

## Undergraduate Wildlife, Sustainability and Ecosystem Sciences Courses

### **WSES 1100. Transitioning to University Studies in the Natural Resource Sciences. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).**

Practical study designed to prepare the student for university life, aid in development of skills for academic success, promote personal growth and responsibility, encourage active involvement in the learning process from an individual college perspective, and introduce students to the field of wildlife, sustainability, and ecosystem sciences. Prerequisites: Major in WSES or approval of the instructor.

### **WSES 1119. Natural Resource Competition I. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

This course provides an introduction to various natural resource-based competitive events. Competition rules, conduct, and etiquette are discussed. The students are introduced to basic facts regarding their chosen field of study. Prerequisites: Approval of the instructor.

### **WSES 1301. Society, Natural Resources, and the Environment. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course provides a broad overview of the role of the environment and natural resources in human society, with particular emphasis on Texas and the United States. A history of the environmental movement is presented. Students study the importance of natural resources in providing basic human necessities, and how these resources are managed. Various careers in environmental science, natural resource management, and wildlife conservation are also discussed.

### **WSES 1307. Concepts and Controversies in Food Studies. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Principles of food studies and exploration of the role food narratives and exposés play in the consumer's perception of the current food supply. Foundation for understanding the connections among food production, ecology, ethics, cuisine, nutrition and health within the framework of sustainability. Can receive credit for either FDSC 1307 or WSES 1307.

### **WSES 2119. Natural Resource Competition II. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

Intended for students with basic understanding of the conduct of their chosen natural resource event, this course provides more advanced study of the topic. Students expand upon the introductory material discussed in Natural Resource Competition I to include a wider array of natural resource science related facts and concepts. Prerequisites: WSES 1119 or approval of the instructor.

### **WSES 2301. General Entomology. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Principal orders of insects; the relation of anatomy and physiology of insects to control methods; insecticides and their uses; development, habits, and economic importance of more common insects with control methods for the injurious species. Prerequisite: C or better in BIOL 1406 or BIOL 1407.

### **WSES 2322. Principles of Wildlife Conservation and Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An in-depth treatment of the fundamental principles of wildlife conservation and management, stressing the application of ecological principles to achieve wildlife management objectives. Topics include conservation, management, and restoration of wildlife habitats; wildlife population assessment and management; human dimensions and human-wildlife interactions; management of wildlife in agricultural, range, and forested ecosystems; and wildlife policy at the local, state, national, and international level. Provides knowledge and understanding required for advancing in the wildlife and natural resource conservation disciplines. Satisfies requirements for Wildlife Science majors. Prerequisite for advanced wildlife science courses. Prerequisites: Grade of C or better in BIOL 1406 and BIOL 1407; grade of C or better in MATH 1316 or MATH 2412; and grade of C or better in WSES 2405, RNRM 3315, or BIOL 4401.

### **WSES 2375. Soil as the Basis for Society. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

The underpinnings of the scientific principles of soils, how people have harmed them, and why everyone should be concerned with how we treat them. This course may not be used to fulfill the degree requirements for wildlife or ecosystem sciences.

### **WSES 2405. Ecology for Natural Resource Managers. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A study of the interactions of plants, animals, and the environment and how these interactions respond to human influence. Emphasis will be placed on terrestrial ecosystems (rangelands, grasslands, deserts, wetlands, and forests), and specific interactions among species which can be manipulated to achieve management outcomes. The laboratory will have a significant outdoor field component. Credit will not be awarded for both WSES 2405 and WSES 3103. Prerequisite: Grade of C or better in BIOL 1406 OR BIOL 1407.

### **WSES 2451. Introduction to Geographic Information Systems. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).**

Basic concepts of design, planning and implementation of geographic information systems. Students will learn how to create, manipulate, project, and interpret geographic information. Students are encouraged to take GEOG 1451: Pre-GIS before this course. Can receive credit for either WSES 2451, GEOG 2451, EASC 2451 or ENV5 2451. Lab fee: \$2.

### **WSES 3103. Ecological Field Methods Laboratory. 1 Credit Hour (Lecture: 0 Hours, Lab: 4 Hours).**

Field methodologies used in the investigation of ecological systems including terrestrial plant, terrestrial animal, and aquatic systems. For students who have completed an introductory ecology or environmental biology course with no laboratory component. Credit will not be offered for both WSES 3103 and WSES 2405. Prerequisites: Grade of C or better in an approved 1000- or 2000-level ecology or environmental biology course; and a grade of C or better in BIOL 1406; and a grade of C or better in either BIOL 1407 or GEOL 1407; or approval of the department head.

### **WSES 3119. Natural Resource Competition III. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

This course is a more advanced treatment of the student's chosen natural resource event. It is intended for students with experience in the competition, having participated in at least one competitive event. Prerequisite: WSES 2119 and approval of the instructor.

### **WSES 3303. Veterinary Entomology. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Classification, biology, and control of arthropods associated with livestock and wildlife. Identification will be emphasized in the laboratory. Prerequisites: BIOL 1406 and BIOL 1407, or approval of the instructor.

### **WSES 3304. Food Processing. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).**

The world food supply, trends and traditions in diet and food sanitation, safety, security, and biotechnology, and impact of processing on diet quality. Lab fee: \$2.

### **WSES 3305. GIS for Natural Resource Scientists. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

An intermediate course on the use of geographic information systems (GIS) in natural resource management. Builds on concepts learned in introductory GIS course. Laboratory exercises will apply knowledge learned in lectures to solve real world problems in natural resource management using GIS software. Prerequisite: WSES 2451 or GEOG 2451 Lab fee \$2.

### **WSES 3307. Systems Thinking. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

This course focuses on the examination and analysis of complex systems, particularly in the environmental, natural resources, and sustainability fields. Major topics will include system structure, system behavior, feedback loops, stock and flow models, non-linear and emergent properties, self-organization, and the application of systems thinking to problem-solving. A significant component of the course will be development and analysis of computer models of complex systems. Prerequisite: C or better in MATH 1314 or equivalent, or approval of the instructor. Lab fee: 2.

### **WSES 3308. Analysis of Natural Resource Data. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Application of statistical principles to the analysis of natural resource science data. Methods of designing studies, managing and analyzing data, and interpreting results. Descriptive statistics, estimation, inference, tests of significance, measurements of relationship and correlation, and non-parametric analyses. Prerequisite: Grade of C or better in MATH 1342 or MATH 3450.

### **WSES 3309. Aquaponics. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Students will examine the pros and cons of various aquaponics methods like raft, nutrient film, vertical towers, and media filled beds and their applications for growing fish and plants sustainably for a family/community or for profit. Students will construct a backyard aquaponics system, establish/harvest plants, and prepare a meal in laboratory. Topics covered are plant and fish choices and recommendations; planting/growing techniques; fish biology, stocking rates, and feeds; plant/fish care and health; water quality; system design, filtration and plumbing components; daily operation; greenhouse management/seasonal adjustments; system start up; food preparation; economics and business considerations.

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### **WSES 3310. Wildlife Management Techniques. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Field and laboratory techniques used in wildlife management and research. Determining age and food habits, population analysis, habitat analysis, and introduction to research. Modest cost of field trips will be borne by student. Prerequisites: Grades of C or better in WSES 2322, and either MATH 1316 or MATH 2412.

### **WSES 3311. Wildlife Diseases. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Basic mechanisms of disease as they occur in wildlife populations; interplay of environmental conditions, individual physiological requirements, and disease agents of various wildlife species. Epidemiology and management of infectious and non-infectious diseases. Prerequisites: Grade of C or better in WSES 2322 or approval of instructor.

### **WSES 3313. Plant Diversity and Conservation. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Patterns and distribution of plant diversity and threats to plant diversity. Plant communities found in a variety of range, forests, and other systems. Strategies and approaches used in plant conservation will be discussed. Prerequisite: Grade of C or better in WSES 2405, RNRM 3315, or BIOL 4401.

### **WSES 3314. Pollinator Ecology and Conservation. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Plant-insect interactions concerning floral resources and the conservation of pollinator insects. Floral morphology, coevolution of plant and pollinator, insect ecology and behavior, management of honeybees for commercial purposes, managing pollinators in urban and suburban settings, and conservation of pollinator habitat. Identifications of major pollinator insect groups, and techniques to monitor native pollinators and floral resources. Prerequisites: Grade of C or better in WSES 2405 or BIOL 4401; and ENTO 3312.

### **WSES 3315. Sustainability. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Explore the varied perspectives of sustainability and analyze factors that contribute to or decrease system sustainability. Investigation of the social, economic, and environmental barriers to achieving sustainable systems and options for overcoming these barriers. Credit will be awarded only for POLS 3315, ENVS 3315, or WSES 3315. Prerequisite: GOVT 2305 or GOVT 2306 or POLS 2304 or approval of the instructor.

### **WSES 3319. Composting. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

The art and science of composting of agricultural, municipal, foodservice and household wastes to include composting techniques, waste products and feedstocks, aerobic vs. anaerobic processes, evaluation of composted products and their beneficial uses. Biological processes used to decompose organic materials will be studied. Prerequisites: Junior standing or permission of the instructor.

### **WSES 3320. Watershed Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Management and planning of range or forest land watersheds for maintenance or improvement of water and soil resources. Effects of vegetation and land management practices on water quality and quantity, erosion, and sedimentation. Prerequisite: Grade of C or better in WSES 2405, RNRM 3315, or BIOL 4401.

### **WSES 3323. Ethical Issues in Agriculture and the Natural Resources. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Students will examine the several major ethical issues facing agriculture and natural resources sciences in our current society. Readings, discussions and lectures will focus on the scientific, capitalistic, and philosophical motivation in common ethical issues. Upon completion of the course, students will be able to construct and dissect ethical arguments and hopefully become more aware of the ethical dilemmas we all face each day.

### **WSES 3340. Fisheries Conservation and Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Fundamentals of fisheries management population estimation and management, harvest management, habitat management, applicable state and federal laws, invasive species management, and human dimensions. Prerequisites: Grade of C or better in WSES 2322.

### **WSES 3350. Writing for the Natural Resource and Environmental Sciences. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**

Use of appropriate strategies to produce written professional and interpretive documents for wildlife and natural resource audiences. Prerequisites: ENGL 1301 and 1302.

### **WSES 3375. Population, Pollution, and Resource Depletion. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Principles and philosophies associated with the development, management, and use of natural resources are studied in the relationship to the ecological and social implications inherent in management alternatives involving the natural environmental and the use of renewable natural resources. Can receive credit for either ENVS 3375 or WSES 3375. Prerequisite: junior classification.

### **WSES 3380. Ecological Pest Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An introduction to the principles of managing pest populations to reduce economic and ecological loss in agriculture, horticulture, domestic, and natural settings in an environmentally compatible manner. Information gleaned from this course should prepare students to apply for state certification as a licensed pesticide applicator. Prerequisites: WSES 2405 and either WSES/ENTO 3312 or WSES 2301.

### **WSES 3385. Fish and Wildlife Laws and Administration. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**

A review and analysis of state and federal laws and international treaties and conventions affecting fish and wildlife; their application and administration. The organizational structure of state, federal and international agencies; their objectives, policies and practices. Prerequisites: GOVT 2305 and GOVT 2306 or; core complete in the Government/Political Science component area.

### **WSES 3386. Human Dimensions of Fish and Wildlife Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Today's natural resource scientist must interact with diverse publics and stakeholders to achieve conservation goals. Few professionals receive training to navigate the murky waters of human dimensions of natural resources management. This course will give students an understanding of ways in which elements of human psychology and society shape our perceptions and management of wildlife and fisheries resources, and how to interact with these stakeholders to achieve ecologically-sound management and conservation. Prerequisite: Grade of C or better in WSES 2322.

### **WSES 3387. Natural Resource Conservation Outreach and Interpretation. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Survey of the history, principles, and content of the Texas Master Naturalist Program as an example of education, public outreach, volunteerism, and interpretation in natural resource conservation and management. Classroom and field instructional modules of foundational concepts and regional specifics about biotic and abiotic natural resources. Principles of interpretation and written analysis of observed teaching and interpretive activities by resource specialists. Students who co-register with the Prairie Oaks Chapter of the Texas Master Naturalist program and complete all class activities can satisfy a portion of the requirements for certification as a Texas Master Naturalist. Attendance at occasional weekend field trips required.

### **WSES 3403. Natural History of the Vertebrates. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Survey of vertebrate taxa, including systematics, taxonomy, anatomy, physiology, and ecology. Identification in laboratory and field. Students required to handle preserved and live specimens. Students required to bear the cost of multiple overnight and multi-day field trips. Prerequisites: Grade of C or better in BIOL 1406 and BIOL 1407.

### **WSES 3406. Wildland Plant Identification and Ecology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Identification and classification of grasses and other herbaceous plants in the North America, with emphasis on distribution, ecology, and economic value of species found in rangeland, forest, grassland, desert, and wetland systems in Texas. Proficiency in the use of a dichotomous key to identify plant species will be emphasized. Prerequisite: WSES 2405, RNRM 3315, or BIOL 4401.

### **WSES 3408. Dendrology and Woody Plant Identification. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Study of woody plants, including trees, shrubs, and vines. Morphological, ecological and phenological traits will be used in field identification. The distribution, habitat, ecology, and importance of these species to wildlife and people will be explored, including community dynamics and the effects of disturbance and succession. Proficiency in the use of a dichotomous key to identify plant species will be stressed. Prerequisite: WSES 2405, RNRM 3315, or BIOL 4401.

**WSES 4084. Internship in the Natural Resource Sciences. 1-6 Credit Hours (Lecture: 0 Hours, Lab: 1-6 Hours).**

Formally arranged and approved on-the-job training with a cooperating sponsor in government or private sector of the natural resources or environmental field. A minimum of 75 hours of training is required for each hour of academic credit. A maximum of six hours of credit may be earned. A written report or other artifact of the experience may be required. Course will be graded as satisfactory or unsatisfactory. Prerequisite: Approval of the instructor.

**WSES 4086. Problems in Natural Resource Sciences. 1-6 Credit Hours (Lecture: 0 Hours, Lab: 1-6 Hours).**

Individualized study of current topics in wildlife, natural resources, environmental science, or related discipline. Specific content and credit depend upon student's interests, needs, and depth of study. May be repeated as topics vary. Prerequisite: approval of instructor.

**WSES 4088. Undergraduate Research in the Natural Resource Sciences. 1-6 Credit Hours (Lecture: 0 Hours, Lab: 1-6 Hours).**

Fundamental research methods will be addressed through a faculty-directed project. Participation in an abbreviated lecture series may be required. Project components may include a literature review, data collection and analysis, testing, planning, project design, and/or computer modeling. The student may be required to prepare a final report and produce a presentation. Course will be graded as satisfactory or unsatisfactory. Prerequisite: Approval of the instructor.

**WSES 4090. Special Topics in the Natural Resource Sciences. 1-6 Credit Hours (Lecture: 0-6 Hours, Lab: 0-6 Hours).**

Selected topics in wildlife, natural resources, environmental science, or related discipline. May be repeated for credit when topics vary.

**WSES 4119. Natural Resource Competition IV. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

This course is intended for highly advanced students who have developed significant experience and competencies in their respective natural resource competition. Students will be expected to take a leadership role on the Tarleton State University Quiz Bowl Team and demonstrate significant ability during practice and competitive events. Prerequisite: WSES 3119 and approval of the instructor. Prerequisites: WSES 3119 and approval of the instructor.

**WSES 4185. Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

Discussions of issues and developments in agriculture, natural resources, or environmental sciences.

**WSES 4187. Senior Capstone Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

This one-hour seminar is designed to provide students with skills at synthesizing and presenting the results of lower-division work, specifically applied learning experiences such as internships, undergraduate research, and study abroad. Course will include a writing and public speaking component. Prerequisites: Successful completion of WSES 4084, WSES 4088, WSES 4340, or WSES 4342, or approval of the Department Head.

**WSES 4301. Population Dynamics, Modeling, and Analysis. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

An introduction to population biology, including models of simple population growth, competition, and predator-prey interactions; demographic rates; and life tables. Prerequisites: Grade of C or better in WSES 2322; and a grade of C or better in MATH 1342 or MATH 3450; or approval of instructor.

**WSES 4302. Habitat Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**

Application of ecological principles to the management of native plant communities. Particular focus will be on plant ecology and physiology and their role in the conservation and management of wildlife habitat. Prerequisite: Grade of C or better in WSES 2322, or approval of the instructor.

**WSES 4303. Ecological Restoration. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Landscape-scale, process-oriented approaches to ecological restoration. Enhancing resource capture, techniques in re-vegetation, and restoration of historic vegetation. Prescribed fire and grazing as restoration and management techniques for range and forest systems. Prerequisites: BIOL 3415, RNRM 3300, WSES 3406, or WSES 3408; and a grade of C or better in WSES 2405, RNRM 3315, or BIOL 4401.

**WSES 4304. Population Genetics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An exploration of the principles of population genetics. Lecture will be a discussion of factors affecting the dynamics of allelic frequencies and the population-level consequences of manipulating these factors. Lecture topics will include the effects of selection, mutation, population size and genetic drift, neutral theory, population structure, inbreeding, and linkage disequilibrium. A significant portion of the class will be dedicated to working on problem sets to provide an empirical connection to population genetic theories. Prerequisite: BIOL 3303, BIOL 3403, or AGRI 3409.

**WSES 4305. Urban Wildlife and Fisheries. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course trains students to establish and maintain diverse, self-sustaining urban wildlife and fish populations at levels in harmony with ecological, social, and economic values of the human community and to develop optimal levels of public appreciation and use of urban wildlife and fish resources and associated habitats. Includes discussions on conservation education as a tool for furthering urban wildlife and fisheries appreciation.

**WSES 4306. Water Resources Policy and Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course will present an overview of water policy, laws and regulations related to ecosystem resource management focusing on water quality, water quantity and water as habitat. Major US and Texas environmental laws regarding water will be covered including the respective agencies involved with regulations. Case studies will facilitate discussion of science-policy interactions with resource management in the implementation of these laws and regulations. Credit for SOCI 4306, WSES 4306, and SOCI 5306 will not be awarded.

**WSES 4308. Horticultural Entomology. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Identification, nature of injury, life history, and control of common insects and related arthropods attacking turf grasses, landscape plants, shade, fruit, and nut trees, and greenhouse succulents. Management and control strategies utilizing chemical, cultural, and biological control agents.

**WSES 4309. Plant-Animal Interactions. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**

Arthropods and vertebrates in aquatic, terrestrial, managed, and natural systems spanning multiple scales and levels of organization. Prerequisite: Grade of C or better in WSES 2405, RNRM 3315, or BIOL 4401.

**WSES 4310. Zoo Biology and Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Biology and management of zoo animals, and the management of zoos. Nutrition, reproduction, behavior, care, and welfare of confined wildlife species. Captive breeding, genetics, herd management, record keeping, and conservation biology. History of zoos and their role in conservation. Zoo exhibits and outreach, legal aspects, and ethics of confined wildlife management. Prerequisite: Grade of C or better in WSES 2322.

**WSES 4311. Fire Ecology. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Ecological role of fire in natural systems, including rangelands, grasslands, shrublands, woodlands, and forests; adaptations of plants and animals to fire; long-term controls on wild fire; use of fire as an ecosystem management tool, with aspects of wildland firefighting; and prescribed burning, including fire behavior, fuels, weather, politics and policy. Hands-on prescribed burning experiences as circumstances and weather permit. Prerequisite: WSES 2405, RNRM 3315, or BIOL 4401.

**WSES 4313. Vegetation Measurement, Inventory, and Monitoring. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Vegetation sampling, measurement, monitoring, inventory, study design, and quantitative and statistical analysis. Assessment of range condition and forest health based on understanding ecological processes. Hands-on, field-based laboratory. Prerequisite: WSES 3406 or WSES 3408.

**WSES 4316. Pesticides. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

A survey of chemical pesticides. Emphasis will be on the chemistry, mode of action, and safe use of insecticides, herbicides, and fungicides. Less common pesticides (rodenticides, piscicides, avicides, etc.) will also be reviewed. The use of chemical pesticides as a part of an integrated pest management program will be discussed. Student's successfully completing the course will be prepared to apply for the Texas Department of Agriculture pesticide applicator's license. Prerequisite: CHEM 1311 and 1111.

**WSES 4324. Organic Agriculture. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Organic agriculture will examine a brief history of the industry development, changes in the structure and industry, USDA NOP rules and regulations, and certification to provide a scope of understanding for the course. The majority of the course will focus on the mechanics of crop and vegetable production in an organic system including seed sources, planting considerations, environment, soil fertility, plant nutrition, soil preparation, weed control methods, insect and disease prevention, rules in applications, harvest issues, and marketing.

**WSES 4325. Crop Production and Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Current concepts and practices in field crop production with emphasis on the applications of technology. Recognition and discussion of cultural practices, fertilization, irrigation, weed and pest control from economic and environmental perspectives. Review of crop improvement strategies and bio-engineering. Prerequisites: SOIL 3301, SOIL 3101, AGRI 1307, and AGRI 1107.

**WSES 4326. Big Game Ecology and Management. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

Survey of the distributions and life histories of North American big game species. Detailed examination of the biology and habitat relationships of several big game species, especially as they relate to management. Other topics include population dynamics, diet, economic significance, and conservation strategies. Modest cost of field trips will be borne by the student. Prerequisite: A grade of C or better in WSES 2322, or approval of the instructor.

**WSES 4327. Avian Ecology and Management. 3 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).**

A study of major wild bird groups, their interactions with their environment, and how these interactions can be manipulated to achieve management objectives. Course emphasis will be on species of conservation significance, including game, nongame, and vulnerable species. Major topics will include population management of migratory and non-migratory birds, habitat management, and wildlife policy consideration unique to bird conservation. Modest cost of field trips will be borne by the student. Prerequisite: A grade of C or better in WSES 2322, or approval of the instructor.

**WSES 4335. Food and Culture. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).**

A study of the food beliefs and practices of the major ethnic and religious groups in the U. S. and the nutritional implications of these food practices, a cultural analysis of American food trends; ethnic issues and dietary changes; and research methods in food habits. Lab fee: \$25.

**WSES 4340. Natural Resource Field Studies. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

A field course in which students capture, measure, and mark animals; collect descriptive measures of vegetation that characterizes wildlife habitat; and record field observations using a journal. This course requires one or more extended field trips at student's expense. Prerequisite: Grade of C or better in WSES 2322.

**WSES 4341. Southern African Ecology and Culture. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Ecology of southern Africa, including climate, soils, vegetation, and wildlife. Ecological interactions with development, agriculture, and tourism. Identification and ecology of bird and large mammal species. Conservation of rare, threatened, and endangered species. Culture, politics, and history from the pre-Colonial Period through today, with emphasis on their effects on management of natural resources. Focuses mainly on South Africa, Botswana, Zambia, and Namibia.

**WSES 4342. Study Abroad. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Conducted at various domestic and international locations for extended periods (frequently outside the United States). Hands-on activities and experiences in agriculture and natural resources. Topics will vary. Enrollment requires a significant study abroad program fee.

**WSES 4401. Ethology. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours).**

An introductory course in the behavior of animals, with emphasis on the natural selection, ontogeny, and function of behaviors as they relate to feeding, reproduction, predator-avoidance, and other traits. Both proximate (sensory, hormonal, genetic) and ultimate (ecological and evolutionary) mechanisms are addressed. Prerequisite: C or better in BIOL 1406 and BIOL 1407, and a C or better in either AGRI 1419 or WSES 2322. Lab fee: \$2.

**WSES 4407. Fermentation and Brewing. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

This course provides a basic understanding of the history of food safety, sanitation, fermentation, fermented foods, beer brewing, wine and cheese making, along with an introduction to industry organization; from commodities production, to processing, distribution, marketing, and sales. The course provides direct hands-on instruction in small-scale brewing. It combines elements of science (chemistry, biology, and physics), economics, food preparation, aesthetics, preferences, and taste. Modest cost of field trips will be borne by the student. Prerequisites: Senior classification and completion of 8 hours of BIOL and 8 hours of CHEM; or approval of the instructor. Must be 21 years of age or older on the first class day to enroll in this course.

**WSES 4408. Sustainable Food Systems. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

This course will survey issues surrounding food production and examine the environmental and social impact of current food production systems. Specific emphasis will be placed on emerging trends to increase the sustainability of food production, distribution, and consumption. This course includes a laboratory field component and will require some field work outside normal class times. Lab fee: \$2.

**WSES 4410. Genomics. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

An exploration of practical applications for high throughput DNA sequencing technology. Hands-on research projects will provide experience in proper sample collection and preparation, automated robotic DNA library preparation, DNA barcoding, quality control metrics, instrument loading and run initiation, and an overview of data processing for a single instrument run generating hundreds of millions of DNA sequences. Prerequisite: BIOL 3303 or AGRI 3409 Lab fee: \$2.