and integrate genetic technologies and production practices in systems approaches to promote the competitiveness and sustainability of New York agriculture.

Objectives:

1. Develop, test and introduce improved germplasm and cultivars of fruits (e.g., apple, blackberry, grape, raspberry, and strawberry), vegetables (e.g., bean, broccoli, cabbage, pea, sweet corn, and tomato) and the renewable energy crop shrub willow that provide producers, processors and consumers with high quality products.

   **Strategy:** Strengthen the capacity for breeding and genetics of fruit and vegetable crops through new faculty hires and development of improved laboratory facilities.

   **Strategy:** Expand crops being bred if market opportunities, producer and consumer demand, and potential for economic growth deem expansion is warranted.

2. Understand and leverage genetic mechanisms involved in fruit and vegetable quality, climate change adaptations (temperature and water stress) and disease and insect resistance through systems approaches and interdisciplinary collaboration.

   **Strategy:** Enhance genetic mechanisms research by hiring appropriate faculty and by stewarding partnerships with Agricultural Research Service (ARS), Boyce Thompson Institute (BTI) and Ithaca-based faculty.

3. Understand how planting systems, cover crops, seed quality, nutrition, and irrigation interact with crop genetics to affect yield and product quality and the impact of these factors on the development of pests and pathogens in production systems.

   **Strategy:** Foster a systems approach to research on crops of interest through allocation of appropriate resources and faculty hiring.

Goal 2: Plant Protection. Produce and adapt fundamental discoveries to develop improved management strategies against arthropod pests and diseases affecting crops in New York State, to ensure long-term economic vitality while protecting the environment.

Objectives:

1) To excel in research on fundamental and applied biology, ecology and plant resistance mechanisms, genetics, genomics and population biology of plant pathogenic microbes and phytophagous arthropods that will inform new plant protection methods through interdisciplinary collaborative efforts.

   **Strategy:** Enhance our capacity for discovery in discipline-based sciences and their subsequent application to improve pest and pathogen management systems through 1) collaborations with Ithaca-based faculty and 2) by hiring faculty who have the dual capacity to conduct innovative, discipline-based science and to contribute to the development of improved pest management systems.

---

1 Goals are aspirational statements that articulate component parts of the vision. Objectives are directly achievable outcomes that lead to realization of goals. Strategies are approaches to achieving objectives. Specific action items, which are not provided in this document, are tracked and used to evaluate progress in realizing objectives and goals.
2) Develop and evaluate integrated management strategies for pests and pathogens of fruits, vegetables and other specialty crops, including emerging threats and/or invasive species, and facilitate their implementation within an economically and environmentally sustainable framework.

**Strategy:** Enhance our ability to apply research-based information to generate and implement improved pest and pathogen management systems by adding necessary expertise to the team in our current foci of entomology and plant pathology, and by exploring increased collaboration with other disciplines, such as weed science, economics, and natural resources (e.g., water quality).

**Strategy:** Develop, deploy, and manage genetic traits conferring resistance to plant pests and foster research in a cropping systems context (see Goal 1, Objective 3).

### B. Extension, Outreach and Education

Translating research and technological advancements and providing general information about breeding, production, protection, value-added products and food safety to stakeholders is critical to fostering economic prosperity and sustainable agricultural practices, especially in light of climate change, economic challenges and concerns about food safety and security. The NYSAES campus, including the Pilot Plant/Food Venture Center and field research facilities, provides an ideal setting for creating a center for extension and education targeting the fruit and vegetable sectors.

Educating undergraduate and graduate students and the public on issues facing breeding, production, protection, value-added products and food safety is essential for careers in education, research, industry and government and for increasing public awareness and knowledge.

**Goal 1: Education of Producers and Consumers.** Communicate solutions to the challenges facing producers and processors and educate the public about advances in fruit and vegetable breeding, production, protection, and utilization.

**Objectives:**

1) Develop, translate, integrate and disseminate existing and new technological advancements and general information relevant to the breeding, production, protection, harvest and utilization of fruits and vegetables, thereby enabling improved production practices for the benefit of producers, consumers, and the environment.

**Strategy:** Utilize traditional and new communication technologies to deliver programming to diverse stakeholder groups, focusing on areas of greatest strength and need and maximizing collaboration and cooperation.

**Strategy:** Develop modern conference and educational facilities so that NYSAES will be the first choice as a venue for extension, outreach and educational programs.

2) Educate the public and regulatory communities about technical issues related to the production and utilization of specialty crops, to foster an appreciation of the value of local food production and to provide context for an improved understanding of issues (such as climate change and genetically modified organisms) of interest.

**Strategy:** Work with NYSAES faculty and staff, academic department/section colleagues, CALS administration, Cornell Cooperative Extension and CALS Communications to enhance public outreach opportunities.
Goal 2: Value Added & Good Agricultural Practices Training. Assist the food industry in the development and improvement of value-added food and beverage products made from crops of importance to New York and in maintaining the safety of these products.

Objectives:

1) Work with the food industry through the New York State Food Venture Center / Northeast Center for Food Entrepreneurship with technical assistance and training to ensure the production of safe, high quality, and value-added foods.

   **Strategy:** Provide assistance and training programs most needed by the New York food industry.

2) Support the wine, beer, cider and distillate industries by providing customized training and specialized analyses through the New York Wine Analytical Laboratory and the Vinification and Brewing Laboratory.

   **Strategy:** Develop and enhance current training and analytical offerings as defined by industry needs and organizational strengths, while examining ways to maximize revenue from the existing facility.

3) Develop and implement new educational programs on produce safety through the National GAPs (Good Agricultural Practices) Program / Produce Safety Alliance.

   **Strategy:** Use scientific research to further refine Good Agricultural Practices (GAPs) to reduce microbial risks on fruit and vegetable farms.

Goal 3: Graduate student education. Recruit, educate and graduate a diverse and talented graduate student body. Our academic homes are an important part of this education, yet there are unique educational opportunities of being a student of Geneva-based faculty.

Objectives:

1) Educate graduate students in a distinctively integrated and interdisciplinary fashion to prepare them for careers and leadership roles in agribusiness, the food industry, non-profit organizations, biotechnology, governmental research / policy, and academia.

   **Strategy:** Ensure that students have opportunities for interdisciplinary and translational research and extension experience with industry activities.

   **Strategy:** Continue to provide extension/outreach graduate fellowships.

   **Strategy:** Working within the context of graduate fields, identify opportunities for graduate students to gain skills that will enable them to pursue careers outside of the typical academic institution. These skills include, but are not limited to, programming for data visualization and mining, online collaboration, networking, and fundamental business practices.

Goal 2: Provide unique undergraduate educational experiences to enhance the agriculture sector research and employee pipeline.

Objectives:

1) Provide a distinctive, high-quality research experience through the Summer Scholars undergraduate research program, which attracts a diverse group of undergraduates from across the country for a two-month internship.
Strategy: Expand funding and research opportunities for the summer scholars program.

2) Increase opportunities for undergraduate experiential learning through courses (e.g., summer sessions in Ithaca and/or Geneva), independent study opportunities, internships and extension fellowships. Connecting undergraduates to stakeholders is a priority.

   Strategy: Meet with the School of Integrated Plant Science (SIPS) curriculum group and curriculum coordinators in aligned departments to discuss opportunities.

   Strategy: Leverage our Memorandum of Understanding (MOUs) agreements with Hobart and William Smith Colleges and the Finger Lakes Community College to enhance the involvement of their students within our research and extension programs.

3) Facilitate participation of tenured faculty in undergraduate and graduate education on the Ithaca campus to address strategic needs and opportunities.

   Strategy: While some Geneva-based faculty teach courses currently, coordinate with our departments and SIPS so that Geneva-based faculty could teach courses to bridge retirement gaps or provide unique expertise.

Goal 3: Develop certificate programs in agricultural production and food safety.

Objectives:

Provide innovative certificate programs for agricultural and agriculture-support professionals through resident and distance-learning short courses, thereby providing needed competencies to advance crop production and use.

   Strategy: Convene a working group to assess capacity based on existing resources, determine strategic partners and develop a set of recommendations to create certificate programs that fit within CALS and university guidelines for such programming.

C. Organizational Structure

Objectives:

1) Sustain scientific expertise at NYSAES needed to realize the vision by prioritizing faculty hiring at NYSAES in the two identified program areas.

   Strategy: Coordinate faculty hiring to ensure complementarity across the Geneva and Ithaca campuses. New faculty positions for Geneva will address the strategic priorities defined in the NYSAES strategic plan.

2) Strategically hire faculty in core strength areas to assure that our focused efforts in breeding, production and protection are comprehensive, preeminent and effective.

   Strategy: Identify key faculty positions by analyzing program strengths and work with academic units to prioritize faculty that will advance research and deliver extension and education programs.

3) Ensure the integration and coordination of NYSAES strategic planning with that of CALS, the departments/section units represented at Geneva, and the School of
Integrated Plant Sciences (SIPS).

**Strategy:** Integrate the NYSAES strategic plan with those of the departments, sections and schools across the Geneva and Ithaca campuses.

### D. Facilities

Renovation of the Agricultural Sciences Research Laboratory (ASRL), the former Food Science building, is a high priority. The current facility is at risk for catastrophic failure of the electrical and air handling systems. The pilot plant is a crucial facility for many research programs at the Station, for clients of the Food Venture Center and as an important part of the transition of products from the pilot plant to the Ag Technology Park. Renovation of this facility will help meet the need for modern biological laboratories and provide opportunities for the development of a modern extension and education center, which would benefit all programs at the station and aid our new emphasis on certificate programs.

**Goal:** Use the Master Plan to identify priority areas for renovation and also those of low priority for future improvements. A modern conference room is needed for communication with Ithaca and for outreach and training.

**Objectives:** Assess current inventory of buildings, greenhouses and field operations to assess status and establish priorities going forward. Recent coordination and management oversight of growth chambers and greenhouses at NYSAES ensures that energy-efficiency is stressed and that fees are used for regular maintenance and repairs.

**Strategies:** To enhance integration across programs, laboratory space and other NYSAES resources (land, greenhouses) should be assessed from a Station perspective as opposed to historical allocations to programs.

### E. A Leadership Model for NYSAES

NYSAES must integrate with and complement the strategic goals of the college and academic units. At the same time, programs and resources at Geneva need to be distinct from and complementary to those in Ithaca. Achieving these goals will require a leadership structure that can guide strategic decisions with a Geneva focus while integrating with the college and academic units.

To ensure recognition as a world-class institution and to maintain and strengthen CALS and NYSAES within the strategic priorities identified in this plan, programmatic areas identified in the strategic plan will be prioritized at NYSAES. Faculty members in the Plant Protection program area will have disciplinary homes in the Department of Entomology and Section of Plant Pathology and Plant-Microbe Biology (PPPMB) in SIPS. Faculty members in plant breeding, crop management and food product development will have disciplinary homes in the Department of Food Science and in SIPS: Section of Horticulture, and some will have joint appointments in the Section of Plant Breeding and Genetics.

An Executive Committee at NYSAES will be led by the NYSAES director and will include four program leaders, one from each of the disciplines represented within the two research and extension program areas. For example, Plant Protection will have a program leader from both PPPMB and from entomology. Program leaders will be expected to collaborate to ensure coordination and efficiencies within each and across program areas at NYSAES. A main responsibility of the Executive Committee will be to lead and facilitate the implementation of the NYSAES strategic plan. Program leaders will also serve as the NYSAES representative for their academic discipline. There will be quarterly meetings with the SIPS director, section leaders and department chairs in entomology and food science.
With input from faculty in each program area and in consultation with department and section chairs, the director will appoint program leaders. The dean of CALS will appoint the director of NYSAES, department chairs and the director of SIPS. In consultation with the dean and with input from section faculty, the director of SIPS will appoint section chairs.

The director of NYSAES leads the faculty, staff and students of NYSAES in delivering scientifically-based innovation and management practices to advance the fruit and vegetable industries of New York, the region and the world. To do so, the director will guide investment of resources allocated to the Station to fulfill the primary mission of conducting research and extension that leads to improved farm viability, economic growth and benefits to consumers and citizens. The director will also play a key role in articulating the critical and distinctive role that NYSAES plays in CALS’ and Cornell University’s mission to ensure food and nutrition security, human health, and sustainability.