Plant Studies Minor

Program Summary

Agriculture is one of the largest industries in New Jersey. Leading NJ agriculture sectors include nursery and greenhouse plants ($444.8 million), fruits and vegetables ($462.9 million), and field crops ($31.6 million). This minor in Plant Studies prepares students for further study or careers in the areas of food production, ornamental plant care, landscape design, sustainable agriculture (farm, nursery, garden, park, golf course, etc.) management, and plant science education.

The proposed minor in Plant Studies consists of two required courses and three electives. Both required courses (BIOL 110 and CHEM 110) have laboratory sections and attribute to the Gen Ed "Science with Experiential" category. Most of the courses in the elective list ensure hands-on learning experience by utilizing the laboratory, greenhouse, and field resources available on/near campus. Faculty-student research or internship experience on plants is encouraged. The students will be able to identify major flowering plants important to environmental conservation or used as ornaments and foods. They will gain substantial knowledge on the principles and practices of plant care, as well as emerging technologies in plant cultivation such as hydroponics, and develop critical thinking skills to interpret data and solve practical problems in plant-related studies.

Impact on Other Ramapo Undergraduate Programs

The minor is composed of existing courses. Most are required or elective courses in the Biology, Environmental Science, and Environmental Studies curriculums. The required courses are offered at least twice a year. Most of the electives are offered once a year. The three majors involved have indicated there would be no problem to accommodate a few extra students. This minor program would not compete with any major.

Program's Need

Student Demand:

At the Biology convening group meetings, potential certificate, concentration, or minor programs that would complement the current Biology curriculum were discussed. Plant-related knowledge turned out to be essential but underrepresented in the Biology major.

On the other hand, more than a few students expressed interest in a plant science/horticulture minor in the past, upon learning plants' relation to our society as foods, ornaments and medicines in 100-level biology courses. Among the students who developed serious interest on plants, many came across some difficulty in seeking a clear curriculum guide to expand their vision on this subject and to prepare for graduate program application.

Alignment with College's Strategic Plan:

This minor program aligns with Goal 1 of the strategic plan, which states "Ramapo College advances academic excellence and student engagement in the undergraduate experience

through its General Education Program and major and minor programs". Interdisciplinary and experiential learning is particularly emphasized in this minor program.

Similar Programs in NJ and Neighboring States:

There are very few Plant Science/Horticulture undergraduate programs in New Jersey. The only B.S. program (major/minor) is offered at Rutgers-New Brunswick. Mercer County Community College provides an A.S. degree in Plant Science. A couple of other community colleges in NJ provide A.A.S. degrees in Horticulture. The scarcity of Plant Science/Horticulture programs also remains in neighboring states. All relevant programs found are listed below.

Degree	Programs	College/University in NJ
B.S.	Plant Science	Rutgers University - New Brunswick
A.S.	Plant Science	Mercer County Community College
A.A.S.	Horticulture	Bergen Community College
A.A.S.	Landscape and Horticultural Technology	County College of Morris
A.A.S.	Ornamental Horticulture	Cumberland County College
A.A.S.	Ornamental Horticulture	Mercer County Community College
Certificate	Horticulture	Brookdale Community College

Degree	Programs	College/University in Neighboring States
B.S.	Plant Sciences	Cornell University
B.S.	Plant Sciences	Penn State
B.S.	Horticulture	University of Connecticut
B.S.	Plant Science	University of Delaware
B.S.	Botany	Connecticut College
B.T.	Plant Science	SUNY Cobleskill
A.A.S.	Horticulture Production	SUNY Morrisville State College

Program's Anticipated Enrollment

Through communication with students and consulting the faculty who taught relevant courses, we expect 2-3 students per year, for a total of 8-12 students enrolling in the minor across time.

Additional Resources Need

Home school:	Theoretical and Applied Science
In collaboration with:	Biology, Environmental Science, Environmental Studies
Proposed convening group:	Yan Xu (BIOL, convener), William Mitchell (BIOL), Eric Karlin (ENSC), Eric Weiner (ENSC), Ashwani Vasishth (ENST), Howard Horowitz (ENST)

Program Assessment

Program Goals, Learning Outcomes and Assessment:

Graduates of the minor in Plant Studies will be able to:

1. Understand the role of plants in agriculture, society and the environment
2. Learn basic knowledge of plant life and practical skills to grow and care for plants
3. Propose a hypothesis and interpret data in a plant study through critical thinking

4. Communicate effectively in oral and written formats to transmit technical information on plants to society

Alignment of Program Outcomes to All-College Goals:

All-College Goals	Goal 1	Goal 2	Goal 3	Goal 4
Interdisciplinary	X	X		
Experiential		X	X	
Critical Inquiry	X		X	
Communication				X
In-depth Knowledge	X	X		
Understanding the World	X	X		

Program's Institutional Context

College's Mission:

This minor program relates closely to interdisciplinary learning and experiential learning, two of the four pillars of Ramapo College. Several electives fulfilling this minor also emphasize on sustainability, specifically in agriculture and plant production, which is another important value widely recognized by the campus community.

School of Theoretical and Applied Science's Mission:

The minor program aligns with the mission of TAS in that it prepares its graduates to be scientifically literate citizens and lifetime learners; it meets the needs of the contemporary marketplace and community; and it emphasizes on practice and public service.

Degree Requirements

Curriculum:

The minor consists of 5 courses, 4 credits each (total: 20 credits). At least 1/2 of the courses fulfilling a minor must be distinct from the student's major. That is, three of the five courses required for a minor cannot be used towards fulfillment of major requirements. Minors are open to students regardless of school affiliation.

Required courses:

Fundamentals of Biology I (BIOL 110) – Gen Ed – Science
Fundamentals of Chemistry I (CHEM 110) – Gen Ed – Science

Electives (Choose three from the following list):

General Ecology (BIOL 221) or Theoretical and Field Ecology (ENSC 210)

Plant Physiology (BIOL 324) – Revise the pre-requisites to BIOL 110 and CHEM 110
Field Botany (BIOL 320)
Medicinal Plants (BIOL 247) – Revise the pre-requisite to BIOL 110
Topics: Native Plant Landscapes (ENST 390)
Sustainable Agriculture (ENST 339)
Forest Resources (GEOG 304)
Ecological Field Research (ENSC 416) [*The project must relate to plants]
Independent Study or Internship [*The project must relate to plants; upon approval by a faculty advisor]

Sequencing:

1. BIOL 110 and CHEM 110 are the pre-requisite courses for BIOL 221, ENSC 210, and BIOL 324.
2. BIOL 221 or ENSC 210 is the pre-requisite course for BIOL 320.
3. Fall courses: BIOL 110, CHEM 110, BIOL 221, BIOL247, BIOL 320, ENST 390, ENSC 416, GEOG 304
   Spring courses: BIOL 110, CHEM 110, BIOL 221, BIOL 324, ENSC 210, ENST 339
   Summer course: BIOL 110

Advisement information for the typical populations who may claim this minor:

1. **BIOL/INSS majors**: Because the two required courses and an elective (BIOL 221 or ENSC 210) are also required in the major, three additional electives are required to complete the minor.
2. **ENSC majors**: Because the two required courses and two electives (ENSC 210 and ENSC 416) are also required in the major, three additional electives are required to complete the minor.
3. **ENST majors**: Because one required course (BIOL 110) and three electives (ENST 339, ENST 390, and GEOG 304) can be used towards fulfillment of major requirements, three additional courses are required to complete the minor.
4. **Non-science majors**: Because either required course can be used as "Gen Ed-Science" towards fulfillment of major requirements, four additional courses are required to complete the minor.

Course Descriptions (All courses are 4 credits)

Fundamentals of Biology I (BIOL 110): An introduction to the principles of biological science. This first semester of a two-semester sequence will cover the cell from its chemical composition, structure, and function to the nature of information coding and transmission. This course also surveys the major phyla of animals, plants and fungi. Three hours of lecture and four hours of recitation/laboratory. Required for some science majors. NOTE: Dissection of plant or animal material is carried out in the laboratory portion of this course. Please refer to the Student Handbook for the College's dissection policy. Lab Fee. **Course Attributes:** GE-SCIENCE W EXPERIENTIAL, WRITING INTENSIVE **Prerequisites:** Must have at least D in CRWT 102 - CRITICAL READING & WRITING II This course can be taken concurrently

Fundamentals of Chemistry I (CHEM 110): This course offers a comprehensive introduction to chemistry for science majors. Chemistry is a mature science that continues to expand and evolve in step with recent developments in science and technology. This course introduces students to the language and theoretical foundations of chemistry. Students will learn to conceptualize abstract ideas about atoms and molecules and relate them to observations in the laboratory. Students will perform experiments that put into practice the ideas discussed in lecture. This course will provide a basic study of atomic structure, chemical measurements, chemical formulas, equations, chemical reactions, nomenclature, gas laws, quantum theory, periodicity, ionic and covalent bonding and chemical bonding theory. Required for Chemistry, Environmental Science, and Biology majors, and recommended for Physics majors. The depth and breadth of the topics covered meet or exceed the standards of the American Chemical Society. **Course Attributes:** GE-SCIENCE W EXPERIENTIAL **Prerequisites:** None

General Ecology (BIOL 221): An exploration of the field of ecology, with emphasis on ecosystem function and structure, interrelationships of plant and animal communities, population dynamics, biogeography, and a survey of representative ecosystems. **Prerequisites:** Must have at least D in BIOL 110 - FUNDAMENTALS OF BIOLOGY I: LECTURE AND LAB This course cannot be taken concurrently **AND** Must have at least D in CHEM 110 - FUNDAMENTALS OF CHEMISTRY I: LECTURE AND LAB This course cannot be taken concurrently

Theoretical And Field Ecology (ENSC 210): An exploration of the field of ecology, with emphasis on ecosystem function and structure, biodiversity, interrelationships of plant and animal communities, population dynamics, biogeography, and a survey of representative ecosystems. Field laboratories introduce students to the ecology and natural history of forest ecosystems in New Jersey, teach students basic skills used by field ecologists, especially pertaining to independently identifying organisms and observing ecological phenomena, and introduce students to how ecologists design and conduct field research. Lab Fee. **Prerequisites:** Must have at least D in BIOL 110 - FUNDAMENTALS OF BIOLOGY I: LECTURE AND LAB This course cannot be taken concurrently **AND** Must have at least D in CHEM 110 - FUNDAMENTALS OF CHEMISTRY I: LECTURE AND LAB This course cannot be taken concurrently

Medicinal Plants (BIOL 247): Perspectives in the history, development and applications of wild and cultivated plants possessing properties for sustaining health, healing ailments and curing diseases. Emphasis is on the identification, distribution, propagation, and cultivation, of those determined to have medicinal, nourishing, psychoactive, or injurious qualities. Attention is also given to certain species used exclusively for culinary purposes **Prerequisites:** Must have at least D in BIOL 110 - FUNDAMENTALS OF BIOLOGY I: LECTURE AND LAB This course cannot be taken concurrently

Plant Physiology (BIOL 324): This course emphasizes on understanding the funamental mechanisms for plants to function and learning applicable techniques for gardening. Topics include: water and nutritional requirements, carbon balance, plant growth regulators, dealing with unfavorable environmental conditions, and plant biotechnology. A lecture and a greenhouse/laboratory practice will be combined into each week's class. Lab Fee: $50.

Prerequisites: Must have at least D in BIOL 110 - FUNDAMENTALS OF BIOLOGY I: LECTURE AND LAB This course cannot be taken concurrently **AND** Must have at least D in CHEM 110 - FUNDAMENTALS OF CHEMSTRY I This course cannot be taken concurrently

Field Botany: Angiosperms (BIOL 320): An ability to identify plants is a fundamental component of many field oriented biological studies, particularly in wetland delineation. Students will learn the distinguishing characters of major families of angiosperms (flowering plants) and gain skills in the identification of plants placed in these families. In addition, students will be introduced to basic methodologies in undertaking botanical field surveys. Lab Fee. **Prerequisites:** Must have at least D in BIOL 221 - GENERAL ECOLOGY This course cannot be taken concurrently **OR** Must have at least D in ENSC 210 - THEORETICAL AND FIELD ECOLOGY LEC/LAB This course cannot be taken concurrently

Ecological Field Research (ENSC 416): This course focuses largely on semester-long, independent field research projects that are designed and implemented by student teams. Primary objectives are for students to: (a) learn how to creatively design, carry out and present independent lines of field research; (b) broaden their knowledge base in forest ecology field methods, research designs, statistical analyses and theory; (c) improve skills at evaluating, interpreting and writing about scientific articles from refereed journals. ENSC 416 is required for the Environmental Science major, and serves as an elective for the Biology and Environmental Studies majors, and for the Environmental Science minor. **Course Attributes:** WRITING INTENSIVE **Prerequisites:** Must have at least D in CHEM 112 - FUNDAMENTALS OF CHEMISTRY II: LECTURE AND LAB This course cannot be taken concurrently **AND** Must have at least D in CRWT 102 - CRITICAL READING & WRITING II This course cannot be taken concurrently **AND** Must have at least D in ENSC 210 - THEORETICAL AND FIELD ECOLOGY LEC/LAB This course cannot be taken concurrently **AND** Must have at least D in ENSC 345 - RESEARCH DESIGN & STATISTICS This course cannot be taken concurrently

Sustainable Agriculture (ENST 339): The course will compare conventional agricultural systems with sustainable agriculture. The course will specifically study the field of agroecology which teaches agriculture from an ecological perspective. The course will review agricultural design on both a large scale and for the small homestead to reduce environmental impacts from agriculture. The horticultural industry, landscape practices, and habitat restoration will also be considered. A final project will produce a conceptual landscape plan for a home site. A section of the course will also have a practical component where students will be able to garden; producing a crop from conception to harvest. **Prerequisites:** Must have at least D in ENST 207 - PUBLIC POLICY This course cannot be taken concurrently

Topics: Native Plant Landscapes (ENST 390): Native Plant Landscapes is a sustainable horticulture course that features the use of native plants in both the landscape industry and in the habitat restoration/re-vegetation ecosystems; with a new emerging discipline in the horticultural industry that involves sustainable techniques. There will be a review of permaculture, native plant gardens, low maintenance turf, use of meadows, rain gardens, wetland construction and restoration, invasive plants, re-vegetation of degraded sites, and habitat restoration. The course

will follow the principles of right plant/right place with the use of native plants. **Course Attributes:** SS-Sch Core-Sustainability **Prerequisites:** None

Forest Resources (GEOG 304): This course provides an introduction to forests and their management on the local, national, and global scales. Field work is designed to familiarize students with basic forest sampling methods. Natural factors examined include basic ecosystem structure, nutrient cycles, succession, climate, fire, soils, water, and wildlife. Cultural factors include a review of management practices in tropical, temperate, and boreal forests, with special focus on deforestation and reforestation. The concepts of multiple-use and sustained-yield are examined from various viewpoints. **Course Attributes:** SS-Sch Core-Sustainability **Prerequisites:** Must have at least D in GEOL 105 - FUNDAMENTALS OF GEOLOGY: LEC/LAB This course cannot be taken concurrently **OR** Must have at least D in ENSC 103 - INTRODUCTION TO ENVIRONMENTAL SCIENCE This course cannot be taken concurrently **OR** Must have at least D in ENST 215 - ENVIRONMENTAL HISTORY This course cannot be taken concurrently **OR** Must have at least D in ENST 209 - WORLD SUSTAINABILITY This course cannot be taken concurrently **OR** Must have at least D in GEOG 101 - PHYSICAL GEOGRAPHY This course cannot be taken concurrently **OR** Must have at least D in GEOL 101 - INTRODUCTION TO GEOLOGY This course cannot be taken concurrently