Why Study Tropical Agriculture and the Environment (TAE) at the University of Hawai‘i at Mānoa?

An exceptional learning experience in a place like no other...

In this remarkable setting, students in the Tropical Agriculture and the Environment (TAE) undergraduate program at the University of Hawai‘i at Mānoa (UH Mānoa) learn how to responsibly manage land, water, crops, and agricultural systems. Our STEM undergraduate and graduate degree programs prepare students to solve complex problems using innovative applied science methods, with the goal of improving plant production, ensuring a sustainable safe and abundant food supply, to protect the environment and meet our community’s needs.

Despite today’s challenging economy, the U.S. Department of Agriculture predicts promising employment prospects for TAE students. The United States currently generates an estimated 54,400 annual job openings in the agricultural, food, and renewable natural resources sectors for individuals holding baccalaureate or advanced degrees, while at the same time fewer plant scientists, soil scientists, and horticulturalists are entering the job market. On average, 29,300 graduates in agriculture and natural resources enter the work force each year, as do about 24,200 degree holders in allied fields. In the next several years, demand for skilled agriculture, forestry, and environmental science graduates is expected to outstrip supply.

Optimizing Our Resources

By 2050, you, your children, and your grandchildren may be sharing the planet’s limited resources with 9.1 billion people. Worldwide food demand is expected to increase by 70%, and an additional 120 million hectares of land may be needed for food production in developing countries. As a soil scientist, you can help farmers use their land more sustainably, efficiently and safely. While nutrient-poor soils can limit crop yields, adding too much fertilizer increases production costs and can damage aquatic environments and sources of drinking water. Soil organic matter increases retention of water and minerals that plants need for growth. With optimized soil nutrient levels and improved soil structure, we can sustainably grow more food per acre.

Developing A Healthy World

Fruits and vegetables are essential for good health. In the developing world, vitamin A deficiency affects about one-third of all children and contributes each year to the death of 670,000 children under the age of five. In the United States, diets that include generous portions of fruits and vegetables may offer protection from stroke, type 2 diabetes, cardiovascular disease, hypertension, and some types of cancer. As a plant scientist, you can help increase the availability of wholesome, nutritious food by breeding fruit and vegetable crops that tolerate pests, diseases, or adverse conditions, provide enhanced levels of vital nutrients, or spoil less quickly. By identifying postharvest practices that minimize damage and decay, you can prevent food losses and waste.

Caring For Our Environment

The relative severity of future climate change hinges on how much we curb CO2 emissions during the next 40 years. A widely adopted goal—limiting global warming to 2°C above pre-1900 temperatures—is predicted to require cutting CO2 emissions to one-half of 1990 levels by 2050. Faculty who are part of the TAE academic program are investigating how we can sustainably use plants and soils to limit greenhouse gas emissions. Hardy non-food crops that thrive on marginal land can provide biofuels without displacing
food production. Generating biochar (stable charcoal) from agricultural wastes and using it as a soil amendment can sequester carbon in soil while improving soil fertility. Rooftop gardens or plant beds, known as green roofs, can help insulate buildings and provide energy savings.

**Helping Hawai‘i Achieve Greater Self Sufficiency**

Agricultural advances can help Hawai‘i achieve greater self-sufficiency that is sustainable and resilient. Our reliance on imports, which represent 85 to 90 percent of our food and more than 90 percent of our energy needs, makes us more vulnerable to natural disasters, invasive species, human misdeeds, and rising fuel prices. Keeping agricultural land in crop production conserves green, open space and allows rainwater to recharge our aquifers. The work you do as a TAE student and graduate can help shape a more sustainable and affordable Hawai‘i for future generations.

**Overview**

How can we feed, clothe, and provide energy for 9.7 billion people by 2050 and sustainably use and protect natural resources and biodiversity? The new Tropical Agriculture and the Environment (TAE) major offers numerous career paths for students interested in becoming part of the scientific solution to some of the most pressing issues we face in the 21st century. TAE offers a Bachelor of Science degree with hands-on knowledge of sciences and technologies related to plant, soil, and pest management in agricultural. urban, and natural environments with a focus on the tropics.

**Choose From Five Diverse Tracks:**

**Environmental Soil Sciences**

Healthy soils are essential for sustaining vital processes for living systems. Learn how healthy soils are generated, maintained, and restored in agricultural and natural systems.

**Invasive Species Management**

An incredible influx of pests threatens the sustainability and viability of agricultural and natural systems. Study the biology of and novel management approaches for controlling invasive insects, plant pathogens, and weeds.

**Landscape Horticulture**

Plants form an integral part of our urban habitats and influence many facets of our daily lives. Master the elements of landscape design and implementation.

**Plant Physiology and Genetics**

Plants are complex and diverse organisms that continue to challenge our understanding of behavior, communication, and evolution. Delve into their inner workings.

**Plant Production and Management**

The tropics pose particular challenges for the production of plant-based food, fiber, and energy. Learn how you can contribute to sustainable and secure production.
Other options for study:

Agribusiness Certificate
Earn a certificate in the business and management of agricultural operations. Gain the skills needed in agribusiness management and entrepreneurship.

Plant Production and Management Minor
Complete a minimum of 15 credits of non-introductory, upper-division-level courses to add a minor in Plant Production and Management to your degree. Contact Dr. Ken Leonhardt (leonhard@hawaii.edu) for more information.

Admission

New students who apply to the University of Hawai‘i at Mānoa (UHM) as first-year students or transfer students may apply directly to the program by specifying Tropical Agriculture and the Environment (TAE), formerly Tropical Plant & Soil Sciences (TPSS) as their major on their application form. Please visit the Office of Admissions website for details about applying: http://manoa.hawaii.edu/admissions/

Students who have taken courses at another university or community college outside of the University of Hawai‘i system must arrange to have their official transcripts sent to the UH-Mānoa Admissions Office for evaluation of transfer credits. Courses not meeting the university core requirements, but are acceptable academically, will be transferred and counted as elective credits.

Transfer students can check the “Transfer Credit Database” created by the UH Admissions Office to see how your courses transfer to UHM, http://www.hawaii.edu/transferdatabase/.

Upon entering the program, students will be required to meet with academic advisors and faculty advisors to identify their career objective. CTAHR academic advisors are available at ctahradv@hawaii.edu, schedule an appointment at ctahradv.youcanbook.me.

Students wishing to transfer from another UHM program must submit the CTAHR College and Curriculum Transfer Request form. The request form is available from advisors. Schedule an appointment with a CTAHR academic advisor by visiting https://ctahradv.youcanbook.me/. Status as a TAE major is not official until all necessary paperwork has been completed and processed. Students are encouraged to apply to the program within the first month of any given semester to allow adequate time to process their transfers prior to registration for classes.

Degree Requirements

The TAE program sheets and four year plans can be found at the following link: http://manoa.hawaii.edu/ovcaa/programsheets/. Please scroll down the page to the College of Tropical Agriculture and Human Resources.

Accepted students who have set up their UH username and password may also find their requirements on their STAR GPS Registration page. Log onto your STAR Account by visiting: https://www.star.hawaii.edu/.
Registration

Students register for courses online through STAR GPS Registration. STAR GPS Registration is an easy-to-navigate registration system that shows courses students need to graduate in a timely manner and allows students to personalize their academic plan to fit their unique college experience. STAR GPS Registration allows students to do the following:

- Register for classes that count directly into their degree/credential so they don’t go off track
- A visual calendar of the classes students are choosing and how they fit together
- Direct integration of students’ class schedule into their Google calendar
- Easily switch classes using the add/drop options
- Search for classes at any UH campus
- View transcript

For help about STAR, students can meet with an academic advisor or visit the help website: https://www.star.hawaii.edu/help/#. Registration dates and times are published on the Registration Timetable: http://myuhinfo.hawaii.edu/object/uhmtimetable.html

Rewarding Career Opportunities

Tropical Agriculture and the Environment graduates pursue careers as scientists and practitioners in plant breeding, pest management, soil conservation, plant physiology, biotechnology, science education, agricultural production, landscape design, and more.

TAE graduates find employment opportunities in businesses, governmental agencies, international organizations, and academic institutions.

Careers are open to graduates as scientists, educators, managers, marketers, merchandising and sales representatives, social services specialists, and agriculturalists trained in all aspects of plant production, management, breeding, and genetics. Entrepreneurship opportunities exist in food and ornamental plant production as well as the landscape industries.

Our graduates become researchers, consultants, teachers and professional officers. They accept jobs in private firms, universities and government agencies, or they run their own businesses. The diversity of agricultural careers places many of these jobs in cities rather than farms. The U.S. Bureau of Labor Statistics (https://www.bls.gov/ooh/) shows increasing demand for graduates with a Bachelor’s degree related to food and agricultural sciences.

Our graduates are employed as

- Agricultural production managers
- Biotechnologists
- Commercial researchers
- Conservationists
- Consultants and managers
- Ecologists
- Educators
- Environmental managers
- Horticulturists
- Landscape designers, installers and managers
- Molecular biologists
- Pest control specialists
- Physiologists
- Plant breeders
- Plant pathologists

**Current Openings**

American Society for Horticultural Science: [https://ashscareers.careerwebsite.com/](https://ashscareers.careerwebsite.com/)
Crop Science Society of America (Horticulture): [https://www.crops.org/careers](https://www.crops.org/careers)
American Society of Agronomy (Agronomy): [https://www.agronomy.org/careers](https://www.agronomy.org/careers)
Soil Science Society of America (Soil Sciences): [https://www.soils.org/careers](https://www.soils.org/careers)
Hawaiʻi Department of Agriculture: [http://hdoa.hawaii.gov/jobs/](http://hdoa.hawaii.gov/jobs/)
Useful Websites for Students Entering into the University of Hawai'i

University of Hawai'i Home page [http://www.hawaii.edu](http://www.hawaii.edu)

All information for students covering how to apply, academic calendar, financial aid, catalog, transfer credit search, new database, on-campus activities, housing (dorms), parking, etc.

UH Mānoa General Catalog [http://www.catalog.hawaii.edu](http://www.catalog.hawaii.edu)

UH Academic Calendar [http://www.hawaii.edu/academics/calendar](http://www.hawaii.edu/academics/calendar)

My UH Services [http://myuh.hawaii.edu](http://myuh.hawaii.edu)

MyUH Services is a mobile-optimized, one stop shop for UH business tasks, form, apps and more. It includes one-click access to services customized for students, faculty and staff across our 10-campus system.

STAR [http://www.star.hawaii.edu](http://www.star.hawaii.edu)

STAR for students is the online degree tracking system for UH. You can view your degree requirements, register for classes, search for scholarships, and view your transcripts through STAR.

College of Tropical Agriculture and Human Resources’ Home Page [http://www.ctahr.hawaii.edu](http://www.ctahr.hawaii.edu)

Select “Academic and Student Affairs” will open all the programs up for students interested in all that CTAHR has to offer for Undergrad and Graduate Programs, financial aid/scholarship information, course requirements and information on who we are, Department, Faculty and Staff as well as publications and research projects.

College of Tropical Agriculture and Human Resources Academic Advisors [https://ctahradv.youcanbook.me/](https://ctahradv.youcanbook.me/)

Use this website to make an appointment with our academic advisors. Advisors can assist you with developing a degree plan and making sure you’re taking the appropriate classes for graduation. Meeting with an academic advisor is mandatory every semester.

Tropical Agriculture and the Environment Program [http://manoa.hawaii.edu/ctahr/tpss/future-students/program-description](http://manoa.hawaii.edu/ctahr/tpss/future-students/program-description)

This website provides information on the TAE program.

General Education – UH Core requirements and class listings: [http://www.catalog.hawaii.edu/corerequirements/coreRequirements.html](http://www.catalog.hawaii.edu/corerequirements/coreRequirements.html)


This website shows information on residency requirements and how your credits transfer into UH Mānoa.
Student Academic Support Services

Access to student academic support services is important to ensure your success while a student at the University of Hawai‘i. Below is a listing of some of these services that can also be found in the University of Hawai‘i catalog (http://www.catalog.hawaii.edu/undergrad-ed/undergrad4.html).

**Office of Civic and Community Engagement** offers UH Manoa students and community agencies the opportunity to participate in a partnership of volunteer service.

**First Year Programs** ease the transition of new students into the academic and social communities at UH Manoa. First-Year Programs provide the opportunity to develop personal relationships with faculty and other students, enhance active involvement in the educational process, and build connections to UH Manoa.

**International Student Services** provides assistance to international students who come from more than countries to study at UH. Students are advised and helped to adjust to the local and U.S. cultures. Website: https://www.hawaii.edu/issmanoa/.

**Kokua Program (Disability Access Services)** provides disability access services to students with documented physical and/or mental disabilities. Services include alternative media production, counseling, early registration, note-taking, sign language interpreting, technology access, testing accommodations and campus transportation. Website: https://www.hawaii.edu/kokua/.

**Learning Assistance Center** provides tutoring, workshops, Supplemental Instruction (SI), and one-on-one appointments in which students learn appropriate study strategies and problem solving skills to achieve their academic goals.

**Mānoa Advising Center** serves as an advising office for exploratory students who have not yet declared a major.

**New Student Orientation Program** offers information sessions for first-time students and transfer students.

**Student Success Center** in Sinclair Library offers students a welcoming and convivial place to study and to learn, and provides them the information and skills they need to be successful in their academic career and beyond. The center provides seating that facilitates collaborative learning, is open long hours, and permits students to bring their own snacks, all in a space that has natural light and air.

**Student Support Services** is a federally funded program that provides academic advising and planning, special courses, financial aid advice, graduate and professional school advising, tutoring, mentoring, and academic enrichment activities to program students enrolled at UH Mānoa.

**Mānoa Writing Center** provides free services to equip students with appropriate writing skills so they can become better and more confident writers. Website: https://sites.google.com/a/hawaii.edu/writingcenter/home.

Do not hesitate to discuss your needs with your academic degree advisor who can help refer you to the appropriate resource.
Course Descriptions

TPSS courses viewable online at:
http://www.catalog.hawaii.edu/courses/departments/tpss.htm

TPSS 120 (Alpha) Plants for People (1) The origins: social, cultural, and ceremonial traditions; culture; food and nutritional properties. Processing of a variety of tropical horticultural plants are presented, with tasting sessions and optional field trips. Topics will rotate among (B) beverage crops (e.g., coffee, tea, chocolate, kava, fruit juices); (C) herbs, spices, and flavoring (selection of examples to be determined); (D) tropical fruits (assortment offered depends on availability during semester); (E) ornamental plants (flowers, houseplants, popular landscape plans, bonsai, ethnic ornamentals). Does not count towards TPSS major. Pre: consent. DB

TPSS 156 Natural History and Conservation of Hawai'i Island (3) The formation of the Hawaiian Islands, establishment of their native terrestrial and marine flora and fauna, and human impacts and conservation. A-F only. Co-requisite: 156L. (Summer only) DB

TPSS 156L Natural History Field Trips on Hawai'i Island (1) Field trips for Natural history and Conservation of the Hawaiian Islands. A-F only. Co-requisite: 156. (Summer only) DY

TPSS 200 Agriculture, Environment, and Society (3) Relationship of plants, soils, and the environment, and how they relate to cultural practices and society in agroecosystems with an emphasis on Hawaii'i as a model system. DB

TPSS 220 Organic Food Crop Production (2) Combined lecture/lab on the theory and practice of certified organic food production. Field visits to organic farms/markets included. Open to nonmajors. (Fall only) DY

TPSS 251 Scientific Principles of Sustainability (3) Introduction to the scientific principles of sustainability, including the ecology of managed and natural ecosystems, global change biology, ecological principles of natural resource management, renewable energy technologies, and the environmental impacts of humans. (Cross-listed as SOCS 251 and TAHR 251)

TPSS 300 Tropical Production Systems (4) (3 Lec, 1 3-hr Lab) Comparisons and contrasts of crop management systems, techniques, and technologies in protected and open field production of tropical crops. Pre: 200 or consent. DB

TPSS 304 Fundamentals of Soil Science (4) (3 Lec, 1 3-hr Lab) Origin, development, properties, management of tropical soils; classification of Hawaiian soils. A-F only. Minimum prerequisite grade of C or consent. Pre: CHEM 161 and 161L, or consent. (Fall only) (Cross-listed as NREM 304) DP DY

TPSS 311 Current Topics in Plant Science (1) Undergraduate seminar that provides the presentation and discussion of topics of current relevance to students preparing for careers in applied plant sciences. Oral focus designation. A-F only. Pre: 200 or NREM 210, or consent. (Cross-listed as NREM 311)

TPSS 322 Marketing Perishable Products (3) Problems, agencies, functions, costs, prices, regulations affecting marketing: proposed improvements. Pre: ECON 130, NREM 220; or consent. (Alt. years) DS
TPSS 336 Renewable Energy and Society (3) Combined lecture/discussion regarding the ability of renewable energy technologies to meet local, national, and global energy demands and their potential impacts on the environment and society. Pre: consent.

TPSS 341 Accounting and Financial Analysis (3) Principles and methods of agricultural accounting. Preparing and interpreting financial statements. Sources and costs of credit, capital budgeting, tax management, estate planning. Repeatable one time. A-F only. Pre: ECON 130 or NREM 220, or consent. (Cross-listed as NREM 341) DS

TPSS 350 Tropical Landscape Practices (3) (2 Lec, 1 3-hr Lab) Concepts and techniques of landscape installation and management in the tropics. Pre: 200 and 369; or consent. DB

TPSS 351 Enterprise Management (3) Introduction of practical concepts and methods used in business management. Introduce broad range of business strategies. Understand the critical role each strategy plays. Facilitate student's practice of analytical and critical thinking through case studies. (Cross-listed as NREM 351)

TPSS 352 Landscape Architecture History (3) Survey of the history of landscape architecture from Mesopotamia to present. Review of the physical, cultural, social, economic, and political factors, as well as the environmental concerns, horticultural techniques, and technological innovations of historic landscapes. A-F only. (Spring only) (Cross-listed as ARCH 352) DH

TPSS 353 Landscape Graphics Studio (4) Basic skills of landscape graphic communication through a creative process model. Learning free hand and technical drafting techniques to creative effective landscape graphics. Pre: consent. (Alt. years) (Cross-listed as ARCH 353) DA

TPSS 354 Tropical Landscape Planting Design Studio (4) Students will develop basic skills of residential landscape graphic and design processes in order to clearly articulate the ability to think, analyze, and extend a physical solution in the proper scale. Repeatable one time. A-F only. (Alt. years) (Cross-listed as ARCH 354) DA

TPSS 364 Horticultural Practices (2) (1 Lec, 1 3-hr Lab) Techniques of culture and management of horticulture crops. Pre: 200 (or concurrent). DB

TPSS 369 Ornamental Plant Materials (3) (2 Lec, 1 3-hr Lab) Identification, origin, use, and cultural requirement of trees, shrubs, vines, and groundcovers used in Hawaiian landscapes. Pre: 200 or consent. DB

TPSS 371 Genetics: Theory to Application (3) Fundamentals of genetic theory using biotechnological procedures in insect and plant pathogen control and plant and animal breeding as practical applications. Repeatable one time. A-F only. (Cross-listed as PEPS 371)

TPSS 401 Vegetable Crop Production (3) (2 Lec, 1 3-hr Lab) Crop biology, requirements, and production techniques for commercial vegetable production in Hawai‘i will be stressed. Pre: 300 or consent. DB

TPSS 402 Flower and Foliage Crop Production (4) Biology and production of cut flowers, blooming potted plants, foliage plants under field and protected cultivation in Hawai‘i and globally. Pre: 300 or consent. DB
TPSS 403 Tropical Fruit Production (3) (2 Lec, 1 3-hr Lab) Botanical aspects and horticultural management practices of selected tropical and subtropical fruit crops, with emphasis on small scale commercial production in Hawai’i. Pre: 300 or consent. DB

TPSS 405 Turfgrass Management (4) (3 Lec, 1 3-hr Lab) Adaptability and selection, establishment, and cultural practices of grasses for various types of turf. Pre: 200 or consent. DB

TPSS 409 Cultural Biogeography (3) Co-evolution of human societies and plants over the last 10,000 years. Foraging, farming and urban societies economies; spread and modification of selected plants; issues of preservation of genetic resources and traditional plant knowledge. The form and function of gardens. Pre: junior standing or higher, or consent. (Cross-listed as GEOG 409) DS

TPSS 416 Introduction to Social, Ethical and Political Issues Associated with Biotechnology (3) Introduces concepts of biotechnology, fundamental issues associated with use of this technology, with special emphasis on agricultural biotechnology. A-F only. Pre: 200 or BIOL 171 or NREM 210, or consent. (Alt. years)

TPSS 418 Turfgrass Pest Management (4) Provides students with knowledge and real world experience on common turfgrass pests and management strategies in Hawai’i, with emphasis on integrated pest management. Common cool-season turfgrass and pest management are also discussed. Repeatable unlimited times but credit earned one time only. A-F only. Pre: PEPS 210 or consent. (Fall only) (Cross-listed as PEPS 418)

TPSS 420 Plant Propagation (3) (2 Lec, 1 3-hr Lab) Theoretical and applied aspects of seed and vegetative propagation technology involving fruits, flowers, vegetables, and landscape plants. Pre: 200 or consent. DB

TPSS 421 Tropical Seed Science (3) (2 Lec, 1 3-hr Lab) Principles of seed science, seed physiology, seed production, and genetic modification. Hawai’i’s seed industry and biotechnology. A-F only. Pre: 200 or consent. DB

TPSS 429 Spreadsheet Modeling for Business and Economic Analysis (3) Introduction to quantitative decision-making methods for effective agribusiness management in resource allocation, scheduling, logistics, risk analysis, inventory, and forecasting. Emphasis on problem identification, model formulation and solution, and interpretation and presentation of results. Pre: ECON 130 or NREM 220, and ECON 321 or NREM 310; or consent. (Once a year) (Cross-listed as ECON 429 and NREM 429) DS

TPSS 430 Nursery Management (3) (2 Lec, 1 3-hr Lab) Management practices in production and operations of commercial nurseries in Hawai’i. Pre: 200 and 364; or consent. DB

TPSS 435 Environmental Soil Chemistry (3) Study of soil chemical processes such as weathering, adsorption, precipitation, and ion exchange; causes of soil acidity, alkalinity, and salinity; reactions between soils and fertilizers, pesticides, or heavy metals. Management strategies to minimize environmental contamination by nitrate, phosphate, and trace elements such as As, Pb, and Se. A-F only. Pre: 304 or consent. (Fall only) DB

TPSS 440 Tissue Culture/Transformation (3) (2 Lec, 1 3-hr Lab) Application of plant tissue culture for plant scientists; study of the growth and development of plant tissues in culture as influenced by chemical and environmental factors, and the regeneration of plants following plant transformation by biolistics and other molecular approaches. Pre: 420 or consent. Recommended: BOT 410. DB
TPSS 450 Sustainable Nutrient Management in Agroecosystems (4) (3 Lec, 1 3-hr Lab) Biological, chemical, and physical processes governing the cycling of nutrients in agroecosystems, crop and livestock production, and the effects on surrounding unmanaged ecosystems. Pre: 304 and CHEM 161, or consent. (Cross-listed as NREM 460) DB

TPSS 453 Plant Breeding and Genetics (3) (2 Lec, 1 3-hr Lab) Unique aspects of plant genetics and applications to crop improvement, with emphasis on breeding plants in Hawai'i. Pre: BIOL 375 (or concurrent) or consent. DB

TPSS 460 Soil Plant Environment (3) (2 Lec, 1 3-hr Lab) Bio-physical processes in the soil-plant-atmosphere continuum that influence crop growth and development. Methods to estimate the impact of soil and climate on crop performance. Use of crop models to simulate effects of planting date, plant spacing and density, fertilizer rate, rainfall or irrigation, and daily weather on crop yield and farm income. Pre: 304 and either PHYS 151 or PHYS 170, or consent. DB

TPSS 463 Irrigation and Water Management (3) Basic soil-water-plant relationships, irrigation water requirements, irrigation efficiencies, different methods of irrigation, planning, design and management of an irrigation system, fertigation and impact of irrigation on soil and water quality. Pre: NREM 203 (or equivalent) and NREM/TPSS 304 (or equivalent), or consent. (Alt. years) (Cross-listed as NREM 463)

TPSS 470 Plant Physiology (3) Integration of form and function from cellular to whole plant levels in processes from seed germination, through photosynthesis, growth, and morphogenesis, to flowering and senescence. A-F only. Pre: BIOL 171 or consent. DB

TPSS 470L Principles of Plant Physiology Lab (1) (1 3-hr Lab) Principles of experimentation in plant physiology, includes individual investigations. A-F only. Pre: consent. DY

TPSS 473 Post-Harvest Physiology (3) Comparative physiological and biochemical processes during growth, maturation, ripening, and senescence in fruits, vegetables, and flowers related to changes in quality and storage life. Tropical commodities emphasized. A-F only. Pre: 200, BIOL 171, or BOT 201; CHEM 152; or consent. DB

TPSS 475 Plant Nutrient Diagnosis in the Tropics (3) Designed for students to identify essential nutrients required by plants; diagnose nutrient disorders in plants; and propose environmentally sound solutions to correct disorders. Pre: 304/NREM 304 (or concurrent) and BIOL 172. (Cross-listed as NREM 475)

TPSS 481 Weed Science (3) (2 Lec, 1 3-hr Lab) Weed classification, identification, adaptations for weediness; principles of weed control; properties, uses, and action of herbicides. Lab: pesticide application equipment and techniques, no-till farming, greenhouse and field experiments. A-F only. Pre: 200 and CHEM 152, or consent. (Fall only) (Cross-listed as PEPS 481) DB

TPSS 491 Experimental Topics (V) Study and discussion of significant topics, problems. Offered by visiting faculty and/or for extension programs. Repeatable. Pre: consent.

TPSS 492 Internship (1) Integration and application of academic knowledge and critical skills emphasizing professional development. Placement with an approved cooperating supervisor/employer. Pre: consent.
TPSS 492L Internship Experience (3) Internship field experience for TPSS majors. TPSS majors only. A-F only. Pre: 200 (or concurrent) or consent.

TPSS 499 Directed Studies (V) Supervised individual instruction in field laboratory and library. Repeatable up to six credits. CR/NC only. Pre: 364 or consent.

PEPS courses viewable online at: http://www.catalog.hawaii.edu/courses/departments/peps.htm

A grade of C or better is required in prerequisite courses.

PEPS 210 Introduction to Environmental Science (3) Analysis of our environment with emphasis on understanding relationships and interactions of physical, biological, technological, and political components using scientific methods of inquiry. Food supply and safety, water quality, pollution control, biodiversity, environmental policy. Open to nonmajors. (Cross-listed as NREM 210) DB

PEPS 250 The World of Insects (3) Biology/ecology of insects with emphasis on relationships to plants, animals, and especially people in Hawai‘i and the tropics. Open to nonmajors. A-F only. DB

PEPS 310 Environment and Agriculture (3) Overview of environmental issues and impacts associated with agriculture, specifically pest management issues, and options for environmentally responsible management and amelioration of these impacts. Pre: 210 or consent.

PEPS 350 Invasive Pest Species (3) Ecological, economic and sociological impacts of invasive pest species on tropical ecosystems; characteristics of invasive species and nature of vulnerable habitats; management of invasive species or eradication options; impacts on evolution, biological diversity and ecological stability. Open to nonmajors. (Alt. years: spring) DB

PEPS 363 General Entomology (3) Biology, diversity, and ecology of insects with emphasis on Hawaiian fauna. Classification to order level. A-F only. Pre: BOT 101 or ZOOL 101 or BIOL 171; or consent. DB

PEPS 363L General Entomology Laboratory (1) Laboratory in the biology and classification to family level of Hawai‘i’s insects and arthropods. A-F only. Pre: 363 (or concurrent) or consent. DY

PEPS 371 Genetics: Theory to Application (3) Fundamentals of genetic theory using biotechnological procedures in insect and plant pathogen control and plant and animal breeding as practical applications. Repeatable one time. A-F only. (Cross-listed as TPSS 371)

PEPS 405 Plant Pathogens and Diseases (4) (3 Lec, 1 3-hr Lab) Classification, morphology, ecology, and biology of bacteria, fungi, nematodes, and viruses that attack economic crops. Etiology and control of plant diseases. Pre: 210 or BOT 101 or MICR 130, or consent. (Fall only) DB

PEPS 410 Sustainable Soil and Plant Health Management (2) Provides knowledge and understanding of soils, agroecology, and sustainable approaches for plant health management, and prepares students for applied research in various tropical cropping systems. A-F only. Pre: 210 or TPSS 220 or consent. (Alt. years: spring)
PEPS 418 Turfgrass Pest Management (4) Provides students with knowledge and real world experience on common turfgrass pests and management strategies in Hawai‘i, with emphasis on integrated pest management. Common cool-season turfgrass and pest management are also discussed. Repeatable unlimited times but credit earned one time only. A-F only. Pre: 210 or consent. (Fall only) (Cross-listed as TPSS 418)

PEPS 421 Foundations of Pest Management (4) (3 Lec, 1 3-hr Lab) Principles and concepts of insect pest management using biological, ecological, cultural, behavioral, legislative, microbial and chemical methods. A-F only. Pre: one of the following: 250 or 363, BIOL 171, BIOL 172, or BOT 101; or consent. (Spring only) DB

PEPS 422 Biocontrol of Invasive Species (3) Biological control of arthropods, weeds, plant pathogens, and vertebrates. Pre: 363 or consent. DB

PEPS 430 Plant Disease Management (3) Diagnosis, epidemiology, and integrated management of important plant diseases and pathogens for key plants and cultivated crops in various agroecosystems in Hawai‘i, the Pacific, and the global tropics. Pre: 405. (Spring only)

PEPS 451 Environmental Law (3) Exploration of federal laws, regulations, and precedents that govern our interaction with the environment. Analysis of laws regulating air, water, toxins, pests, endangered species, and environmental justice. Pre: junior or senior standing.

PEPS 463 Urban Pest Management (3) (2 Lec, 1 3-hr Lab) Biology, ecology, and management of pest organisms associated with people, structures and the urban environment. Pre: 363 or consent. DB

PEPS 481 Weed Science (3) (2 Lec, 1 3-hr Lab) Weed classification, identification, adaptations for weediness; principles of weed control; properties, uses, and action of herbicides. Lab: pesticide application equipment and techniques, no-till farming, greenhouse and field experiments. A-F only. Pre: CHEM 152 and TPSS 200, or consent. (Fall only) (Cross-listed as TPSS 481) DB

PEPS 486 Symbioses (3) Study of symbioses in insects and a wide range of organisms. Students will learn the types of symbioses, evolution, and ecology of symbiotic lifestyles, and their impact on agriculture and human health.

PEPS 491 Topics in Plant & Environmental Protection (V) Study and discussion of significant topics and problems. May be offered by visiting faculty, extension faculty or research faculty. Repeatable two times.

PEPS 495 PEPS Capstone (4) Integration and application of academic knowledge and critical skills emphasizing professional development, Directed Research, field studies, employment with cooperating businesses, government or schools are all options. A-F only. Pre: consent.

PEPS 499 Directed Research (V) Conduct original research in environmental protection sciences. Limited to qualified undergraduate students. Repeatable two times. CR/NC only.