

In an increasingly complex world, solutions to issues of emerging societal importance often require crossing traditional boundaries. Recognizing that students will need information from many available sources, Oregon State University offers a variety of undergraduate and graduate opportunities for interdisciplinary exploration and enrichment.

Interdisciplinary programs depend fundamentally upon the existence of strong disciplinary programs and place significant responsibility upon students to integrate and synthesize information.

Because there are so many choices of subjects and so many ways to approach a given interest, it is crucial that students obtain guidance in order to understand the advantages and the limitations of particular disciplinary and interdisciplinary alternatives. Students are encouraged to contact the individuals identified at the beginning of each certificate, department, and degree listing for more information and advice.

UNDERGRADUATE PROGRAMS

Although OSU has offered interdisciplinary programs for many years, new and innovative interdisciplinary baccalaureate degree programs are continually being approved.

At the undergraduate level, students have a variety of opportunities to pursue interdisciplinary interests:

Combine a major with one or more minors or options in other disciplines. Undergraduate minors and options are listed throughout the catalog; and a table of majors, minors, and options is located in the front section of this catalog. Consult the appropriate departmental catalog section for requirements.

Complete a certificate program. These programs may be completed in conjunction with any baccalaureate degree program. Certificates in Applied Ethics, Latin American Affairs, Peace Studies, Russian Studies, and Women Studies are available through the College of Liberal Arts. The College of Health and Human Sciences offers a certificate in Gerontology. The College of Business offers a postbaccalaureate Certificate in Accounting. Consult the appropriate college section of this catalog for further information on particular certificate programs.

Earn a baccalaureate degree. Baccalaureate degrees in American Studies and Liberal Studies are offered through the College of Liberal Arts and a baccalaureate degree in General Science in the College of Science. These programs allow students considerable flexibility in tailoring course work to particular interdisciplinary interests in the liberal arts and the sciences.

The Bioresource Research degree provides students with broad academic training, focused course work in a specific bioresource option, and a research/mentorship opportunity unmatched in any other OSU undergraduate degree program.

The Environmental Sciences major combines strong interdisciplinary preparation in the physical, biological, and social sciences with a core of environmental courses and a specialization in one science discipline relevant to the environment.

The Natural Resources baccalaureate degree, drawing upon a broad curriculum based in the Colleges of Agricultural Sciences, Forestry, Liberal Arts, and Science, provides understanding of the social and scientific dimensions of a range of natural resource management challenges.

The International Studies degree, earned concurrently with any other baccalaureate degree, allows students—through experience abroad, advanced course work in language and culture, and an individualized project—to bring an international dimension to any major. (See the International Programs section of this catalog.)

AMERICAN STUDIES

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Undergraduate Major

American Studies (BA, BS, HBA, HBS)

Option

Ethnic Studies

See the College of Liberal Arts, American Studies program section of this catalog.

APPLIED ETHICS

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Certificate Program

Applied Ethics Certificate

See the College of Liberal Arts, Department of Philosophy section of this catalog.

BIORESOURCE RESEARCH

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Undergraduate Major

Bioresource Research (BS)

Options

Animal Reproduction and Development

Applied Genetics

Biosystems Modeling

Biotechnology
Environmental Chemistry
Food Quality
Genomics/Bioinformatics
Pest Biology and Management
Plant Growth and Development
Sustainable Ecosystems
Toxicology
Water Resources

Bioresource Research is an interdisciplinary biosciences major leading to a BS degree. The centerpiece of BRR is a comprehensive mentored research experience. BRR students take foundation courses in the biological and physical sciences. Each student's upper-division curriculum is individualized based on choice of option and research topic. All BRR students do a two-year, mentored research project culminating in a thesis, in a cutting-edge area of agricultural, biological, chemical, environmental, food, or health science. BRR faculty research mentors currently come from seven OSU colleges (Agricultural Sciences, Science, Engineering, Pharmacy, Oceanic and Atmospheric Sciences, Forestry, Veterinary Medicine). BRR courses include classes in scientific research, data presentation, and seminar presentation. The BRR curriculum is flexible enough to allow students to complete a second major or minor related to their research interests.

In addition to research expertise, BRR students graduate with a strong background in biosciences, job training, and problem-solving and communication skills. Many will enter industrial or academic research or natural resource management. Others will enter graduate and professional schools in the life sciences or become secondary school science teachers. The BRR program fulfills requirements for entry to medical, veterinary, dental and related biomedical schools and graduate programs.

BIORESOURCE RESEARCH (BS, CRED, HBS)

SAMPLE CURRICULUM

First Year (45)

BI 211, BI 212, BI 213. *Principles of Biology (4,4,4)
 BRR 100. Great Experiments in Bioresource Sciences (1)
 CH 221, CH 222, CH 223. *General Chemistry (5,5,5)
 HHS 231. *Lifetime Fitness for Health (2) or NUTR 232. *Nutrition and Lifetime Fitness (2)
 HHS 241–HHS 248. *Lifetime Fitness: (various activities) (1)
 WR 121. *English Composition (3)
 Baccalaureate core (6)
 Unrestricted electives (5)

Second Year (45)

PHL 205. *Ethics (4)
 CH 331, CH 332. Organic Chemistry (4,4)

CH 337. Organic Chemistry Lab (4)
 PH 201, PH 202, PH 203. *General Physics (5,5,5)
 ST 351. Intro to Statistical Methods (4)
 Baccalaureate core selection (6)
 Unrestricted electives (4)

Third Year (45)

BI 311. Genetics (4)
 BRR 401. Research (8)
 COMM 111. *Public Speaking (3)
 MTH 251. *Differential Calculus (4)
 MTH 252. Integral Calculus (4) or MTH 268. Mathematical Ideas in Biology (4)
 Baccalaureate core selection (3)
 Unrestricted electives (4)
 Selected courses to meet BRR option requirement (15)

Fourth Year (45)

BB 450, BB 451. General Biochemistry (4,3)
 BRR 401. Research (6)
 BRR 403. ^Thesis (4)
 BRR 406. Data Presentations-Projects (1)
 BRR 407. Seminar (1)
 BRR 409. Practicum: Teaching (1)
 WR 327. *Technical Writing (3)
 Baccalaureate core selection (3)
 Unrestricted electives (5)
 Selected courses to meet BRR option requirement (14)

Options Curricula

One option specialization is required (more are often possible). Course work for EACH option must total 29 credits.

ANIMAL REPRODUCTION AND DEVELOPMENT OPTION

Animal Reproduction and Development entails the study of life processes in cells, organs, and whole animals to enhance efficient production of high quality animals and animal food products. Students use antibody based assays, molecular genetics, protein chemistry, embryo and tissue culture, electron chemistry, and other modern laboratory techniques in research in areas of animal reproduction, development and growth, preparing them for positions or graduate programs in the bioscience/biomedical/veterinary/agricultural fields.

Required Courses

ANS 121. *Intro to Animal Sciences (4)
 ANS 314. Animal Physiology (4)
 ANS 316. Reproduction in Domestic Animals (4)
 ANS 317. Reproduction in Domestic Animals Lab (1)
 CSS 300. Intro to Crop Production (4)
Select one of the following courses:
 BI 314. Cell and Molecular Biology (4)
 BOT 331. Plant Physiology (4)
 CSS 305. Principles of Soil Science (4) and CSS 306. Problem Solving: Soil Science (1)
 CSS 311/ENT 311. Intro to Insect Pest Management (5)

MB 302. General Microbiology (3)
 RNG 241. Rangeland Ecology and Management (3)

TOX 411. Fundamentals of Toxicology (3)

Specialization and Breadth Courses
7 to 9 credits approved by option faculty and research mentor.

Total=29

APPLIED GENETICS OPTION

Applied Genetics is directed at changing the genomes of organisms, to increase their utility to humans. Techniques are derived from cytogenetics, molecular biology, and Mendelian and quantitative genetics. Typically, applied geneticists have expertise in one or more related fields of study such as agronomy, biochemistry, botany, entomology, food processing, forestry, microbiology, pathology, physiology, and statistics.

The goals of applied genetics include:

1. improving the quality of food and fiber products,
2. improving the cost efficiency of any given product, and
3. minimizing adverse environmental effects of food or fiber production.

Students in this option will be well prepared for positions in biosciences and agriculture, or in graduate and professional programs.

Required Courses

CSS 430. Plant Genetics (3) and CSS 450. Plant Breeding (4) or ANS 378. Animal Genetics (4)
 ST 411. Methods of Data Analysis (4)

Specialization and Breadth Courses

18 to 21 credits approved by option faculty and research mentor.

Total=29

BIOSYSTEMS MODELING OPTION

Biosystems Modeling applies general systems theory to the analysis of agricultural and environmental systems. Systems theory provides a method of analyzing overall system behavior by examining relations among—and behavior of—individual components, and synthesizing these relationships into a mathematical framework that describes the total system. Computer simulation using this mathematical framework can predict and analyze the response to various changes in the inputs to, and/or structure of, the system, providing a powerful tool for the development of comprehensive solutions to problems. Examples are the responses of salmon in natural and hatchery environments to water flow, oxygen levels, and temperature; interactions between crops (e.g. sweet corn, filberts, and apples), pests (e.g. corn earworm, filbert moth, and codling moth), pesticides, and crop yields.

Required Courses

BEE 471. Biosystems Modeling Techniques (3) or ST 435. Quantitative Ecology (3) or ST 443. Applied Stochastic Models (3)

CS 151. Intro to C Programming (4)
or CS 161. Intro to Computer Science I (4)
ST 411, ST 412. Methods of Data Analysis
(4,4)
or ST 421, ST 422. Intro to Mathematical
Statistics (4,4)

Specialization and Breadth Courses
14 to 16 credits approved by option faculty
and research mentor.

Total=29

BIOTECHNOLOGY OPTION

Biotechnology refers to laboratory-based techniques such as genetic engineering, recombinant DNA, tissue culture, and horizontal gene transfer, to make or modify products, to improve plants or animals, or to develop useful microorganisms. Examples include: gene transfer to increase plant yield or disease resistance; cell and tissue culture to clonally propagate plants or animals; manipulation of microorganisms or cultured cells for the production of fermented food and beverages or the development of vaccines; production of antibodies for detection of animal and plant diseases; drug discovery and development. Students will gain laboratory and/or field experience in modern techniques of biotechnology, preparing them for biosciences or biomedical graduate/professional schools or careers in biotechnology.

Substituted Courses

BB 490 and BB 491. Biochemistry (3,3)
for BB 450 and BB 451. Biochemistry (4,3)

Required Courses

BB 492. Biochemistry (3)
BI 314. Cell and Molecular Biology (4)
MB 302. General Microbiology (3)
and MB 303. General Microbiology Lab (2)
or HORT 441. Plant Tissue Culture (4)
MB 456. Plasmid Biology (3)

Specialization and Breadth Courses
13 to 15 credits approved by option faculty
and research mentor.

Total=29

ENVIRONMENTAL CHEMISTRY OPTION

Environmental Chemistry focuses on the basic principles that control the fate of chemicals in the environment. A bewildering variety of chemicals, an inevitable result of modern industrial civilization, are released daily; some of them persist in soil, water, or air. The extent to which these chemicals are a health hazard depends in part on where, how much, and in what form they accumulate. OSU scientists use state-of-the-art methods to detect trace amounts of chemicals in the environment, at levels as low as one part per trillion, and track their movement and transformations. Students will acquire laboratory skills that will be in high demand as worldwide public concern with environmental quality increases.

Substituted Courses

CH 334, CH 335, CH 336. Organic
Chemistry (3,3,3)
for CH 331, CH 332. Organic Chemistry
(4,4)
PH 211, PH 212, PH 213. *General Physics
with Calculus (4,4,4)
for PH 201, 202, 203. *General Physics (5,5,5)

Required Courses

CH 390. Environmental Chemistry (3)
CH 440. Physical Chemistry (3)
CSS 305. Principles of Soil Science (4)
and CSS 306. Problem Solving: Soil
Science Applications (1)
MTH 254. Vector Calculus I (4)

Select two courses from:

CH 324. Quantitative Analysis (4)
CH 421. Analytical Chemistry (3)
CH 428. Instrumental Analysis (4)
CH 435. Structural Determination by
Spectroscopic Methods (3)
CH 440. Physical Chemistry (3)
CH 461. Experimental Chemistry II (3)
CSS 545. Geochemistry of Soil Ecosystems
(4)
CSS 546. Soil Geochemistry Lab (1)
TOX 430. Chemical Behavior in the
Environment (3)
TOX 490. Environmental Forensic
Chemistry (3)

Specialization and Breadth Courses
5 to 8 credits approved by option faculty
and research mentor.

**Total=29 (not including substitute
courses)**

FOOD QUALITY OPTION

Food Quality research includes a broad range of studies involving sensory appeal, convenience, safety, and nutrition of food and beverages. The sensory aspects of food quality emphasize taste, texture, aroma, and appearance. The convenience aspects of food quality include shelf-life, ease of preparation, and improved functional properties. Food safety is concerned with acute and chronic responses of consumers to microorganisms and chemicals that occur naturally or are added to foods. Nutritional aspects of food quality are related to the nutrient content of foods and the role of nutrients in human health. Research in these areas is grounded in the application of basic sciences, including biology, chemistry, microbiology, molecular biology, psychology and engineering. Students will acquire skills appropriate for laboratory, industrial, or regulatory positions.

Required Courses

FST 421. Food Law (3)
FST 422. Food Chemistry (5)
FST 423. Food Analysis (4)
MB 302. General Microbiology (3)

Specialization and Breadth Courses
14 credits approved by option faculty and
research mentor.

Total=29

GENOMICS/ BIOINFORMATICS OPTION

Computational advances and the development of high throughput sequencing methods have led to a virtual explosion of genomics, proteomics, and metabolomics data, providing new approaches to problems in biosciences. The computer-aided analysis of these data with new tools from information science comprises the field of Genomics/Bioinformatics. The Genomics/Bioinformatics option examines the use of computational techniques to convert large amounts of information from DNA sequencing, DNA chips, and other high-throughput experimental methods into useful information that can be shared with other research scientists and medical professionals. The emphasis is on DNA and protein sequence alignment and analysis, and involves computational biology and biological statistics. Students will acquire skills preparing them for jobs or graduate programs in this new, rapidly growing field.

Genomics/Bioinformatics Option (29 credits):

Students are required to take one or two courses in each of four areas:

1. Biochemistry/Molecular Biology
2. Genetics/Organismal Biology
3. Computer Science
4. Statistics/Modeling.

In addition, students obtain depth by choosing one of these four areas as their area of emphasis and taking an additional 6 to 8 credits of upper-division courses in that area, plus additional upper-division electives.

Finally, students are required to do an internship in biocomputing, as a prerequisite to, or concurrent with starting, their research projects.

Mathematics:

Substitute MTH 231. Elements of Discrete
Mathematics (4)
and MTH 232. Elements of Discrete
Mathematics II (4)
for MTH 251. *Differential Calculus (4)
and MTH 252. Integral Calculus (4)

Required:

BRR 410. Internship (Biocomputing) (3)

1. Biochemistry/Molecular Biology:

Choose one course:

BI 314. Cell and Molecular Biology (4)
or BB 331. *Intro to Molecular Biology (3)

Students choosing the biochemistry/ molecular biology emphasis choose 6 to 8 additional credits:

BI 315. *Molecular Biology Lab (4)
or BB 481. Biophysics (3)
or BB 494. Biochemistry Laboratory (3)
or MB 310. Bacterial Molecular Genetics
(3)
or MB 311. ^Molecular Microbiology
Laboratory: A Writing Intensive Course (3)
or equivalent upper-division courses
approved by research mentor.

2. Genetics/Organismal Biology:**Choose one course:**

CSS 430. Plant Genetics (3)
 or ANS 378. Animal Genetics (4)
 or BOT 321. Plant Systematics (4)
 or FS 444. Forest Genetics (4)
 or MB 302. General Microbiology (3)
 Students choosing the genetics/organismal biology emphasis choose 6 to 8 additional credits:
 MB 310. Bacterial Molecular Genetics (3)
 or MB 554. Genome Organization, Structure and Maintenance (4)
 or MB 668. Bioinformatics and Genomics (4)
 or equivalent upper-division courses approved by research mentor.

3. Computer Science:

CS 161, CS 162. Introduction to Computer Science I, II (4,4)

Students choosing the computer science emphasis choose 6 to 8 additional credits:

CS 261. Data Structures (4)
 or CS 325. Analysis of Algorithms (4)
 or CS 420. Graph Theory with Applications to Computer Science (3)
 or equivalent upper-division courses approved by research mentor to fulfill the computer science emphasis.

4. Statistics/Modeling:**Choose one course:**

BEE 471. Biosystems Modeling Techniques (3)
 or CSS 590. Experimental Design in Agriculture (4)
 or ST 352. Introduction to Statistical Methods (4)

Students choosing the statistics/modeling emphasis will choose 6 to 8 additional credits:

ST 411, ST 412. Methods of Data Analysis (4,4)
 or ST 421, ST 422. Introduction to Mathematical Statistics (4,4)
 or ST 441. Probability, Computing, and Simulation in Statistics (4)
 or equivalent upper-division courses approved by research mentor.

Electives:

3 to 6 additional credits of upper-division courses approved by research mentor, for a total of 29 credits.

PEST BIOLOGY AND MANAGEMENT OPTION

Pest Biology and Management involves the study of living organisms, such as insects, fungal and bacterial pathogens, vertebrates, and weeds, that limit agricultural productivity. Students with an interest in entomology may study identification, biology and control of insects, including integrated plant protection, biocontrol, and use of beneficial insects. Research approaches range from basic laboratory studies to field experiments. Students will develop research skills in pest biology, development of management strategies, and assessment of pest impact on plants or livestock, preparing

them for a variety of regulatory and research positions and graduate programs.

Required Courses

BOT 331. Plant Physiology (4)
 BOT 350. Introductory Plant Pathology (4)
 CSS 311. Introduction to Insect Pest Management (5)
 CSS 440. Weed Management (4)

Specialization and Breadth Courses

12 credits approved by option faculty and research mentor.

Total=29**PLANT GROWTH AND DEVELOPMENT OPTION**

Plant Growth and Development involves study of the control and coordination of processes in cells, organs, and/or whole plants, including, for example, changes in gene expression in response to environmental conditions such as climate change. Students will develop research skills and knowledge about the regulation of plant growth and development, metabolism, structure and function of macromolecules (i.e. enzymes, storage proteins, and nucleic acids), and whole plant physiology, preparing them for agricultural and biosciences positions or graduate programs.

Required Courses

BOT 313. Plant Structure (4)
 BOT 331. Plant Physiology (4)

Select two of the following:

BI 314. Cell and Molecular Biology (4)
 BOT 332. Laboratory Techniques in Plant Biology (3)
 BOT 421. Advanced Plant Systematics (4)
 CSS 305. Principles of Soil Science (4)
 and CSS 306. Problem Solving: Soil Science (1)
 HORT 316. Plant Nutrition (4)

Specialization and Breadth Courses

12 to 14 credits approved by option faculty and research mentor.

Total=29**SUSTAINABLE ECOSYSTEMS OPTION**

Sustainable Ecosystems research addresses the sustainability of agricultural, forest, rangeland, wildlife, fishery, and native ecosystems. The program aims to define and develop natural and managed ecosystems in which environmental soundness results from the conscious interaction of humans with wildlife and other components of the systems. Innovative links among scientific and humanistic disciplines will bring about increased understanding of the present and future health of natural and managed ecosystems and associated human communities. Sustainable ecosystems research is multi disciplinary: insights from sociology, political science, anthropology, or philosophy may be combined with basic concepts from biology, chemistry, and physics to support research rooted in

agricultural, forestry, rangeland management, or wildlife management. Students will acquire perspective by choosing among a broad variety of courses, and will participate in field, laboratory, or systems analysis projects, preparing them for graduate/professional schools or research and regulatory positions.

Required Courses

BI 370. Ecology (3)
 or BOT 341. Plant Ecology (4)
 or FOR 341. Forest Ecology (3)
 BI 371. ^Ecological Methods (3)
 or RNG 441. Rangeland Analysis (4)

Additional courses are required in three categories: ethics, social/political, and management. Please call the advisor, 737-2999.

Specialization Courses

9 to 14 credits approved by option faculty and research mentor.

Total=29**TOXICOLOGY OPTION**

Toxicology concerns potentially hazardous chemicals in food and the environment, and their effects on biological life. Toxic chemicals include pesticides such as insecticides and herbicides, industrial waste products, compounds that exist naturally in plants, those that contaminate foods as a result of fungal growth, and even some that are produced in the preparation and cooking of foods. Potential health effects from toxin exposures can range from immediate impairment of breathing or nerve function to chronic diseases, cancer, birth defects, and immune disorders. Toxicology research focuses on understanding mechanisms of toxicity, human and environmental risks from exposure, and means for reducing risks. Students will acquire laboratory skills in applied biochemistry and molecular, cellular, and organismal biology, preparing them for research or regulatory positions or biosciences/biomedical graduate/professional programs.

Substituted Courses

CH 334, CH 335, CH 336. Organic Chemistry (3,3,3) for CH 331, 332 (4,4).

Required Courses

TOX 411. Fundamentals of Toxicology (3)
 TOX 413. Environmental Toxicology and Risk Management (3)

Specialization and Breadth Courses

23 credits approved by option faculty and research mentor.

Total=29**WATER RESOURCES OPTION**

Water Resources research involves the use of science and policy tools to identify contaminants and make assessments of water quality. Students will acquire laboratory skills to detect water contaminants and track their movements and transformations, while learning related policy

and management concerns. Research areas could include microbial contaminants, the impact of urbanization on water quality, and marine and estuarine water quality and its impact on fisheries and shellfish industries. Option course work covers water sciences and hydrology, environmental policy and management. Students completing this option will be prepared for graduate school or for positions in environmental consulting, research, and natural resource management.

Water Sciences:

Choose four courses:

CSS 305. Principles of Soil Science (4)
or FW 456. Limnology (5)
or GEO 487. Hydrogeology (4)
or MB 302. General Microbiology (3)
or OC 332. Coastal Oceanography (3)
or OC 433. Coastal and Estuarine Oceanography (3)
or TOX 430. Chemical Behavior in the Environment (3)

Watersheds and Hydrology:

Choose one course:

FE 430. Watershed Processes (4)
or CE 412. Hydrology (4)

Water Resources

Environmental Analysis:

Choose one course:

BI 371. Ecological Methods (3)
or BEE 448. Non-point Source Pollution Assessment and Control (3)
or BOT 547. Nutrient Cycling (3)
or CE 413. GIS in Water Resources (3)
or ENVE 456. Sustainable Water Resources Development (3)
or GEO 424. International Water Resources Management (3)
or TOX 455. Ecotoxicology: Aquatic Ecosystems (3)

Water Resources Environmental Policy and Management:

Choose one course:

FW 326. Integrated Watershed Mgt. (3)
or AREC 432. Environmental Law (4)
or FOR 462. Natural Resource Policy and Law (3)
or PS 475. Environmental Politics and Policy (4)
or CSS/GEO 335. *Introduction to Water Science and Policy (3)
or GEO 425. Water Resources Management in the US (3)
or MRM 515. Coastal Resources Management (4)
or RNG 455. Riparian Ecology and Management (3)

Plus:

1 to 7 additional credits of upper division courses approved by research mentor, for a total of 29 credits.

These courses are chosen to complement and support the research project and prepare the student for future careers or graduate school.

Recommended areas: climatology, geology, resource economics, watersheds, watersheds management, microbial ecology, engineering, mathematics, hydrology, hydrogeology, irrigation, toxicology, ecology, environmental analysis, environmental chemistry, geochemistry, environmental management, environmental policy, economics, marine biology, aquatic and marine botany and zoology, oceanography, statistics, geography, environmental ethics, research ethics.

COURSES

BRR 100 GREAT EXPERIMENTS IN BIORESOURCE SCIENCES (1).

Course for students interested in research in bioresources. Students meet other BRR students and faculty. Participating BRR faculty mentors describe research projects and experimental approaches, and pose interesting political and ethical questions related to scientific research. Students write about and discuss research, research ethics, and social and political considerations with first- and second-year students interested in research and the BRR major, and third- and fourth-year student mentors already involved in research projects. This course is repeatable for a maximum of 2 credits.

BRR 401 RESEARCH AND SCHOLARSHIP (1-16).

BRR students select from over 100 research faculty and programs, across college and departmental boundaries, to complete 14 credits of research. Students and faculty follow established guidelines for preparing their project proposals and reports, and completing their research thesis. Students learn research methodologies applicable to their chosen field, gain valuable professional contacts, and acquire self-confidence in their area of specialization after having completed a project. Students are evaluated on their ability to develop and complete a research project proposal, learn and develop research methodologies, and learn trouble shooting procedures applicable to their chosen field of research. This course is repeatable for a maximum of 99 credits. **PREREQS:** Departmental approval required.

BRR 403 THESIS (4). Course for BRR students allowing them to independently develop and summarize their own research project in writing. This is a writing intensive course (WIC) and because the writing process for each project is interactive, students have several opportunities to learn and improve their writing abilities. Students write their thesis in a style appropriate for submission to a peer reviewed journal in their chosen scientific disciplines. Ungraded required writing assignments include project proposal, laboratory notebook, and project update. Students receive a letter grade based on their final thesis. The student's faculty mentor and the BRR director provide comments on reports and a consensus grade when the thesis is completed. (Writing Intensive Course) This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

BRR 405 READING AND CONFERENCE (1-16).

This course is repeatable for a maximum of 16 credits.

BRR 406 PROJECTS: DATA PRESENTATIONS (1).

Course for all students involved in research, to help them design, evaluate, and develop poster and Power Point presentations of their research data. Students are exposed to a variety of disciplines as they prepare presentations and critique their own and other students' data presentations. This course helps students improve written and oral communication skills as they learn aspects of good presentation and discussion skills and discover the appropriate information to display on slides and posters. Students receive a letter grade based on participation, improvement, and the quality of a final poster project and oral presentation. Open to any student involved in research. CROSSLISTED as HORT 406. This course is repeatable for a maximum of 99 credits.

BRR 407 SEMINAR (1). Course for BRR students encouraging excellence in public speaking. The class exposes students to a variety of current seminar topics and provides them with the opportunity to evaluate components of good public seminars. Senior students receive a grade only after completing a public seminar on their own research.

BRR 409 PRACTICUM: TEACHING AND PEER MENTORING (1-2).

Upper-division students are grouped with lower-division students to facilitate discussion, serve as approachable science-writing assistants, and encourage dialogue about current research topics. Juniors and seniors learn new ways to teach and communicate science issues in both written and verbal formats. Students write about and discuss research, research ethics, and social and political considerations. This course is repeatable for a maximum of 16 credits.

BRR 410 INTERNSHIP (1-12).

Supervised internship allowing students to gain off-campus work experience for credit. Under direction and approval of the program director, students will submit a statement of intent, identify employer contact, and provide a written report upon completion. This course is repeatable for a maximum of 16 credits. **PREREQS:** Junior standing.

ENVIRONMENTAL SCIENCES

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Undergraduate Major
Environmental Science (BS)

Options

Applied Ecology and Resource Management (for Ecampus students only)

Aquatic Biology

Environmental Chemistry for the Environmental Sciences

Environmental Conservation and Sustainability Option

Environmental Policy

Land-Air Interaction

Pre-Education Environmental Science

Terrestrial Ecosystems

Water Science and Resources

Minors

Environmental Science

Graduate Major

Environmental Sciences (MA, MS, PhD)

Also see the Environmental Sciences Graduate Program

Graduate Minor

Environmental Sciences

Environmental science consists of curricula that foster interdisciplinary education for students seeking to better understand earth systems. The undergraduate curriculum leads to the BS in Environmental Science degree and requires students to complete courses that develop a broad base of knowledge in basic science disciplines, social sciences, and an area of specialization. A minor in environmental sciences is also available for those undergraduate students completing their degrees in other fields. The theme of the Environmental Sciences Program is central to the mission of OSU and reflects the strengths of OSU and other agencies and institutions in Corvallis and throughout the state of Oregon. The BS in Environmental Science degree provides excellent training for careers with agencies responsible for environmental protection and natural resource use, consulting firms, and those seeking opportunities for graduate studies.

MAJOR CURRICULUM

The environmental science degree requires credits in five categories: 48 credits of baccalaureate core; 70 credits of basic science, humanities and skills core; 25–26 credits of environmental sciences and humanities; 27–31 credits of specialization; and 32–37 credits of elective courses.

BACCALAUREATE CORE (48)

The university baccalaureate core course (BCC) requirement is met with 48 credits and a writing intensive course (WIC). The environmental science student satisfies the general education requirement by selecting 27 unrestricted credits from the general list of approved courses and 21 credits from a restrictive list of BCC courses, which simultaneously satisfy requirements for the environmental sciences major. The WIC and Synthesis requirements are satisfied by courses taken as part of the environmental sciences core curriculum.

Sample Curriculum

Courses listed below are required and may be taken in an order other than that listed below

Freshman Year

CH 121, CH 122, CH 123. General Chemistry (5,5,5)

or CH 221, CH 222, CH 223. *General Chemistry (5,5,5)

HHS 231. *Lifetime Fitness for Health (2)

HHS 241–HHS 248. *Lifetime Fitness: (various activities) (1)

MTH 251. *Differential Calculus (4)

either MTH 252. Integral Calculus (4)

or MTH 268. Mathematical Ideas in Biology (4)

WR 121. *English Composition (3)

Required courses and/or electives (8)

Sophomore Year

BI 211, BI 212, BI 213. *Principles of Biology (4,4,4)

ECON 201. *Intro to Microeconomics (4)

or AREC 250. *Intro to Environmental Economics and Policy (3)

Required courses and/or electives (11–13)

Writing II, III* (6)

Junior and Senior Years

ATS 210. Intro to Atmospheric Sciences (3)

or GEO 323. ^Climatology (4)

BI 370. Ecology (3)

CSS 305. Principles of Soil Science (4)

or GEO 202. *Earth System Science (4)

or GEO 221. *Environmental Geology (4)

or GEO 424. International Water Resources Management (3)

OC 331. Intro to Oceanography (3)

or CE 412. Hydrology (4)

or FE 532. Forest Hydrology (3)

or FW 456. Limnology (5)

or FW 580. Stream Ecology (3)

PH 201, PH 202. *General Physics (5,5)

or PH 211, PH 212. *General Physics with Calculus (5,5)

Two courses in environmental law and management, selected from the following:

AREC 253. *Environmental Law, Policy, and Economics (4)

AREC 352. *Environmental Economics and Policy (3)

AREC 432. Environmental Law (4)

FOR 462. Natural Resource Policy and Law (3)

FOR 463. Environmental Policy and Law Interactions (3)

FW 325. *Global Crises in Resource Ecology (3)

FW 326. Integrated Watershed Management (3)

FW 435. ^Wildlife in Agricultural Ecosystems (3)

FW 453. Forest Management and Wildlife Conservation (3)

FW 458. Management of Big Game Animals (4)

PH 313. *Energy Alternatives (3)

RNG 355. Desert Watershed Management (3)

RNG 421. Rangeland Improvements and Restoration Ecology (4)

RNG 455. Riparian Ecology and Management (3)

RNG 490. Rangeland Management Planning (4)

One course in environmental ethics and policy, selected from the following:

ANTH 481. *Natural Resources and Community Values (3)

AREC 351. *Natural Resource Economics and Policy (3)

AREC/ECON 352. *Environmental Economics and Policy (3)

AREC 434. ^Environmental and Resource Economics (3)

PHL 440. Environmental Ethics (3)

PHL 443. *World Views and Environmental Values (3)

PS 474. Bureaucratic Politics (4)

PS 475. Environmental Politics & Policy (4)

PS 477. International Environmental Politics and Policy (4)

One course in the human environment, selected from the following:

BI 301. *Human Impacts on Ecosystems (3)

BI 306H. ^*Environmental Ecology (3)

CH 390. Environmental Chemistry (3)

ENSC 479. ^*Environmental Case Studies (3)

FW 325. *Global Crises in Resource Ecology (3)

H 344. Environmental Science; a Global Perspective (3)

Z 348. *Human Ecology (3)

Courses required for specialization area (27–31)

Observational experience (3)**Required courses and/or electives (13–20).****Specialization Area (27–31)**

This requirement can be met by completing an approved certificate, option, or minor from a participating program in the environmental or closely related

sciences, or working with advisors to develop an innovative course cluster to analyze environmental systems.

APPROVED CERTIFICATE:

- Certificate of Applied Ethics
- Geographic Information Sciences

APPROVED OPTIONS:

- Applied Ecology and Resource Management (*for Ecampus students only*)
- Aquatic Biology
- Environmental Chemistry for the Environmental Sciences
- Environmental Conservation and Sustainability
- Environmental Policy
- Land-Air Interaction
- Pre-Education Environmental Science
- Terrestrial Ecosystems
- Water Science and Resources

APPROVED MINORS:

- Botany
- Business and Entrepreneurship
- Environmental Engineering
- Environmental Geosciences
- Environmental Safety and Health
- Fisheries and Wildlife
- Forest Management
- Natural Resource and Environmental Law and Policy
- Oceanography
- Resource Economics
- Soil Science
- Zoology

Curricula with greater details for these options are available from the Environmental Sciences Program office, 2046 Cordley Hall.

Elective Courses (32-37)

These courses are unrestricted.

Observational Experience Requirement (3)

The program must contain at least one course, internship or research experience, that provides opportunities for hands-on experience in design and collection of observations in the physical, biological or social environment. Students are urged to work with advisors at an early stage in their study to identify courses or experiences that are appropriate.

APPLIED ECOLOGY AND RESOURCE MANAGEMENT OPTION

Via Ecampus Distance Education Only

This option was designed for students wishing to complete a BS in Environmental Sciences degree from off-campus locations. Many of the courses are Web or video based.

Applied Ecology Core (7)

BOT 440. Field Methods in Vegetation Science (4)

RNG 241. Rangeland Ecology and Management (3)

or RNG 455. Riparian Ecology and Management (3)

Resource Management Core

Choose any 3 of the following:

AREC 351. *Natural Resource Economics and Policy (3)

FOR 365. Issues in Natural Resource Conservation (3)

FW 323. Management Principles of Pacific Salmon in the Northwest (3)

FW 435. ^Wildlife in Agricultural Ecosystems (3)

NR 455. Natural Resource Decision Making (3)

RNG 355. Desert Watershed Management (3)

The Land and its Interpretation (6-7)

Choose any 2 of the following:

FW 303. Survey of Geographic Information Systems in Natural Resources (3)

GEO 301. Map and Image Interpretation (4)

GEO 465. Geographic Information Systems (3)

Electives (3-5)

Additional courses above or:

FW 251. Principles of Fish and Wildlife Conservation (3)

Total Credits=27+

AQUATIC BIOLOGY OPTION

Option I—Hatfield Term (27+credits)

BI 450, BI 451. Marine Biology (at Hatfield Marine Science Center) (8,8)

Plus 11 credits of electives chosen from the list for Option 2, below, in consultation with ENSC advisor.

Option II

Choose 27 credits or more from below:

BI 358. Symbioses and the Environment (3)

BOT 416. Aquatic Botany (4)

FW 315. Biology of Fishes (3)

FW 316. Systematics of Fishes (2)

FW 421. Aquatic Biological Invasions (4)

FW 431. Dynamics of Marine Biological (4)

FW 454. Fishery Biology (4)

FW 456. Limnology (5)

FW 465. Marine Fisheries (4)

FW 473. Fish Ecology (4)

FW 499. Special Topics in Fisheries and Wildlife (4)

FW 580. Stream Ecology (3)

MB 492. Diseases of Fish (3)

OC 441. Marine Zooplankton (4)

OC 440. Intro to Biological Oceanography (3)

TOX 455. Ecotoxicology: Aquatic Ecosystems (3)

Z 351, Z 352. Marine Ecology and Lab (3,2)

Z 361, Z 362. Invertebrate Biology and Lab (3,2)

Z 461. Marine and Estuarine Invertebrate Zoology (4)

- Hatfield summer term classes (these vary each year, must be approved by advisor)

- Galapagos term abroad classes (these vary each year, must be approved by advisor)

BB 350. Elementary Biochemistry (4) *recommended*

CH 331, 332. Organic Chemistry (4,4) *recommended*

Total=27

ENVIRONMENTAL CHEMISTRY FOR THE ENVIRONMENTAL SCIENCES OPTION

Environmental chemistry focuses on the basic principles that control the fate of chemicals in the environment. A bewildering variety of chemicals, an inevitable result of modern industrial civilization, are released daily; some of them persist in soil, water, or air. The extent to which these chemicals are a health hazard depends in part on where, how much, and in what form they accumulate. Students will acquire laboratory skills that will be in high demand as worldwide public concern with environmental quality increases.

Substituted Courses

PH 211, 212. *General Physics with Calculus (4,4) for PH 201, 202. *General Physics (5,5)

Required Courses

CH 334, CH 335, CH 336. Organic Chemistry (3,3,3)

CH 390. Environmental Chemistry (3)

CH 440. Physical Chemistry (3)

MTH 254. Vector Calculus I (4)

PH 213. *General Physics with Calculus (4)

Select two courses from below:

CH 324. Quantitative Analysis (4)

CH 421. Analytical Chemistry (3)

CH 435. Structural Determination by Spectroscopic Methods (3)

CH 461. Experimental Chemistry II (3)

TOX 430. Chemical Behavior in the Environment (3)

TOX 490. Environmental Forensic Chemistry (3)

Total greater than or = 29

(not including substitute courses)

ENVIRONMENTAL CONSERVATION AND SUSTAINABILITY OPTION

(**Note:** Most classes are offered through Ecampus; those offered on Corvallis campus only are marked with "cc")

Core courses (12-14):

1. Choose at least 1 from:

FOR 365. *Issues in Natural Resources Conservation (3)

FW 251. Principles of Fish and Wildlife Conservation (3)

2. Choose at least 2 from:

ANTH 481. *Natural Resources and Community Values (3)

AREC 351. *Natural Resource Economics and Policy (3)

AREC 352. *Environmental Economics and Policy (3)

SOC 481. *Society and Natural Resources (4)

3. Choose at least 1 from:

- ATS 320. *Man's Impact on Climate (3)
 BI 306H. *Environmental Ecology (3)cc
 Z 348. *Human Ecology (3)cc

Electives (13–15):

Students must choose at least 5 credits from both the natural science group and the social science group in consultation with an advisor.

Natural Sciences

- ATS 320. *Man's Impact on Climate (3)
 BEE 439. Irrigation Principles and Practices (4)
 BI 301. *Human Impacts on Ecosystems (3)cc
 BI 306. *Environmental Ecology (3)cc
 BI 311. Genetics (4)
 CH 374. *Technology, Energy, and Risk (3)
 CH 390. Environmental Chemistry (3)
 CSS/GEO 335. *Intro to Water Science and Policy (3)
 CSS 375. Soil Resource Potentials (3)cc
 CSS 499. Special Topics: Genetically Modified Organisms and Sustainable Agriculture (1–16)
 CSS 499. Special Topics: Organic Farming (1–16)
 ENGR 350. *Sustainable Engineering (3)cc
 FOR 352. Wilderness Management (3)
 FOR 365. *Issues in Natural Resources Conservation (3)
 FOR 445. Ecological Restoration (4)
 FW 251. Principles of Fish and Wildlife Conservation (3)
 FW 303. Survey of Geographic Information Systems in Natural Resource (3)
 FW 321. Fisheries and Wildlife Resource Ecology (3)
 FW 323. Management Principles of Pacific Salmon in the Northwest (3)
 FW 325. *Global Crises in Resource Ecology (3)
 FW 350. *Endangered Species, Society and Sustainability (3)
 FW 435. ^Wildlife in Agricultural Ecosystems (3)cc
 GEO 300. *Environmental Conservation and Sustainability (3)
 GEO 365. Introduction to Geographic Information Systems (4)
 GEO 423. Land Use (3)
 PH 313. *Energy Alternatives (3)cc
 RNG 241. Rangeland Ecology and Management (3)
 Z 348. *Human Ecology (3)cc
 Z 349. *Biodiversity: Causes, Consequences, and Conservation (3)cc

Social Sciences

- ANTH 481. *Natural Resources and Community Values (3)
 AREC 351. *Natural Resource Economics and Policy (3)
 AREC 352. *Environmental Economics and Policy (3)
 FOR 330. Forest Economics I (3)
 FOR 332. Risk and Decision-Making for Natural Resource Management (3)
 FOR 462. Natural Resource Policy and Law (3)cc
 GEO 306. *Minerals, Energy, Water and the Environment (3)
 GEO 423. Land Use (3)
 GEO 425. Water Resources Management in the United States (3)cc

- GEO 424. International Water Resources Management (3)cc
 GEO 452. Principles and Practices of Rural and Resource Planning (3)cc
 PS 449. ^Topics in Comparative Politics (4)cc
 PS 474. Natural Resource Policy and Bureaucratic Politics (4)cc
 PS 475. Environmental Politics and Policy (4)
 PS 477. International Environmental Politics and Policy (4)
 SOC 480. *Environmental Sociology (4)
 SOC 481. *Society and Natural Resources (4)

Footnotes:

- * Baccalaureate Core Course
 ^ Writing Intensive Course (WIC)
 cc Available on Corvallis campus only.

ENVIRONMENTAL POLICY OPTION

Students should select PHL 440, Environmental Ethics (3), for the environmental ethics and politics requirement and AREC 351, Natural Resource Management and Policy (3), for the conservation and management requirement found in the Environmental Sciences core curriculum. These are the best choices for core requirements; they do not count toward specialization requirements.

Core Courses (17)

- AREC 352. Environmental Economics and Policy (3)
 COMM 440. Theories of Conflict and Conflict Management (3)
 ECON 435. The Public Economy (4)
 HST 481. Environmental History of the United States (3)
 PS 475. Environmental Politics and Policy (4)

Electives (10)

Choose two courses from one of the following groups. It is recommended that all three courses be selected from the same group.

Agricultural**Resources/Economics Group**

- AREC 351. Natural Resource Economics and Policy (3)
 AREC 353. Public Land Statutes and Policy (4)
 AREC 407. Seminar (1)
 AREC 433. International Agricultural Development (3)
 AREC 434. Environmental and Resource Economics (3)
 AREC 453. Public Land and Resource Law (4)
 AREC 454. Rural Development Economics and Policy (3)
 AREC 461. ^Agricultural and Food Policy Issues (4)
 AREC 550. Environmental Economics (3)
 AREC 551. Natural Resource Economics (3)
 ECON 311. Intermediate Microeconomic Theory I (4)
 ECON 315. Intermediate Macroeconomic Theory I (4)
 ECON 428. ^Intro to Economic Research (4)
 ECON 439. Public Policy Analysis (4)
 ECON 455. Economic Development (4)

Forest Resources Group

- FOR 365. Issues in Natural Resources Conservation (3)
 FOR 430, FOR 431. Forest Resource Economics I, II (4,4)

- FOR 444. Ecological Aspects of Park Management (3)
 FOR 451. History and Cultural Aspects of Recreation (4)
 FOR 457. Techniques for Forest Resource Analysis (4)
 FOR 460. ^Forest Policy (4)
 FOR 462. Natural Resource Policy and Law (3)
 FOR 463. Environmental Policy and Law Interactions (3)
Political Science and Communication Group
 AREC 432. Environmental Law (4)
 COMM 426. Intercultural Communication: Theories and Issues (3)
 COMM 442. Bargaining and Negotiation Processes (3)
 PS 300. Political Analysis (4)
 PS 311. Legislative Politics (4)
 PS 414. ^Interest Groups (4)
 PS 415. Politics and the Media (4)
 PS 424. Administrative Law (4)
 PS 452. Alternative International Futures (4)
 PS 474. Bureaucratic Politics (4)

Resource Ecology Group

- FW 325. Global Crises in Resource Ecology (3)
 GEO 335/CSS 335. *Intro to Water Science and Policy (3)
 GEO 423. Land Use (3)
 GEO 424. International Water Resources Management (3)
 GEO 425. Water Resource Management in the U.S. (3)
 GEO 426. Third World Resource Development (3)
 HST 467, HST 468. History of the American West (4,4)

Sociology Group

- SOC 360. *Population Trends and Policy (4)
 SOC 415. Understanding Social Research (4)
 SOC 421. Social Change and Modernization (3)
 SOC 466. International Development: Gender Issues (4)
 SOC 480. *Environmental Sociology (4)
 SOC 481. *Society and Natural Resources (4)
 SOC 485. *Consensus and Natural Resources (3)

Total=27**LAND-AIR INTERACTION OPTION****Basic Science Core Requirement**

- PH 211, 212, 213. *General Physics with Calculus (4,4,4)
 BI 211, 212, 213. *Principles of Biology (3,3,3)

Core (minimum of 28)

- ATS 320. Man's Impact on Climate (3) or GEO 323. ^Climatology (4)
 ATS 413. Atmospheric Chemistry (3) or CH 390. Environmental Chemistry (3)
 ATS 420. Principles of Atmospheric Science (4)
 BOT 331. Plant Physiology (4)
 CSS 305. Principles of Soil Science (4)
 CSS 306. Problem Solving: Soil Science Applications (1)
 FE 430. Watershed Processes (4)
 MTH 254. Vector Calculus I (4)

Total=28 minimum

PRE-EDUCATION ENVIRONMENTAL SCIENCE OPTION

This option prepares students to apply for a graduate teacher licensure program in science and math education.

The core courses for the Environmental Sciences degree and for this option, plus electives from the appropriate track below, can complete a student's preparation for a first subject area endorsement in biology or integrated science. The core plus courses listed under the mathematics track below provide partial preparation for a second subject area endorsement in mathematics (to teach at the middle/high school level).

Core Courses (6 credits)

SED 406. Projects (3) – Winter classroom immersion or September experience
 SED 409. Field Practicum: Science and Mathematics (3)

Education Courses (5–6 credits)

SED 412. Technology Foundations for Teaching Math and Science (3)
 SED 413. Sciences Materials and Laboratories (3)
 SED 414. Mathematics Materials and Laboratories (3)
 TCE 216. Purpose, Structure, and Function of Education in a Democracy (3)
 TCE 219. Multicultural Issues in Education Settings (2)

Human Development Course (3–4 credits)

HDFS 313. Adolescent Development (4)
 TCE 253. Learning Across the Lifespan (3)
 TCE 512. Psychology of the Adolescent (3)

Students should consult with their advisor regarding course selection for the Education and Human Development courses.

Electives selected from one of the endorsement areas listed below:

Integrated science

first subject area endorsement:

Add the following to the BI, CH and PH courses taken for the Environmental Science core, and take GEO 202 for the lithosphere requirement in the Environmental Science core:

GEO 201. *Physical Geology (4)
 GEO 203. *Evolution of Planet Earth (4)
 Select 1–2 additional upper-division course(s) from the following departments: BB, BI, BOT, CH, GEO, MB or Z

Total credits from core and endorsement area: 27

Mathematics Endorsement (for middle-level mathematics teaching; partial preparation)

MTH 211. *Foundations of Elementary Mathematics (4)
 MTH 212. Foundations of Elementary Mathematics (4)
 MTH 361. Introduction to Probability (3)
 MTH 390. Foundation of Elementary Mathematics (4)

Total credits from core and endorsement area: 29

Biology first subject area endorsement:

BI 311. Genetics (4)
 BI 445/BI 545. Evolution (3)
 Select 2 additional upper-division courses from the following departments: BB, BI, BOT, HSTS, MB, OC or Z

Total credits from core and endorsement area: 27

TERRESTRIAL ECOSYSTEMS OPTION

Core Courses (3)

BI 371. ^Ecological Methods (3)

Advanced Ecology (9)

BI 349. *Biodiversity: Causes, Consequences and Conservation (3)
 BOT 440. Field Methods in Vegetation Science (4)
 BOT 442. Plant Population Ecology (3)
 ENT 420. Insect Ecology (3)
 FOR 445. Ecological Restoration (4)
 GEO 324. Geography of Life: Species Distribution and Conservation (4)
 RNG 241. Rangeland Ecology and Management (3)
 RNG 450. Landscape Ecology and Analysis (3)
 RNG 455. Riparian Ecology and Management (3)
 Z 423. Environmental Physiology (4)

Land/Air Processes (6)

ATS 412. Atmospheric Radiation (3)
 ATS 413. Atmospheric Chemistry (3)
 ATS 420. Principles of Atmospheric Science (4)
 ATS 564. Interactions of Vegetation and Atmosphere (3)
 BOT/FS 547. Nutrient Cycling (3)
 FE 430. Watershed Processes (4)
 FE 537. Hillslope and Watershed Hydrology (4)
 GEO 322. Surface Processes (4)
 GEO 323. ^Climatology (4)
 GEO 430. Geochemistry (3)
 GEO 432. Applied Geomorphology (3)

Principles of Terrestrial Ecosystem Management (9)

Select three courses from one of the following groups for a total of 9 credits. Courses may be substituted with advisor's written consent.

Forest Group

FOR 332. Risk and Decision-Making for Natural Resource Management (3)
 FOR 346. Topics in Wildland Fire (3)
 FOR 441. Silviculture Principles (4)
 FOR 444. Ecological Aspects of Park Management (3)
 FOR 445. Ecological Restoration (4)
 FOR 446. Wildland Fire Ecology (3)
 FOR 457. Techniques for Forest Resource Analysis (4)
 FOR 459. Forest Resource Planning and Decision Making (4)
 FS 415. Forest Insect and Disease Management (5)
 FS 430. *Biotechnologies: Agriculture, Food and Resource Issues (3)
 FS 453. Forest Management and Wildlife Conservation (3)
 FS 548. Biology of Invasive Plants (3)

Soils Group

CSS 315. ^Nutrient Management and Cycling (4)
 CSS 330. *World Food Crops (3)
 CSS 335. *Intro to Water Science and Policy (3)
 CSS 415. Soil Fertility Management (3)
 CSS 455. Biology of Soil Ecosystems (4)
 CSS 466. Soil Morphology and Classification (4)
 CSS 468. Soil Landscape Analysis (4)
 CSS 480. Case Studies in Cropping Systems Management (4)
 CSS 525. Mineral-Organic Matter Interactions (3)
 CSS 535. Soil Physics (3)
 CSS 536. Vadose Zone Hydrology Lab (1)
 CSS 545. Geochemistry of Soil Ecosystems (4)

Fisheries and Wildlife Group

FW 321. Fisheries and Wildlife Resource Ecology (3)
 FW 322. Investigations in Population Dynamics (2)
 FW 446. Wildland Fire Ecology (3)
 FW 453/FS 453. Forest Management and Wildlife Conservation (3)
 FW 458. Management of Big Game Animals (4)
 FW 479. Wetlands and Riparian Ecology (3)
 FW 481. Wildlife Ecology (4)

Range Group

RNG 346. Topics in Wildland Fire (3)
 RNG 355. Desert Watershed Management (3)
 RNG 421. Wildland Restoration and Ecology (4)
 RNG 441. Rangeland Analysis (4)
 RNG 442. Rangeland-Animal Relations (4)
 RNG 446. Wildland Fire Ecology (3)
 RNG 450. Landscape Ecology and Analysis (3)
 RNG 455. Riparian Ecology and Management (3)

GIS and Mapping Group

FE 357. GIS and Forest Engineering Applications (3)
 FOR 420. Advanced Aerial Photos and Remote Sensing (3)
 FOR 421. Spatial Analysis of Forested Landscapes (3)
 GEO 301. Map and Image Interpretation (4)
 GEO 360. Cartography (4)
 GEO 365. Intro to Geographic Information Systems (4)
 GEO 444. Remote Sensing (4)
 GEO 445. Computer-Assisted Cartography (3)
 GEO 465. Geographic Information Systems and Science (3)
 GEO 466. Digital Imaging Processing (3)

Total=27+

WATER SCIENCE AND RESOURCES OPTION

The Water Science and Resources option focuses on water as a resource and on hydrological sciences. It requires a minimum of 27 credits.

Core Courses (9–12)

CSS/GEO 335. Introduction to Water Science and Policy (3)

Select one hydrological science (3–4)

CE 412 Hydrology (4)

GEO 487. Hydrogeology (4)
 FE 430. Watershed Processes (4)
 FE 434. Forest Watershed Management (4)
Select one resource ecology/management (3–5)
 FW 456. Limnology (5)
 FW 479. Wetlands and Riparian Ecology (3)
 FW 580. Stream Ecology (3)
 RNG 355. Desert Watershed Management (3)
 RNG 455. Riparian Ecology and Management (3)

Choose courses from one track listed below (15–18 credits, to bring total to 27 or more)

Water Resources and Policy Track (15–18)

AREC 351. *Natural Resource Economics and Policy (3)
 FE 535. Water Quality and Land Use (3)
 FW 431. Dynamics of Marine Biological Resources (4)
 FW 464. Marine Conservation Biology (3)
 GEO 306. *Minerals, Energy, Water, and the Environment (3)
 GEO 420. Geography of Resource Use (3)
 GEO 424. International Water Resources Management (3)
 GEO 425. Water Resources Management in the U.S. (3)
 GEO 451. Environmental Site Planning (3)
 GEO 534. Field Geography of Oregon (3)

Hydrological Sciences and Engineering Track (15–18)

Select from courses not used to fulfill the hydrological sciences portion of the core and from the following:

BEE 439. Irrigation Principles and Practices (4)
 BEE 448. Non-point Source Pollution (3)
 CE 311. Fluid Mechanics I (4)
 CE 313. Hydraulic Engineering (4)
 CE 417. Hydraulic Engineering Design (4)
 GEO 322. Surface Processes (4)
 GEO 432. Applied geomorphology (3)
 GEO 487. Hydrogeology (4)

Graduate-level Courses

The following graduate-level courses in hydrological sciences and engineering may be appropriate for strong students. One or more of these may be substituted for courses listed above in this track. Advisor approval is required for such substitution.

BEE 512. Physical Hydrology (3)
 BEE/CE/GEO 514. Groundwater Hydraulics (3)
 BEE/CE 525. Stochastic Hydrology (3)
 BEE 542. Vadose Zone Transport (4)
 BEE 544. Open Channel Hydraulics (4)
 BEE 546. River Engineering (4)
 CE 543. Applied Hydrology (4)
 CE 545. Sediment Transport (4)
 FE 535. Water Quality and Forest Land Use (3)
 GEO 582. Geomorphology of Forests and Streams (3)

Total=27

Footnotes:

* Baccalaureate Core Course
 ^ Writing Intensive Course

ENVIRONMENTAL SCIENCE MINOR

The Environmental Science minor is available to students from all departments and programs at Oregon State University.

The 28–29 credits required for the minor are in addition to the credits required for the student's major. Course substitutions must be selected in consultation with an environmental sciences advisor. Substitutions must cover material in the same course category (natural environmental systems or humans and the environment) at a similar or higher level.

Core: Natural Environmental Systems (12–14)

ATS 210. Intro to the Atmospheric Sciences (3)
 or GEO 323. ^Climatology (4)
 BI 370. Ecology (3)
 GEO 202. *Earth Systems Science (4)
 or GEO 221. *Environmental Geology (4)
 or CSS 305. Principles of Soil Science (4)
 OC 331. Intro to Oceanography (3)

Humans and the Environment (15–19)

Select at least one course in each of the following three categories, and then additional electives from these categories to bring the total number of credits to 28.

Environmental Ethics and Politics:

ANTH 481. *Natural Resources and Community Values (3)
 AREC 352. *Environmental Economics and Policy (3)
 PHL 440. Environmental Ethics (3)
 PHL 443. *World Views and Environmental Values (3)
 PS 474. Natural Resource Policy and Bureaucratic Politics (4)
 PS 475. Environmental Politics and Policy (4)
 PS 476. *Science and Politics (4)

The Human Environment:

BI 301. *Human Impacts on Ecosystems (3)
 BI 306. *^Environmental Ecology (3)
 or BI 306H. *^Environmental Ecology (3)
 ENSC 479. *^Environmental Case Studies (3)
 FW 325. *Global Crises in Resource Ecology (3)
 H 344. Foundations of Environmental Health (3)
 Z 348. *Human Ecology (3)

Environmental Law and Management:

AREC 253. *Environmental Law, Policy, and Economics (4)
 AREC 352. *Environmental Economics and Policy (3)
 AREC 432. Environmental Law (4)
 FOR 462. Natural Resource Policy and Law (3)
 FOR 463. Environmental Policy and Law Interactions (3)
 FW 325. *Global Crises in Resource Ecology (3)

FW 326. Integrated Watershed Management (3)
 FW 435. ^Wildlife in Agricultural Ecosystems (3)
 FW 453. Forest Management and Wildlife Conservation (3)
 FW 458. Management of Big Game Animals (4)
 PH 313. *Energy Alternatives (3)
 RNG 355. Desert Watershed Management (3)
 RNG 421. Wildland Restoration and Ecology (4)
 RNG 455. Riparian Ecology and Management (3)
 RNG 490. Rangeland Management Planning (4)

Total=28

COURSES

ENSC 101. ENVIRONMENTAL SCIENCES ORIENTATION (1). Introduction to the Environmental Sciences Program and related professional and educational opportunities. Recommended for all freshman and first-year transfer environmental sciences majors, but open to all students interested in learning about career options in the environmental sciences. Graded P/N.

ENSC 399. SPECIAL TOPICS (1-16). This course is repeatable for a maximum of 16 credits.

ENSC 401. RESEARCH AND SCHOLARSHIP (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Instructor and departmental approval required.

ENSC 402. INDEPENDENT STUDIES (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 403. THESIS (1-16). **PREREQS:** Departmental approval required.

ENSC 405. READING AND CONFERENCE (1-12). This course is repeatable for a maximum of 12 credits. **PREREQS:** Instructor and departmental approval required.

ENSC 406. PROJECTS (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 407. SEMINAR (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 408. WORKSHOP (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 410. INTERNSHIP (1-12). Supervised practical experience working with professionals at selected cooperating institutions, agencies, laboratories, or companies. Graded P/N. This course is repeatable for a maximum of 12 credits. **PREREQS:** Instructor and departmental approval required.

ENSC 420. WILDERNESS RESOURCE STEWARDSHIP (3). Internships introduce the concept of wilderness and the management principles and issues associated with applying that concept to National Wilderness Preservation System units through directed study reinforced by field service experience. Student interns complete 90 hours of individually scheduled, supervised Wilderness Information Specialist service in the Three Sisters Wilderness of Central Oregon during the summer visitor season. This service is supplemented by pre-service directed reading and training, on-the-job training, and post-service submission of a journal or term report. Graded P/N. **PREREQS:** Departmental approval required.

ENSC 479. **ENVIRONMENTAL CASE STUDIES (3). Improves students' ability to ask questions, gather and synthesize information, and communicate ideas on environmental topics. Instruction and information necessary for the course is entirely Web based. (Bacc Core Course) (Writing Intensive Course) **PREREQS:** One year of college biology or chemistry, junior standing required.

ENSC 499. SPECIAL TOPICS (1-16). This course is repeatable for a maximum of 16 credits.

ENSC 501. RESEARCH AND SCHOLARSHIP (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 503. THESIS (1-16). This course is repeatable for a maximum of 16 credits.

ENSC 505. READING AND CONFERENCE (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 506. PROJECTS (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 507. SEMINAR (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 508. WORKSHOP (1-16). This course is repeatable for a maximum of 16 credits.

ENSC 510. INTERNSHIP (1-12). This course is repeatable for a maximum of 12 credits. **PREREQS:** Departmental approval required.

ENSC 515. ENVIRONMENTAL PERSPECTIVES AND METHODS (3). Unique perspective or method each quarter. Possibilities include: remote sensing, modeling over a range of scales in time, space, and levels of system organization; and risk analysis.

ENSC 520. ENVIRONMENTAL ANALYSIS (3). Develop analytical thinking, explore analytical approaches, enhance writing skills, and gain experience in oral communication about environmental issues.

ENSC 530. RESEARCH PROFILES (1-2). Faculty and graduate student environmental research presentations.

ENSC 599. SELECTED TOPICS (1-16). This course is repeatable for a maximum of 16 credits.

ENSC 601. RESEARCH AND SCHOLARSHIP (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 603. THESIS (1-16). This course is repeatable for a maximum of 16 credits.

ENSC 605. READING AND CONFERENCE (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 606. PROJECTS (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 607. SEMINAR (1-16). This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

ENSC 630. RESEARCH PROFILES (1-2). Faculty and graduate student environmental research presentations.

ENSC 699. SELECTED TOPICS (1-16). This course is repeatable for a maximum of 16 credits.

GERONTOLOGY

Karen Hooker, Director
Program on Gerontology
Oregon State University
Corvallis, OR 97331-5102
541-737-4992
E-mail: geroprogram@oregonstate.edu
Website: <http://www.hhs.oregonstate.edu/gerontology/index.html>

Undergraduate Option

Gerontology
(see *HDFS degree options*)

Certificate Program

Gerontology

See the College of Health and Human Sciences, Human Development and Family Sciences Department section of this catalog.

LATIN AMERICAN AFFAIRS

Juan A. Trujillo, Director
36 Kidder Hall
Oregon State University
Corvallis, OR 97331-4603
541-737-3956
E-mail: jtrujillo@oregonstate.edu

Certificate Program

Latin American Affairs

See College of Liberal Arts, Foreign Languages and Literatures Department section of this catalog.

LIBERAL STUDIES

Jeffrey Hale, Director
Polly Jeneva, Pre-Education Adviser
213 Gilkey Hall
Oregon State University
Corvallis, OR 97331-6202
541-737-0561
E-mail: jhale@oregonstate.edu
Website: http://oregonstate.edu/cla/liberal_studies/

Undergraduate Major and Options

Liberal Studies (BA, BS)

Options

New Media Communications

Pre-Education

Women Studies

See the College of Liberal Arts, Liberal Studies Department section of this catalog.

NATURAL RESOURCES

Paul Doescher, Director
Connie Patterson, Program
 Coordinator
 211 Peavy Hall
 Oregon State University
 Corvallis, OR 97331-5703
 541-737-9135
 E-mail: naturalresources@oregonstate.edu
 Web site: <http://naturalresources.oregonstate.edu/>

Undergraduate Major**Natural Resources (BS)**

A collaborative program offered by the Colleges of Forestry, Agricultural Sciences, Science, and Liberal Arts. It is currently administered by the College of Forestry.

Options

Agroforestry
Arid Land Ecology
Fish and Wildlife Conservation
Forest Ecosystems
Geosciences and Natural Resources
Human Dimensions in Natural Resources
Law Enforcement in Natural Resources
Native Americans and Natural Resources
Natural Resource Education
Natural Resource Policy
Natural Resources Technology
Resource Conservation
Soil Resources
Watershed Management

Minor**Natural Resources**

The Natural Resources degree program provides a broad-based approach to the study of natural resources. The curriculum is designed to produce graduates who can understand a range of natural resource issues, work with experts in a variety of resource fields, and deal with social and political components of resource management. This program is an interdisciplinary offering of the Colleges of Agricultural Sciences, Forestry, Liberal Arts, and Science.

In addition to the baccalaureate core, the three main areas for course work include: the natural resources core (46 credits), breadth requirements (21 credits), and the specialty option (50 credits). Within these areas, students have a number of courses to choose from to fulfill requirements. Students acquire knowledge and background in physical and biological systems, math and statistics, natural resource policy, economics, and decision making. Breadth is acquired in seven key areas of resource management. Finally, students develop depth in the specialty option, choosing from a number of pre-approved options, or creating

an individualized specialty option.

Only two courses used to complete the natural resources major requirements may be taken S/U. Grades of "C-" or better are required in upper-division natural resources core courses, plus all breadth requirements.

The Natural Resources major is also available at the OSU-Cascades Campus in Bend and through the OSU Extended Campus program.

NATURAL RESOURCES (BS, HBS)**Core and breadth requirements for the Natural Resources (BS):****Natural Resources Core (46)**

AREC 351. *Natural Resource Economics and Policy (3)
 or AREC 352. *Environmental Economics and Policy (3)
 or FOR 330. Forest Resource Economics I (4)
 or FOR 432. Economics of Recreation Resources (4)
 ATS 210. Intro to the Atmospheric Sciences (3)
 or GEO 323. ^Climatology (4)
 BI 101, BI 102, BI 103. *General Biology (4,4,4)
 or BI 211, BI 212, BI 213. *Principles of Biology (4,4,4)
 BI 370. Ecology (3)
 or FOR 240. *Forest Biology (4)
 or FOR 341. Forest Ecology (3)
 FE 430. Watershed Processes (4)
 or RNG 355. Desert Watershed Management (3)
 or OC 331. Intro to Oceanography (3)
 or OC 332. Coastal Oceanography (3)
 GEO 101. *The Solid Earth (4)
 or CSS 205. *Soils: Sustainable Ecosystems (4)
 or GEO 102. *The Surface of the Earth (4)
 or GEO 201. *Physical Geology (4)
 or GEO 202. *Earth Systems Science (4)
 MTH 112. *Elementary Functions (4)
 or MTH 241. *Calculus for Management and Social Science (4)
 or MTH 245. *Mathematics for Management, Life, and Social Sciences (4)
 or MTH 251. *Differential Calculus (4)
 NR 455. Natural Resource Decision Making (3)
 PS 474. Natural Resource Policy and Bureaucratic Politics (4)
 or RNG 490. Rangeland Management Planning (4)
 or FOR 460. ^Forest Policy (4)
 or FOR 462. Natural Resource Policy and Law (3)
 or FOR 463. Environmental Policy and Law Interactions (3)
 or PS 475. Environmental Politics and Policy (4)
 or PS 477. International Environmental Politics and Policy (4)
 ST 351. Intro to Statistical Methods (4)
 or ST 201. Principles of Statistics (3) and ST 209. Principles of Hypothesis Testing (1)
 or ST 201. Principles of Statistics (3) and ST 211. Intro to Hypothesis Testing (1)

NR 201. Managing Natural Resources for the Future (3)

or Seminars—Natural Resources (1)+(1)

Note: Particular option programs may specify additional core courses to assure that students meet prerequisites for option courses, or develop background in fields important for the option. Students should not assume that the core courses listed above include all of the necessary background in science or math for every option.

Breadth (21)

Students must complete one course from each of the following groups:

Amenity Uses of Natural Resources

FOR 351. Recreation Behavior and Management (4)
 FOR 352. Wilderness Management (3)
 FOR 353. Field School (3)
 FOR 354. Amenity Resource Management (3)
 FOR 371. Eco and Adventure Tourism (3)
 FOR 444. Ecological Aspects of Park Management (3)
 FOR 451. History and Cultural Aspects of Recreation (4)
 FOR 453. Nature Based Tourism (3)
 FOR 459. Forest Resource Planning and Decision Making (4)
 FOR 493. Environmental Interpretation (4)
 SOC 454. *Leisure and Culture (3)

Fisheries and Wildlife

FOR/FW/RNG 346. Topics in Wildland Fire (3)
 FOR/FW 445. Ecological Restoration (4)
 FOR/FW/RNG 446. Wildland Fire Ecology (3)
 FW 311. Biology of Birds (3)
 FW 315. Biology of Fishes (3)
 FW 317. Biology of Mammals (3)
 FW 320. Introductory Population Dynamics (4)
 FW 321. Fisheries and Wildlife Resource Ecology (3)
 FW 323. Management Principles of Pacific Salmon in the NW (3)
 FW 435. ^Wildlife in Agricultural Ecosystems (3)
 FW 451. Avian Conservation and Management (5)
 FW 453/FS 453. Forest Management and Wildlife Conservation (3)
 FW 454. Fishery Biology (4)
 FW 458. Management of Big Game Animals (4)
 FW 465. Marine Fisheries (4)
 FW 473. Fish Ecology (4)
 FW 481. Wildlife Ecology (4)
 GEO 421. Humans and Their Wildlife Environment (3)

Forestry

BOT/FS 415. Forest Insect and Disease Management (5)
 FE 370. Harvesting Operations (4)
 FOR 341. Forest Ecology (3)
 FOR 342. Forest Types of the Northwest (3)
 FOR/FW/RNG 346. Topics in Wildland Fire (3)
 FOR 365. *Issues in Natural Resources Conservation (3)
 FOR/RNG 436. Wildland Fire Science and Management (4)
 FOR 441. Silviculture Principles (4)

FOR/FW 445. Ecological Restoration (4)
 FOR/FW/RNG 446. Wildland Fire Ecology (3)
 FOR/FE 456. *International Forestry (3)
 FOR 457. Techniques for Forest Resource Analysis (4)
 FOR 459. Forest Resource Planning and Decision Making (4)
 FOR 460. ^Forest Policy (4)
 FS/FW 453. Forest Management and Wildlife Conservation (3)
 FW/FOR/RNG 436. Wildland Fire Science and Management (4)
 RNG 477. *Agroforestry (3)
 WSE 470. *Forests, Wood, and Civilization (3)

Land and Water

CSS 305. Principles of Soil Science (4)
 CSS/GEO 335. *Introduction to Water Science and Policy (3)
 CSS 395. *World Soil Resources (3)
 FE 430. Watershed Processes (4)
 FW 456. Limnology (5)
 FW 479. Wetlands and Riparian Ecology (3)
 GEO 300. *Environmental Conservation and Sustainability (3)
 GEO 306. *Minerals, Energy, Water, and the Environment (3)
 GEO 424. International Water Resources Management (3)
 GEO 425. Water Resources Management in U.S. (3)
 GEO 429. Topics in Resource Geography (3)
 RNG 355. Desert Watershed Management (3)
 RNG 455. Riparian Ecology and Management (3)

Range

FOR/FW/RNG 346. Topics in Wildland Fire (3)
 FOR/RNG 436. Wildland Fire Science and Management (4)
 FOR/FW 445. Ecological Restoration (4)
 FOR/FW/RNG 446. Wildland Fire Ecology (3)
 RNG 351. Range Ecology I-Grasslands (3)
 RNG 352. Range Ecology II-Shrublands (3)
 RNG 421. Wildland Restoration and Ecology (4)
 RNG 441. Rangeland Analysis (4)
 RNG 442. Rangeland-Animal Relations (4)
 RNG 450. Landscape Ecology and Analysis (3)
 RNG 477. *Agroforestry (3)
 RNG 490. Rangeland Management Planning (4)

Resource Values/Philosophy

AG 301. *Ecosystem Science of Pacific NW Indians (3)
 ANTH 481. *Natural Resources and Community Values (3)
 ANTH 482. *Anthropology of International Development (4)
 FW 340. *Multicultural Perspectives in Natural Resources (3)
 GEO 309. *Environmental Justice (3)
 GEO 420. Geography of Resource Use (3)
 HST 481. *Environmental History of the United States (3)
 PHL 440. Environmental Ethics (3)
 PHL 443. *World Views and Environmental Values (3)

Social and Political

AREC 432. Environmental Law (4)
 AREC/PS/SOC 407. Seminar: Current Issues in Rural Policy (4)

BI 301. *Human Impacts on Ecosystems (3)
 FOR 462. Natural Resource Policy and Law (3)
 GEO/CSS 335. *Intro to Water Science and Policy (3)
 GEO 423. Land Use (3)
 HST 481. *Environmental History of the United States (4)
 PS 449. ^Topics in Comparative Politics: Environmental Politics and Policy (4)
 PS 474. Natural Resource Policy and Bureaucratic Politics (4)
 PS 475. Environmental Politics and Policy (4)
 PS 476. *Science and Politics (4)
 PS 477. International Environmental Politics and Policy (4)
 SOC 360. *Population Trends and Policy (4)
 SOC 456. *Science and Technology in Social Context (4)
 SOC 475. Rural Sociology (4)
 SOC 480. *Environmental Sociology (4)
 SOC 481. *Society and Natural Resources (4)
 SOC/ANS/FW 485. *Consensus and Natural Resources (3)

AGROFORESTRY OPTION

Required Courses:

BOT 488. Environmental Physiology of Plants (3)
 CH 130. General Chemistry of Living Systems (4)
 CSS 300. Intro to Crop Production (4)
 CSS 305. Principles of Soil Science (4) and CSS 306. Problem Solving: Soil Science Applications (1)
 CSS 315. ^Nutrient Management and Cycling (4) or HORT 316. Plant Nutrition (4)
 CSS 440. Weed Management (4) or RNG 421. Wildland Restoration and Ecology (4)
 FOR 441. Silviculture Principles (4)
 HORT 301. Principles of Horticultural Technology (4)
 HORT 311. ^Plant Propagation (4)
 RNG 441. Rangeland Analysis (4)
 RNG 442. Rangeland-Animal Relations (4)
 RNG 477. *Agroforestry (3)

Choose one of the following courses:

ANS 215. Beef/Dairy Industries (3)
 ANS 216. Sheep/Swine Industries (3)
 CSS 310. Forage Production (4)
 HORT 451. Tree Fruit Physiology and Culture (4)
 HORT 452. Berry and Grape Physiology and Culture (4)

Other special requirements:

RNG 403. Senior Thesis (3)

ARID LAND ECOLOGY OPTION

Courses in Rangeland Resources (25 credits)

RNG 253. Wildland Plant Identification (4)
 RNG 351. Range Ecology I-Grasslands (3)
 RNG 352. Range Ecology II-Shrublands (3)
 RNG 421. Wildland Restoration and Ecology (4)
 RNG 441. Rangeland Analysis (4)
 RNG 442. Rangeland-Animal Relations (4)
 RNG 450. Landscape Ecology and Analysis (3)

Courses in Animals, Plants, Soils, and Ecology (25 credits)

BOT 321. Plant Systematics (4)
 BOT 414. Agrostology (4)
 FOR/FW/RNG 446. Wildland Fire Ecology (3)
 BOT 488. Environmental Physiology of Plants (3)
 CSS 305. Principles of Soil Science (4)
 CSS 306. Problem Solving: Soil Science Applications (1)
 CSS 466. Soil Morphology and Classification (4)
 An additional course not in RNG chosen with advisor approval.

FISH AND WILDLIFE CONSERVATION OPTION

FOR 445. Ecological Restoration (4)
 FW 251. Principles of Fish and Wildlife Conservation (3)
 FW 303. Survey of Geographic Information Systems in Natural Resources (3)
 FW 321. Fisheries and Wildlife Resource Ecology (3)
 RNG 241. Rangeland Ecology and Management (3)
 RNG/FOR 446. Wildland Fire Ecology (3)
 RNG 455. Riparian Ecology and Management (3)

Choose one of the following three:

GEO 365. Introduction to Geographic Information Systems (4)
 GEO 301. Map and Image Interpretation (4)
 GEO 465. Geographic Information Systems and Science (3)

Choose two of the following three:

FW 311. Biology of Birds (3)
 FW 315. Biology of Fishes (3)
 FW 317. Biology of Mammals (3)

Choose two of the following three:

FW 326. Integrated Watershed Management (3)
 FW 435. ^Wildlife in Agricultural Ecosystems (3)
 FW 479. Wetlands and Riparian Ecology (3)

One of the following two:

FW 323. Management Principles of Pacific Salmon in the Northwest (3)
 FW 470. *Ecology and History: Landscapes of the Columbia Basin (3)

One of the following three:

AREC 253. *Evolution of U.S. Environmental and Natural Resources Law [Becomes "Environmental Law, Policy, and Economics" fall 2009] (4)
 AREC 353. Public Land Statutes and Policy (4)
 AREC 453. Public Land and Resource Law (4)

One of the following three:

PS 474. Natural Resource Policy and Bureaucratic Politics (4)
 PS 475. Environmental Politics and Policy (4)
 SOC 481. *Society and Natural Resources (4)
 An additional Natural Resources-related course not in FW to bring total to 50 credits.

FOREST ECOSYSTEMS OPTION**Ecological Foundations:
(27–29 credits)**

- BOT 415/FS 415. Forest Insect and Disease Management (5)
 CSS 305. Principles of Soil Science (4)
 Plus CSS 306. Problem Solving: Soil Science Applications (1)
 or CSS 205. *Soils: Sustainable Ecosystems (4)
 FOR 240. *Forest Biology (4)
 or FOR 341. Forest Ecology (3)
 or BOT 341. Plant Ecology (4)
 FOR 241. Dendrology (5)
 FOR 441. Silviculture Principles (4)
 FS 453/FW 453. Forest Management and Wildlife Conservation (3)
 FW 251. Principles of Fish and Wildlife Conservation (3)

**Ecology Breadth Courses:
(Choose at least 12 credits)**

- BOT 321. Plant Systematics (4)
 BOT 442. Plant Population Ecology (3)
 FOR/FW 445. Ecological Restoration (4)
 FOR/RNG 436. Wildland Fire Science and Management (4)
 or FOR/FW/RNG 446. Wildland Fire Ecology (3)
 FW 458. Management of Big Game Animals (4)
 FW 479. Wetlands and Riparian Ecology (3)
 RNG 351. Range Ecology I-Grasslands (3)
 RNG 352. Range Ecology II-Shrublands (3)
 RNG 450. Landscape Ecology and Analysis (3)
 RNG 455. Riparian Ecology and Management (3)
 RNG 477. *Agroforestry (3)

**Technical Electives:
(Choose at least 10 credits)**

- BOT 425. Flora of the Pacific Northwest (3)
 BOT 440. Field Methods in Vegetation Science (4)
 FE 308. Forest Surveying (4)
 FE 309. Forest Photogrammetry (4)
 FE 370. Harvesting Operations (4)
 FOR 321. Forest Mensuration (5)
 GEO 365. Introduction to Geographic Information Systems (4)
 or FE 357. GIS and Forest Engineering Applications (3)

Note: If necessary, an additional course approved by your advisor to bring total to 50 credits.

GEOSCIENCES AND NATURAL RESOURCES OPTION**Courses within the Department of Geosciences: (36)
(25 credits in the Geography Program and 11 credits in the Geology Program for a total of 36 credits)**

- GEO 201. *Physical Geology (4)
 GEO 301. Map and Image Interpretation (4)
 GEO 322. Surface Processes (4)
 GEO 360. Cartography (4)
 GEO 420. Geography of Resource Use (3)
 GEO 423. Land Use (3)
 GEO 444. Remote Sensing (4)
 GEO 465. Geographic Information Systems and Science (3)

Choose one of the following three courses:

- GEO 305. *Living With Active Cascade Volcanoes (3)
 GEO 306. *Minerals, Energy, Water, and the Environment (3)
 GEO 487. Hydrogeology (4)

Choose two of the following three pairs of courses, which are offered in alternate years:

- Either** GEO 324. Geography of Life: Species Distribution and Conservation (4)
or GEO 421. Humans and their Wildlife Environment (3)
Either GEO 424. International Water Resources Management (3)
or GEO 425. Water Resources Management in the U.S. (3)
Either GEO 452. Principles and Practices of Rural and Resource Planning (3)
or GEO 453. Resource Evaluation Methods/EIS (3)

Courses in the Department of Crop and Soil Science: (8 credits)

- CSS 305. Principles of Soil Science (4)
 CSS 306. Problem Solving: Soil Science Applications (1)
 CSS 395. *World Soil Resources (3)

Courses in Liberal Arts: (3–4 cr)

- ANTH 481. *Natural Resources and Community Values (3)
 or PS 475. Environmental Politics and Policy (4)
 or SOC/ANS/FW 485. *Consensus and Natural Resources (3)
 An additional course not in GEO approved by your advisor.

HUMAN DIMENSIONS IN NATURAL RESOURCES OPTION**Ethical Issues**

- Select 9 credits from the following:**
 ANTH 110. *Introduction to Cultural Anthropology (3)
 BI/FS 430. *Biotechnologies: Agriculture, Food and Resources Issues (3)
 PHL 201. *Introduction to Philosophy (4)
 PHL 205. *Ethics (4)
 PHL 439. Philosophy of Nature (3)
 PHL 440. Environmental Ethics (3)
 PHL 443. *World Views and Environmental Values (3)
 PHL 470. Philosophy of Science (3)

Management and Communication Issues

- Select 18 credits from the following:**
 AREC 253. *Environmental Law, Policy, and Economics (4)
 AREC 351. *Natural Resource Economics and Policy (3)
 AREC 352. *Environmental Economics and Policy (3)
 AREC 453. Public Land and Resource Law (4)
 COMM 321. Introduction to Communication Theory (3)
 COMM 322. Small-Group Problem Solving (3)
 COMM 324. Communication in Organizations (3)
 COMM 440. Theories of Conflict and Conflict Management (3)

- FOR 351. Recreation Behavior and Management (4)
 FOR 352. Wilderness Management (3)
 FOR 354. Amenity Resource Management (3)
 FOR 365. *Issues in Natural Resources Conservation (3)
 FOR 391. Natural Resource Communications (3)
 FOR/FW/RNG 446. Wildland Fire Ecology (3)
 FW 251. Principles of Fish and Wildlife Conservation (3)
 FW 326. Integrated Watershed Management (3)
 SOC/ANS/FW 485. *Consensus and Natural Resources (3)

**Social Issues (24 credits):
Required background course**

- SOC 204. *Introduction to Sociology (3)

Select 21 credits from the following:

- ANTH 481. *Natural Resources and Community Values (3)
 ANTH 482. *Anthropology of International Development (4)
 AREC 432. Environmental Law (4)
 FOR 451. History and Cultural Aspects of Recreation (4)
 FW 340. *Multicultural Perspectives in Natural Resources (3)
 FW 350. *Endangered Species, Society, and Sustainability (3)
 GEO 300. *Environmental Conservation and Sustainability (3)
 HST 481. *Environmental History of the U.S. (4)
 PS 414. Interest Groups (4)
 PS 475. Environmental Politics and Policy (4)
 SOC 360. *Population Trends and Policy (4)
 SOC 454. *Leisure and Culture (4)
 SOC 456. *Science and Technology in Social Contexts (4)
 SOC 466. International Development: Gender Issues (4)
 SOC 480. *Environmental Sociology (4)
 SOC 481. *Society and Natural Resources (4)
 WS 450. *Ecofeminism (3)

LAW ENFORCEMENT IN NATURAL RESOURCES OPTION

- COMM 440. Theories of Conflict and Conflict Management (3)
 FW 251. Principles of Fish and Wildlife Conservation (3)
 FW 316. Systematics of Fishes (2)
 FW 318. Systematics of Mammals (2)
 FW 341. Fish and Wildlife Law Enforcement (2)
 FW 458. Management of Big Game Animals (4)
 FOR 141. Tree and Shrub Identification (3)
 FOR 251. Recreation Resource Management (4)
 FOR 351. Recreation Behavior and Management (4)
 FOR 354. Amenity Resource Management (3)
 FOR 391. Natural Resource Communications (3)
 FOR 462. Natural Resource Policy and Law (3)
 PHL 440. Environmental Ethics (3)

SOC 340. Deviant Behavior and Social Control (4)
 SOC 440. Juvenile Delinquency (4)
 SOC 441. Criminology and Penology (4)
 SOC 448. Law and Society (3)

Recommended additional training:

Completion of an approved off-campus law enforcement training program, such as the Santa Rosa Training Center in California; Skagit Valley College in Washington; or the Oregon State Police Cadet Program in Monmouth, Oregon.

NATIVE AMERICANS AND NATURAL RESOURCES OPTION

Background: (3 credits)

ANTH 330. *Evolution of People, Technology, and Society (3)

General Requirements: (19 credits)

ANTH 411. World Cultures-North America (4)
 ANTH 434. North America after the Ice Age (3)
 ANTH 436. Northwest Prehistory (3)
 ENG 360. *Native American Literature (3)
 HST 469. History of the Pacific Northwest (4)
 HST 481. *Environmental History of the U.S. (4)

Archaeology: (6 credits)

ANTH 432. *The Archaeology of Domestication and Urbanization (3)
 ANTH 433. First Americans, Last Frontiers (3)

Geography: (10 credits)

GEO 300. *Environmental Conservation (3)
 GEO 324. Geography of Life: Species Distribution and Conservation (4)
 GEO 420. Geography of Resource Use (3)

Methods: (6 credits)

ANTH 490. Topics in Methodology (3)
 ANTH 497. Archeological Field Methods (3)

Natural Resource Values and Processes in Communities:

Select two courses from below, 6 cr:

AG 301. *Ecosystem Science of Pacific Northwest Indians (3)
 ANTH 477. Cultural Ecology (3)
 ES 445. *Native American Science and Technology (3)
 FW 340. *Multicultural Perspectives in Natural Resources (3)

NATURAL RESOURCE EDUCATION OPTION

Natural Resource Base: (23 credits)

FOR 141. Tree and Shrub Identification (3)
 FOR 251. Recreation Resource Management (4)
 FOR 365. *Issues in Natural Resource Conservation (3)
 or FW 325. *Global Crises in Resource Ecology (3)
 FW 251. Principles of Fish and Wildlife Conservation (3)
 RNG 241. Rangeland Ecology and Management (3)

Plus 7 additional credits from AG, FE, FOR, FS, FW, GEO or another area of natural resources.

Education/Communication Processes: (27 credits)

COMM 312. Advanced Public Speaking (3)
 FOR 390. Forestry for Teachers (3)
 FOR 391. Natural Resource Communications (3)
 FOR 493. Environmental Interpretation (4)
 FOR 495. Interpretive Projects (2)
 TCE 411. Educational Psychology, Learning and Development (3)
 WR 327. *Technical Writing (3)

Plus 6 additional credits in speech communication, education, agriculture education, writing, or an allied communication/education field

NATURAL RESOURCE POLICY OPTION

Note: A maximum of 25 credits allowed from one department.

Social Science Foundation

At least three courses from the following: [ECON, PS and SOC are prerequisites for upper-division courses]

ECON 201. *Intro to Microeconomics (4)
 PHL 201. *Introduction to Philosophy (4)
 PS 201. *Introduction to United States Government and Politics (4)
 PSY 201. *General Psychology (3)
 SOC 204. *Introduction to Sociology (3)

Social Sciences and Natural Resources

At least four courses from the following, with no more than two from any one department:

AG 421. ^Leadership Development (3)
 COMM 321. Introduction to Communication Theory (3)
 FOR 111. Introduction to Forestry (3)
 FW 251. Principles of Fish and Wildlife Conservation (3)
 FW 323. Management Principles of Pacific Salmon in the Northwest (3)
 FW 340. *Multicultural Perspectives in Natural Resources (3)
 FW 470. *Ecology and History: Landscapes of the Columbia Basin (3)
 GEO 300. *Environmental Conservation (3)
 RNG 490. Rangeland Management Planning (4)
 SOC 360. *Population Trends and Policy (4)
 SOC 454. *Leisure and Culture (4)
 SOC 480. *Environmental Sociology (4)
 SOC 481. *Society and Natural Resources (4)

Emphasis Area

Students have the choice of choosing one of the two emphasis areas below for 28 credits or selecting 28 credits from the comprehensive list of courses. Selection of an emphasis area will provide a clearer focus to the student's program. Courses in the emphasis areas may not duplicate courses taken for the Social Science Foundation and Social Science and Natural Resources areas listed above.

Management Emphasis

Select 28 credits from the following:
 AREC 253. *Environmental Law, Policy, and Economics (4)
 BOT 440. Field Methods in Vegetation Science (4)

FOR 445. Ecological Restoration (4)
 FOR/FW/RNG 446. Wildland Fire Ecology (3)
 FW 303. Survey of Geographic Information Systems in Natural Resources (3)
 FW 311. Biology of Birds (3)
 FW 315. Biology of Fishes (3)
 FW 317. Biology of Mammals (3)
 FW 321. Fisheries and Wildlife Resource Ecology (3)
 FW 323. Management Principles of Pacific Salmon in the Northwest (3)
 FW 326. Integrated Watershed Management (3)
 FW 435. ^Wildlife in Agricultural Ecosystems (3)
 FW 479. Wetlands and Riparian Ecology (3)
 GEO 301. Map and Image Interpretation (4)
 GEO 365. Introduction to Geographic Information Systems (4)
 GEO 465. Geographic Information Systems and Science (3)
 RNG 455. Riparian Ecology and Management (3)
 RNG 490. Rangeland Management Planning (4)

Policy Emphasis

Select 28 credits from the following:

AREC 253. *Environmental Law, Policy, and Economics (4)
 ENSC 479. ^^Environmental Case Studies (3)
 FOR 365. *Issues in Natural Resources Conservation (3)
 FW 340. *Multicultural Perspectives in Natural Resources (3)
 FW 435. ^Wildlife in Agricultural Ecosystems (3)
 or RNG 490. Rangeland Management Planning (4)
 FW 470. *Ecology and History: Landscapes of the Columbia Basin (3)
 GEO 365. Introduction to Geographic Information Systems (4)
 PS 449. ^Topics in Comparative Politics (4)
 PS 475. Environmental Politics and Policy (4)
 SOC 456. *Science and Technology in Social Context (4)
 SOC 480. *Environmental Sociology (4)
 SOC 481. *Society and Natural Resources (4)

NATURAL RESOURCES TECHNOLOGY OPTION

This option is designed specifically for Central Oregon Community College students pursuing an initial two-year AAS in Forest Resources Technology. The option may be modified to provide appropriate transfer of courses from other community colleges with forest technology degree programs.

This option contains 50 credits. Specific lower-division courses to be taken at COCC total 25 credits; the following 25 credits may be taken through OSU Extended Campus (Ecampus) or at the OSU-Cascades Campus, as available.

Select 25 credits from the following:

CSS 305. Principles of Soil Science (4)
 or CSS 205. *Soils: Sustainable Ecosystems (4)
 FOR 445. Ecological Restoration (4)
 FOR/FW/RNG 446. Wildland Fire Ecology (3)
 FW 479. Wetlands and Riparian Ecology (3)

GEO 301. Map and Image Interpretation (4)
 GEO 322. Surface Processes (4)
 GEO 462. ^Geosciences Field Methods (4)
 RNG 253. Wildland Plant Identification (4)
 RNG 351. Range Ecology I-Grasslands (3)
 RNG 352. Range Ecology II-Shrublands (3)
 RNG 441. Rangeland Analysis (4)

RESOURCE CONSERVATION OPTION

This option contains 50 credits. Specific lower-division courses to be taken at Central Oregon Community College total 25 credits; the following 25 credits may be taken through OSU Extended Campus (Ecampus) or at the Cascades Campus, as available.

Select 25 credits from the following:

AREC 353. Public Land Statutes and Policy (4)
 ENSC 479. *Environmental Case Studies (3)
 FW 303. Survey of Geographic Information Systems in Natural Resources (3)
 FW 323. Management Principles of Pacific Salmon in the Northwest (3)
 FW 435. ^Wildlife in Agricultural Ecosystems (3)
 PS 475. Environmental Politics and Policy (4)
 PS 479. Topics in Public Policy and Public Administration (4)
 RNG 490. Rangeland Management Planning (4)
 SOC 456. *Science and Technology in Social Context (4)

SOIL RESOURCES OPTION

Soil System Science (22 credits)

CSS 455. Biology of Soil Ecosystems (4)
 CSS 466. Soil Morphology and Classification (4)
 CSS 535. Soil Physics (3)
 CSS 536. Vadose Zone Hydrology Laboratory (1)
 CSS 545. Geochemistry of Soil Ecosystems (4)

Electives: Select 2 from the following:

FE 430. Watershed Processes (4)
 FW 479. Wetlands and Riparian Ecology (3)
 RNG 241. Rangeland Ecology and Management (3)
 RNG 351. Range Ecology I-Grasslands (3)
 RNG 352. Range Ecology II-Shrublands (3)

Agroecosystems

Choose 9 credits:

BEE 433. Irrigation System Design (4)
 BEE 439. Irrigation Principles and Practice (4)
 BEE 448. Nonpoint Source Pollution Assessment and Control (3)
 CSS 306. Problem Solving: Soil Science Applications (1)
 CSS 415. Soil Fertility Management (3)
 HORT 300. Intro to Crop Production (4)

Soil Resource Studies (19 credits)

Soil Landscapes (8 credits)

CSS 468. Soil Landscape Analysis (4)
 GEO 322. Surface Processes (4)

Geomatics and Landscape Analysis (select 11 credits from below)

FE 309. Forest Photogrammetry (4)

GEO 301. Map and Image Interpretation (4)
 GEO 444. Remote Sensing (4)
 HORT 414. Information Systems in Agriculture (4)
 RNG 441. Rangeland Analysis (4)
 RNG 450. Landscape Ecology and Analysis (3)

WATERSHED MANAGEMENT OPTION

CH 130. General Chemistry of Living Systems (4)
 CH 202. Chemistry for Engineering Majors (3)
 CSS 305. Principles of Soil Science (4)
 CSS 466. Soil Morphology and Classification (4)
 ENVE 431. Fate and Transport of Chemicals in Environmental Systems (4)
 FE 308. Forest Surveying (4)
 FW 456. Limnology (5)
 GEO 487. Hydrogeology (4)
 or CE 412. Hydrology (4)
 or FE 330. Forest Engineering Fluid Mechanics and Hydraulics (3)
 MTH 251. *Differential Calculus (4)
 MTH 252. Integral Calculus (4)
 PH 201, PH 202. *General Physics (5,5)
 RNG 455. Riparian Ecology and Management (3)
 or FW 479. Wetlands and Riparian Ecology (3)

NATURAL RESOURCES MINOR

Students majoring in other programs at OSU can choose a minor in natural resources. The minor is intended to provide a broad exposure to the natural resources field. It offers course work that integrates a number of natural resource disciplines.

Choose four of the following five courses:

FOR 111. Introduction to Forestry (3)
 FOR 251. Recreation Resource Management (4)
 FW 251. Principles of Fish and Wildlife Conservation (3)
 NR 201. Managing Natural Resources for the Future (3)
 RNG 241. Rangeland Ecology and Management (3)

One upper-division course from each of the following breadth requirements courses list:

Resource Values/Philosophy (3)
 Social and Political (3-4)
 Land and Water (3-5)

Any additional classes from the breadth requirements course list to total 28 credits.

Total=28

COURSES

NR 201. MANAGING NATURAL RESOURCES FOR THE FUTURE (3). Overview of the complexities involved in managing natural resources of the Pacific Northwest. Exposure to major natural resource issues of the region. Development of critical thinking skills useful in seeking solutions.

NR 350. SUSTAINABLE COMMUNITIES (4).

Introduction to the concept of sustainable communities from a multi-disciplinary perspective. Instructors from a broad array of disciplines and professions. Development of holistic thinking skills and innovative solutions to complex problems.

NR 401. RESEARCH AND SCHOLARSHIP (1-16).

This course is repeatable for a maximum of 16 credits.

NR 403. THESIS (1-16).

This course is repeatable for a maximum of 16 credits. **PREREQS:** Departmental approval required.

NR 405. READING AND CONFERENCE (1-9).

This course is repeatable for a maximum of 18 credits.

NR 406. PROJECTS (1-9).

This course is repeatable for a maximum of 16 credits.

NR 407. SEMINAR (1-9).

This course is repeatable for a maximum of 18 credits. **PREREQS:** Departmental approval required.

NR 455. NATURAL RESOURCE DECISION MAKING (3).

Individuals, groups, and corporate or organizational decision making. Emphasis on analysis of decision making in natural resource contexts: decision factors, cognitions, and processes.

NR 499. SPECIAL TOPICS (1-16).

NR 499H. SPECIAL TOPICS (1-16). **PREREQS:** Honors College approval required.

NATURAL RESOURCE AND ENVIRONMENTAL LAW AND POLICY

Susan M. Capalbo, *Department Head*
 213 Ballard Extension Hall
 Oregon State University
 Corvallis, OR 97331-3601
 541-737-2942
 E-mail: arec@oregonstate.edu
 Web site: <http://arec.oregonstate.edu>

Undergraduate Minor

Natural Resource and Environmental Law and Policy Minor

The Natural Resource and Environmental Law and Policy minor is an interdisciplinary minor available to students outside the AREC Department.

Each minor in the Agricultural and Resource Economics (AREC) Department is created to provide students within and outside the discipline the opportunity to study a secondary area. Each minor requires 27 credits of course work in addition to the student's major. At least 12 of the 27 credits must be upper division. No credits counted toward the minor can be courses also counted toward the student's major.

Agricultural Business Management (ABM) majors **may not** elect to complete an Agricultural Business Management minor.

Environmental Economics, Policy and Management (EPPM) majors **may not** elect to complete a Resource Economics or Natural Resource and Environmental Law and Policy minor.

Requirements

AREC 253. *Environmental Law, Policy, and Economics (4)
 AREC 432. Environmental Law (4)
 FOR 462. Natural Resource Policy and Law (3)
Select 16 credits from the list below:
 AREC 461. *^Agricultural and Food Policy Issues (4)
 FW 341. Fisheries and Wildlife Law Enforcement (2)
 FW 415. Fisheries and Wildlife Law and Policy (3)
 PHL 365. *Law in Philosophical Perspective (4)
 PHL 440. Environmental Ethics (4)
 PS 321, PS 322, PS 323. American Constitutional Law (4,4,4)
 PS 474. Natural Resource Policy and Bureaucratic Politics (4)
 PS 475. Environmental Politics and Policy (4)
 PS 476. *Science and Politics (4)
 PS 477. International Environmental Politics and Policy (4)
 SOC 448. Law and Society (3)

Total=27**PEACE STUDIES****Joseph A. Orosco, Director**

102C Hovland Hall
 Oregon State University
 Corvallis, OR 97331-3902
 541-737-4335

E-mail: joseph.orosco@oregonstate.edu
 Website: http://oregonstate.edu/cla/philosophy/Undergrads.php/PEACE_require.php

FACULTY

Joseph Orosco, Lani Roberts

**Undergraduate Certificate Program
Peace Studies**

See the College of Liberal Arts, Philosophy Department section of this catalog.

RUSSIAN STUDIES

34 Kidder Hall
 Oregon State University
 Corvallis, OR 97331-3957
 E-mail:

**Undergraduate Certificate Program
Russian Studies**

See the College of Liberal Arts, Department of Foreign Languages and Literatures section of this catalog.

WOMEN STUDIES**Susan Shaw, Director**

200 Gilkey Hall
 Oregon State University
 Corvallis, OR 97331-6208
 541-737-2826
 E-mail: llawson@oregonstate.edu
 Web site: http://oregonstate.edu/cla/women_studies/

FACULTY**Professor Lee****Associate Professors** Duncan, Shaw, Watkins

Program faculty in departments throughout the university.

Undergraduate Certificate Program**Women Studies****Degree Option****Women Studies (See Liberal Studies)****Minor****Women Studies****Graduate Minor****Women Studies**

See the College of Liberal Arts, Women Studies Program section of this catalog.

GRADUATE PROGRAMS

At the graduate level, Oregon State University offers a flexible Master of Arts in Interdisciplinary Studies degree program, as well as interdisciplinary masters and doctoral programs in agriculture, economics, environmental sciences, forestry, genetics, marine resource management, material science, molecular and cellular biology, plant physiology, public health, toxicology, and water resources.

In addition, graduate minors in gerontology, and water resources are offered.

For more information about these interdisciplinary programs, see the related listings in this section or see the appropriate college or departmental listing.

AGRICULTURE**Cary Green, Assistant Dean**

College of Agricultural Sciences
 137 Strand Agriculture Hall
 Oregon State University
 Corvallis, OR 97331
 541-737-5746
 E-mail: cary.green@oregonstate.edu

Graduate Major**Master of Agriculture (MAG)**

The Master of Agriculture degree requires a student to attain advanced knowledge

and achievement integrated across three fields of study. Two of the three fields must be from the College of Agricultural Sciences or closely related areas. The third field of study can be from any approved graduate major or minor. With appropriate justification, each of these three fields of study may contain integrated components.

A minimum of 45 credits is required for the degree with a minimum of 24 credits outside of the major. The program of study will consist of a major concentration and two minor concentrations. The major must be in the College of Agricultural Sciences and contain a minimum of 12 credits (excluding research or thesis credit.) Students have the option of a research paper (3-6 credits) or thesis (6 credits). Each minor concentration must contain a minimum of 9 credits. No more than 6 blanket numbered credits are to be contained in the program, excluding research paper or thesis.

The program is administered by the academic department of the major and requires the department head's signature. The student's committee will consist of a representative from the major and each minor concentration. A Graduate Council representative will serve on thesis programs. The committee will meet prior to the end of the student's second quarter in the program to approve the student's program of study proposal. The proposal will include the student's academic/professional background, intended occupational/educational destination, and rationale for the course combinations. A final oral examination is required and may include questions from both the course work and the research paper or thesis.

MASTER OF AGRICULTURE**Graduate Areas of Concentration**

Three agriculturally related areas are required. Areas may be agricultural economics, agricultural education, animal science, botany and plant pathology, crop science, fisheries science, food science, horticulture, rangeland resources, soil science, wildlife science, or other areas approved by the College of Agricultural Sciences.

The Department of Agricultural Education and General Agriculture offers course work that serves teachers and leaders in agriculture. The Master of Science (MS), Master of Agriculture (MAG), and Master of Arts in Interdisciplinary Studies (MAIS) degrees may be pursued with an emphasis in leadership, communication, pedagogy, extension, and/or technical agriculture. Candidates work with an advisor to develop programs that meet their specific needs as indicated by their occupational objectives.

APPLIED ECONOMICS

Munisamy Gopinath, *Director*
 Graduate Program in Applied Economics
 213 Ballard Hall
 Oregon State University
 Corvallis, OR 97331.
 541-737-1402
 541-737-2563 fax
 E-mail: AppliedEconomics@oregonstate.edu
 Website: http://oregonstate.edu/dept/grad_school/economics.htm

AFFILIATE FACULTY

More than 30 faculty members, drawn from five Departments in five Colleges, participate in the Graduate Program in Applied Economics.

Graduate Major**Applied Economics (MA, MS, PhD)**

Graduate Areas of Concentration
International trade, public health economics, resource and environmental economics, transportation Economics (MA/MS only)

Graduate Minor**Applied Economics**

The Graduate Program in Applied Economics provides students with a strong foundation in economic theory, and econometrics and other quantitative methods while reserving sufficient flexibility to specialize in their areas of interest. The core curriculum includes courses in microeconomic and macroeconomic theory, and quantitative methods, along with qualifying examinations. Additional course work is required in the areas of concentration, which can include an open area to meet the student's interests and needs (subject to the approval of the student's thesis committee). The program also offers access to the entire participating faculty as potential research advisors (more than 30 faculty in the five participating Departments in five Colleges). The Graduate Program in Applied Economics aims to lower interdisciplinary barriers and allow students to work with faculty who most closely match their interests.

ENVIRONMENTAL AND MOLECULAR TOXICOLOGY

1007 Agricultural and Life Sciences
 Oregon State University
 Corvallis, OR 97331-7301
 541-737-3791
 Website: <http://www.emt.orst.edu/>

Graduate Major**Toxicology (MS, PhD)****Graduate Minor****Environmental Sciences**

See the College of Agricultural Sciences, EMT Program section of this catalog.

ENVIRONMENTAL SCIENCES

Andrew Blaustein, *Program Director*
 Environmental Sciences Graduate Program
 2046 Cordley Hall
 Oregon State University
 Corvallis, OR 97331
 541-737-2404
 E-mail: ensc@oregonstate.edu
 Web site: <http://envsci.science.oregonstate.edu/>

Graduate Major**Environmental Science (MA, MS, PhD)**

Graduate Areas of Concentration
Biogeochemistry, ecology, environmental education, natural resources, quantitative analysis, social science, water resources

The Environmental Sciences Graduate Program provides curricula leading to MA, MS and PhD degrees in environmental science. The curricula integrates thinking across disciplines, especially life, physical, and social sciences. Environmental science explores natural processes on earth and their alteration by human activity. OSU has exceptional strength in many of the disciplines, including science, agriculture, forestry, engineering, public health, liberal arts, social science, and oceanography and atmospheric science. Strength in these disciplines allows the ES Graduate Program to provide high-quality interdisciplinary education for environmental scientists and continuing postgraduate educational opportunities to scientists who are already active in the field. The degrees administered by the program are OSU's contribution to the Joint-Campus Graduate Program for Environmental Sciences, Studies, and Policy, which links environmental graduate programs among the major research universities in Oregon.

The ES Graduate Program develops scientists who will be able to analyze and understand environmental systems, predict environmental change, and participate in the management of the environment. Each student completing a major in the ES Graduate Program will perform research and complete a thesis, dissertation, or research project. Each student will complete a core of ES graduate courses that will integrate concepts across the physical sciences, life sciences, and social sciences. Each student will also develop depth in a carefully designed, interdisciplinary area of concentration or track. Tracks that are currently available include ecology, biogeochemistry, social science, quantitative analysis, water resources, and environmental education. Methods and numerical skill courses, electives, and thesis make up the remainder of a student's program.

Students in the ES Graduate Program may choose advisors from faculty members already appointed at OSU, as well as other scientists who apply and are accepted in the Environmental Sciences Graduate Faculty. The Environmental Sciences Graduate Program fosters interdisciplinary education, and seeks connections between institutions.

For more information, contact Dr. Andrew Blaustein, Director, Environmental Sciences Graduate Program, Oregon State University, Corvallis, OR 97331-2904, or e-mail: esgp@oregonstate.edu.

PROFESSIONAL SCIENCE MASTER'S DEGREE IN ENVIRONMENTAL SCIENCE

Website: <http://professionalmasters.science.orst.edu/>

The College of Science offers a two-year professional program leading to a Master's (MS) degree in either **Environmental Science**, Molecular and Cellular Biology, Botany and Plant Pathology, or Applied Physics. Students must complete a Bachelor's degree to be eligible to apply. An internship is required in lieu of research and in addition to specific training in a scientific discipline, skills in business management and communications are acquired, enabling students to effectively work between scientific and business communities. Students successfully completing this program are eligible for employment in a variety of work settings throughout the world.

For general information about Professional Science Master's Programs, contact **Ursula Bechert**, *Director of Off-Campus Programs*, College of Science, 2082 Cordley Hall, 541-737-5259, e-mail: ursula.bechert@oregonstate.edu.

DEGREE REQUIREMENTS

MA and MS Degrees (45 credits)
 Environmental science core courses (9)
 Methods and numerical skills courses (6)

ES area of concentration (Track) (15)

Elective courses (3–9)

Thesis (6–12)

Note: The MA degree requires proficiency in a foreign language.

PhD Degree (108 credits)

Environmental sciences core courses (10)

Methods and numerical skills courses (9)

ES area of concentration (Track) (30)

Elective courses (3–23)

Thesis (36–56)

ENVIRONMENTAL SCIENCES GRADUATE MINOR

For more information, see the departmental advisor.

FORESTRY

140 Peavy Hall

Oregon State University

Corvallis, OR 97331-5704

541-737-2004

E-mail: forestinfo@oregonstate.edu

Web site: <http://www.forestry.oregonstate.edu>

Graduate Major

Master of Forestry (MF)

See the department pages of the College of Forestry section of this catalog

GENETICS

Barbara J. Taylor, *Director*

3021 Agricultural and Life Sciences Building

Oregon State University

Corvallis, OR 97331-7303

541-737-3799

541-737-3045 FAX

E-mail: millimag@cgrb.oregonstate.edu

Web site: <http://agsci.oregonstate.edu/genetics/>

Graduate Major

Genetics (MA, MS, PhD)

Graduate Areas of Concentration

Molecular, developmental, and quantitative genetics of microbes, plants, animals, and their viruses

Graduate Minor

Genetics

See the College of Agricultural Sciences, Genetics Program section of this catalog.

GERONTOLOGY

Karen Hooker, *Director*

Program on Gerontology

Oregon State University

Corvallis, OR 97331-5102

541-737-4992

E-mail: geroprog@oregonstate.edu

Website: <http://www.hhs.oregonstate.edu/gerontology/index.html>

Graduate Programs

Gerontology Minor

Graduate Area of Concentration Gerontology

See the College of Health and Human Sciences, HDFS Department section in this catalog.

INTERDISCIPLINARY STUDIES

David A. Bernell

College of Liberal Arts

312 Gilkey Hall

Oregon State University

Corvallis, OR 97331

541-737-6281

E-mail: david.bernell@oregonstate.edu

Also e-mail: graduate.school@oregonstate.edu

Web site: http://oregonstate.edu/dept/grad_school/mais.html

Graduate Major

Interdisciplinary Studies (MAIS)

Graduate Areas of Concentration Selected from three fields offering graduate majors and minors

PROGRAM REQUIREMENTS

The Master of Arts in Interdisciplinary Studies (MAIS) degree is granted for attainment of broad, advanced knowledge and achievement integrated from three fields of study. Any graduate major or minor may serve as a field for this degree. Two of the three fields may be from one department if the areas of concentration within these two fields are different. A minimum of 9 credits in each of the three fields of study is required. The degree requires a minimum of 49 credits, including 4 credits of course work on interdisciplinary research methods.

No more than 21 credits (excluding thesis or research paper credit) may be taken in any field unless the total program exceeds 49 credits. There is no foreign language requirement. No more than 3 credits of blanket-numbered courses in each field of study may be used in the program; thesis credits (Option A) or research paper credits (Option B) are exempt from this limitation. The

student's committee consists of four members of the graduate faculty—one from each of the three fields—and a Graduate Council representative. A formal program meeting must be held prior to the completion of 18 graduate credits. A final oral examination is required.

There are two options under the program:

Option A: Thesis option. The thesis must coordinate work in the three fields. The requirement is 6 to 9 credits of Thesis 503. The thesis advisor must be a member of the graduate faculty authorized to direct theses.

Option B: Research paper option. The research paper must integrate work from at least two of the three fields. The requirement is 4 to 7 credits, registered as Research 501, Reading and Conference 505, or Projects 506.

COURSES

IST 501. RESEARCH AND SCHOLARSHIP (1-16). This course is repeatable for a maximum of 16 credits.

IST 503. THESIS (1-16). This course is repeatable for a maximum of 16 credits.

IST 505. READING AND CONFERENCE (1-16). This course is repeatable for a maximum of 16 credits.

IST 506. PROJECTS (1-16). This course is repeatable for a maximum of 16 credits.

IST 511. INTRODUCTION TO INTERDISCIPLINARY GRADUATE STUDIES (1). First term graduate seminar for master's students in interdisciplinary studies to design their program of study; discover and access library and other university resources related to their fields of study; and practice synthesizing aspects of three differing fields.

IST 512. APPLYING AN INTERDISCIPLINARY PERSPECTIVE (3). Students will develop knowledge and skills in theory, research methods, and practice of approaching problems, issues, or events from an interdisciplinary perspective.

PREREQS: IST 511

MARINE RESOURCE MANAGEMENT

Michael Harte, *Director*

Robert Allan, *Assistant Director*

104 COAS Administration Building

Oregon State University

Corvallis, OR 97331-5503

541-737-3504

FAX 541-737-2064

Website: <http://www.coas.oregonstate.edu/>

Students may contact the Student Programs Office, COAS Administration Building, 541-737-5188.

Graduate Major

Marine Resource Management (MA, MS)

Graduate Area of Concentration Marine resource management

Marine Resource Management (MRM) is a science-based, interdisciplinary master's

program based in College of Oceanic and Atmospheric Science (COAS). The program provides students with the interdisciplinary training necessary to function confidently and effectively in professional resource management positions. Marine and coastal issues are technically and politically complex, involving many interests, perspectives and stakeholders. To deal effectively with these issues, marine resource managers need a broad-based background in both physical and social sciences. Graduates from the program are trained to bridge the gap between science and policy.

More than 40 faculty from COAS, other university departments and outside institutions participate in MRM. These partnerships include Departments of Fisheries and Wildlife, Geosciences, Agricultural and Resource Economics, Political Science, Sociology, and Anthropology; Sea Grant extension specialists; and scientists and management professionals from state and federal agencies. The program consists of required courses in oceanography, atmospheric science, and marine law. Typical elective courses include resource economics, fisheries science, political science, anthropology, sociology, and communications. Each program of study is adjusted to the needs of the individual. Applicants must meet the general admission requirements of the college.

Students may elect to take the course-work-intensive professional track or the research-intensive thesis track.

The **professional track** requires 57 credits of course work plus 9 internship or project credits for a total of 66 credits. Students on a professional track develop a project and defend a report on that work, based on either an internship or a research project. Projects are conducted under the guidance of the student's major professor and/or committee members. Internships may be with local, state or federal agencies, with nongovernmental organizations, or with private firms, including consultants.

The **thesis track** requires 40 credits of course work and 12 thesis credits for a total of 52 credits. Students on a thesis track are expected to produce a more extensive and rigorous piece of original work and analysis, and must meet additional requirements set by the Graduate School and advisor.

Requirements

Applicants should have an undergraduate major in a physical, natural or social science; or business administration, or engineering. The Graduate Record Examination is required. International students must score at least 575 on the TOEFL. The program recommends one year each of college-level chemistry, physics and calculus. Course work in statistics and economics is also desirable.

MATERIALS SCIENCE

Bill Warnes, Program Director
204 Rogers Hall
Oregon State University
Corvallis, OR, 97331
E-mail: william.warnes@oregonstate.edu.

Graduate Major Materials Science (MS, PhD)

Graduate Areas of Concentration
Chemistry, chemical engineering, civil engineering, electrical and computer engineering, forest products, mathematics, mechanical engineering, nuclear engineering, physics

Graduate Minor Materials Science

The discipline of materials science is inherently interdisciplinary, involving fundamental aspects of chemistry, physics, biology, geoscience, agricultural science, mathematics, and engineering.

Reflecting this characteristic, the materials science program at Oregon State University, initiated in the 1980s, is distributed over nine departments spanning three OSU colleges. This allows students to earn MS and PhD degrees in materials science in many different areas of concentration, including all classes of materials, and in a wide range of materials behavior. The course work requirements are extremely flexible to allow students to tailor their program of study to directly support their research activities.

Applications and other inquiries should be forwarded to: Prof. Bill Warnes, Materials Science Program Director, 204 Rogers Hall, Oregon State University, Corvallis, OR, 97331, USA. E-mail: william.warnes@oregonstate.edu.

For more information, visit the Web site at <http://matsci.oregonstate.edu/>

MATERIALS SCIENCE GRADUATE MINOR

For more details, see the school advisor.

MOLECULAR AND CELLULAR BIOLOGY

Barbara J. Taylor, Director
3021 Ag and Life Sciences Building
Oregon State University
Corvallis, OR 97331-7303
541-737-3799
541-737-3045 fax
E-mail: mcb@cgrb.oregonstate.edu
Website: <http://mcb.oregonstate.edu>

AFFILIATE FACULTY

Over 90 faculty members drawn from 18 departments in six colleges participate in the MCB program.

Graduate Major Molecular and Cellular Biology (MS, PhD)

Graduate Areas of Concentration
Bioinformatics, biotechnology, cell biology, developmental biology, genome biology, molecular biology, molecular pathogenesis, molecular virology, plant molecular biology, structural biology

Graduate Minor Molecular and Cellular Biology

The Molecular and Cellular Biology Degree Program provides students with comprehensive interdisciplinary training in molecular and cellular biology while reserving sufficient flexibility for students to specialize in their areas of interest. The elements of the core curriculum include courses in molecular genetics and cell structure and function, a seminar and ethics class, a series of faculty research presentations, and research rotations. Additional course work is custom-tailored to the individual student's interests and needs. Each program requires 36 units of graduate-level course work, participation in seminar programs, two quarters of supervised teaching experience, written and oral preliminary examinations, supervision by an individual committee of five faculty members, and presentation of a thesis containing the results of publishable original research.

The program also offers access to all of the participating faculty as potential research advisors. Students do three research rotations in the first year and select their advisor from over 90 faculty members in the 18 participating departments in six colleges. Therefore, the MCB Program lowers interdisciplinary barriers and allows the students to select the advisors that most closely match their interests after they have been on campus for one or more terms.

MOLECULAR AND CELLULAR BIOLOGY (MS, PhD)

Graduate Areas of Concentration
Bioinformatics, biotechnology, cell biology, developmental biology, genome biology, molecular biology, molecular pathogenesis, molecular virology, plant molecular biology, structural biology

MCB doctoral students do research rotations in three laboratories during the first year, and then carry out their thesis research in subsequent years under the direction of a member of the MCB faculty. The MCB Program lowers interdisciplinary barriers and allows each individual the opportunity to select the most suitable advisor and committee.

For more information, contact Dr. Barbara J. Taylor, Director, Molecular and Cellular Biology Program, 3021 Agricultural and Life Sciences Building, OSU, Corvallis, OR 97331-7303.

PROFESSIONAL SCIENCE MASTER'S DEGREE IN APPLIED BIOTECHNOLOGY

Website: <http://professionalmasters.science.orst.edu/>

The College of Science offers a two-year professional program leading to a Master's (MS) degree in either Environmental Sciences, **Molecular and Cellular Biology**, Botany and Plant Pathology, or Applied Physics. Students must complete a Bachelor's degree to be eligible to apply. An internship is required in lieu of research and in addition to specific training in a scientific discipline, skills in business management and communications are acquired, enabling students to effectively work between scientific and business communities. Students successfully completing this program are eligible for employment in a variety of work settings throughout the world.

For general information about Professional Science Master's Programs, contact **Ursula Bechert**, Director of Off-Campus Programs, College of Science, 2082 Cordley Hall, 541-737-5259, e-mail: ursula.bechert@oregonstate.edu.

DOCTORATE IN MOLECULAR AND CELLULAR BIOLOGY

Core Curriculum

MCB 511. Research Perspectives in Molecular and Cellular Biology (3)
 MCB 525. Techniques in Molecular and Cellular Biology (3)
 MCB 554. Genome Organization, Structure, and Maintenance (4)
 MCB 555. Genome Expression and Regulation (4)
 MCB 556. Cell and Developmental Biology (4)
 MCB 557. Scientific Skills and Ethics (3)
 MCB 610. Internship (1-9)
 MCB 668. Bioinformatics and Genomics (4)
 Additional requirements include seminar presentations, journal club participation, research rotations, teaching assistance and at least 9 additional credits of relevant course work.

MCB Electives

MCB 526. Advanced Biotechnology Techniques (2-4)
 MCB 541. Plant Tissue Culture (4)
 MCB 564. Receptors and Signal Transduction: Advanced Topics (3)
 MCB 573. Cytogenetics (4)
 MCB 501/601. Research (1-16)
 MCB 503/603. Thesis (1-16)
 MCB 505/605. Reading and Conference (1-16)
 MCB 509/609. Practicum (1-16)
 MCB 510. Internship (1-9)
 MCB 565. Mammalian Molecular Genetics (3)
 MCB 599. Special Topics (1-16)
 MCB 620. DNA Fingerprinting (1)
 MCB 621. Genetic Mapping (1)
 MCB 622. Mapping Quantitative Trait Loci (1)

MCB 625. Plant Molecular Genetics (3)
 MCB 637X. Molecular Host-Microbe Interactions (3)
 MCB 651. Molecular Basis of Plant Pathogenesis (3)
 MCB 669. Genome Evolution (3)
 MCB 699. ST/Introductory Bioinformatics (2)
 MCB 699. ST/Bioinformatics Programming (2)
 MCB 699. Special Topics (1-16)

MOLECULAR AND CELLULAR BIOLOGY GRADUATE MINOR

Graduate Areas of Concentration

Bioinformatics, biotechnology, cell biology, developmental biology, genome biology, molecular biology, molecular pathogenesis, molecular virology, plant molecular biology, structural biology

For more information and application forms, contact Dr. Barbara J. Taylor, Director, Molecular and Cellular Biology Program, 3021 Agricultural and Life Sciences Building, OSU, Corvallis, OR 97331-7303.

COURSES

MCB 501. RESEARCH AND SCHOLARSHIP (1-16). This course is repeatable for a maximum of 99 credits.
MCB 503. THESIS (1-16). This course is repeatable for a maximum of 99 credits.
MCB 505. READING AND CONFERENCE (1-16). This course is repeatable for a maximum of 99 credits.
MCB 507. SEMINAR (1-16). This course is repeatable for a maximum of 99 credits.
MCB 508. WORKSHOP (1-16). This course is repeatable for a maximum of 99 credits.
MCB 509. PRACTICUM (1-16). This course is repeatable for a maximum of 99 credits.
MCB 510. INTERNSHIP (1-16). This course is repeatable for a maximum of 99 credits.
MCB 511. RESEARCH PERSPECTIVES IN MOLECULAR AND CELLULAR BIOLOGY (3). Provides graduate students with an in-depth exposure to faculty members at OSU involved in molecular and cellular biology and their specific fields of research.
MCB 524. MOLECULAR AND CELLULAR BIOLOGY TECHNIQUES (1). Modern methods for manipulation of cellular macromolecules. Recombinant DNA technology and protein chemistry methods will be covered. Includes daily lectures over a two-week period. Lec/lab. Graded P/N. **PREREQS:** BB 451 or equivalent. May not be taken concurrently with MCB 525.
MCB 525. TECHNIQUES IN MOLECULAR AND CELLULAR BIOLOGY (3). An intensive laboratory course introducing modern methods for the manipulation of cellular macromolecules. Recombinant DNA technology, protein chemistry, and in situ hybridization methods presented in a format that emphasizes experimental continuity. The course requires two weeks of intensive full-time involvement. **PREREQS:** Departmental approval required.
MCB 526. M/ADVANCED BIOTECHNOLOGY TECHNIQUES (1-3). Provide technical experience and training in research techniques that are relevant to a career in the biotechnology industry. Section 001: Microscopy (1) Section 002: Mass Spectrometry (1) Section 003: Bioinformatics (1) This course is repeatable for a maximum of 3 credits. **PREREQS:** Graduate standing required.

MCB 541. PLANT TISSUE CULTURE (4). Principles, methods, and applications of plant tissue culture. Laboratory is important part of course. Topics include callus culture, regeneration, somaclonal variation, micropropagation, anther culture, somatic hybridization, and transformation. CROSSLISTED as HORT 541.

MCB 554. GENOME ORGANIZATION, STRUCTURE, AND MAINTENANCE (4). How diverse organisms store their individual sets of genetic information (genomes). Evolution of genomes and gene families. Structures of DNA and chromatin. Biochemical and regulatory pathways that protect cellular genomes against environmental and endogenous damage and ensure transmission of faithful copies to progeny. Remodeling of genomes by recombination and transposition. CROSSLISTED as GEN 554 and TOX 554. **PREREQS:** BI 311 (genetics or equivalent), BB 450, BB 451, BB 452 or BB 490, BB 491, BB 492 (biochemistry) or equivalent.

MCB 555. GENOME EXPRESSION AND REGULATION (4). Prokaryotic and eukaryotic systems will be used to describe recent advances in understanding transcriptional and posttranscriptional control mechanisms. Topics include: microbial, yeast and mouse model systems; transcriptional control mechanisms; RNA processing, silencing and microRNAs; protein synthesis and posttranslational modification; microarray- and mass spectrometry-based expression genomics. CROSSLISTED as GEN 555. **PREREQS:** BB 451 or equivalent.

MCB 556. CELL AND DEVELOPMENTAL BIOLOGY (4). Examination of molecular and structural elements in eukaryotic cells and their relationship to function and development. Topics include nuclear organization, membranes, organelles, intracellular sorting, cell energetics, cell signaling, cell motility, cell division cycle, and developmental processes of selected model organisms. Critical reading and writing skills will be emphasized. CROSSLISTED as GEN 556. **PREREQS:** BB 450, BB 451 (biochemistry) or equivalent; BI 311 (genetics) or equivalent. Recommended: BI 460 (cell biology) or equivalent; MCB 554, MCB 555.

MCB 557. SCIENTIFIC SKILLS AND ETHICS (3). Offered alternate years.

MCB 564. RECEPTORS AND SIGNAL TRANSDUCTION: ADVANCED TOPICS (3). Advanced concepts and recent developments in receptor pharmacology. Topics include receptor theory and regulation, and signal transduction pathways and functions. Offered alternate years. CROSSLISTED as PHAR 564.

MCB 565. MAMMALIAN MOLECULAR GENETICS (3). Covers general principles of the molecular genetics and functional genomics of mammalian organ system development. Advanced methodologies and emerging biotechnologies and their social, economic, political and cultural impacts will be discussed. CROSSLISTED as PHAR 565. **PREREQS:** BB 450, BB 490, MCB 556.

MCB 573. CYTOGENETICS (4). Effects of variations in chromosome structure and number. Offered alternate years. CROSSLISTED as GEN 573, HORT 573. **PREREQS:** BI 311 or equivalent.

MCB 599. SPECIAL TOPICS (1-16). This course is repeatable for a maximum of 16 credits.

MCB 601. RESEARCH (1-16). This course is repeatable for a maximum of 16 credits.

MCB 603. THESIS (1-16). This course is repeatable for a maximum of 16 credits.

MCB 605. READING AND CONFERENCE (1-16). This course is repeatable for a maximum of 16 credits.

MCB 609. PRACTICUM (1-16). This course is repeatable for a maximum of 16 credits.

MCB 610. INTERNSHIP (1-9). Laboratory rotation. This course is repeatable for a maximum of 16 credits. **PREREQS:** MCB graduate students only.

MCB 620. DNA FINGERPRINTING (1).

Principles and methods for producing and analyzing DNA fingerprints. Offered alternate years. **CROSSLISTED** as CSS 620, GEN 620. **PREREQS:** BI 311 or CSS 430/CSS 530 or equivalent.

MCB 621. GENETIC MAPPING (1). Principles and methods for constructing genetic maps comprised of molecular and other genetic markers. Offered alternate years. **CROSSLISTED** as CSS 621, GEN 621. **PREREQS:** BI 311 or CSS 430/CSS 530 or equivalent.

MCB 622. MAPPING QUANTITATIVE TRAIT LOCI (1). Principles and methods for mapping genes underlying phenotypically complex traits. Offered alternate years. **CROSSLISTED** as CSS 622, GEN 622. **PREREQS:** CSS 590 or ST 513 or equivalent.

MCB 625. PLANT MOLECULAR GENETICS (3). Structure, expression, and interactions of the plant nuclear, chloroplast, and mitochondrial genomes. Critical examination of the current literature on gene regulation, mobile genetic elements, and biotechnology in higher plants. Offered alternate years. **CROSSLISTED** as BOT 625, GEN 625. **PREREQS:** MCB 555 or equivalent and BB 451 or instructor approval required.

MCB 637X. MOLECULAR HOST-MICROBE INTERACTIONS (3). Lecture and discussion-based presentation of the molecular bases for interactions between organisms. Will address bacterial, algal, and fungal symbionts of eukaryotes and will consider pathogenesis, commensalism, and mutualism. A focus on the evolution of host-microbe interactions will be included. **PREREQS:** Graduate standing.

MCB 651. MOLECULAR BASIS OF PLANT PATHOGENESIS (3). Analysis of current concepts in the physiology, biochemistry, and genetics of host-parasite interactions. Topics covered include specificity, recognition, penetration, toxin production, altered plant metabolism during disease, resistance mechanisms and regulatory aspects of gene expression during host-parasite interactions. Offered alternate years. **CROSSLISTED** as BOT 651. **PREREQS:** BOT 550.

MCB 668. BIOINFORMATICS AND GENOMICS (4). This course is divided into two 2-credit modules. First module teaches both the theory and practice of basic informatics techniques—including sequence alignment, sequence searching, and the evolution of protein families—and their applications at a genome-wide level (comparative genomics and functional genomics). Second module introduces the fundamental tools of bioinformatics (Linux, Perl) and bioinformatics algorithms necessary to process and analyze large datasets generated from high-throughput genomics experiments. The second module is structured in three sections: Programming Concepts (PC), Biological Applications (BA) and Biological Projects (BP). Programming Concepts lays the foundation for the later two sections. PC will teach students to work within a Linux operating system in a client/server environment. Students learn to create programs in Perl scripting language, which permeates modern bioinformatics applications. Relevant programming concepts are presented and code examples illustrated using biological data. BA builds on the PC foundation to provide “snapshots” of common bioinformatics methods. For example, formatting biological sequence data into standard file formats, parsing the output from common bioinformatics software, adding notations to biosequences, calculating common statistics associated with biosequences (i.e., reverse complementation of DNA sequence). BP uses the BA snapshots to develop more extensive projects. BP incorporates extensive coverage of theoretical and algorithmic concepts to explore a biological topic where dealing with the data in a computational and mathematical framework is essential. **CROSSLISTED** as MB 668.

MCB 669. GENOME EVOLUTION (3). Recent advances in our understanding of the evolutionary mechanisms by which genomes change over time will be the central focus of this course. Specific areas of study will include principles of molecular evolution and population genetics, phylogenetics, and recent topics in evolutionary genomics.

MCB 699. SPECIAL TOPICS (3). This course is repeatable for a maximum of 3 credits.

PUBLIC HEALTH

Marie Harvey, Chair
258 Waldo Hall
Oregon State University
Corvallis, OR 97331-6406
541-737-3824

E-mail: marie.harvey@oregonstate.edu
Website: <http://www.hhs.oregonstate.edu/ph/index.html>

Graduate Major Master of Public Health (MPH)

See the College of Health and Human Sciences, Public Health Department section in this catalog.

PUBLIC POLICY

Professor Brent Steel, Director

Master of Public Policy
311 Gilkey Hall
Oregon State University
Corvallis, OR 97331-6206
Phone: 541-737-2811
Fax: 541-737-2289
E-mail: mpp@oregonstate.edu
Web site: <http://oregonstate.edu/cla/mpp/>

Graduate Major Public Policy (MPP)

Graduate Areas of Concentration
Environmental policy, international policy, rural policy, science policy, social policy

Oregon State University offers the Master of Public Policy to graduate students interested in environmental policy, international policy, rural policy and social policy. The degree is granted by the College of Liberal Arts and provides graduate education for students wishing to develop their interests and careers in the public and nonprofit sectors. The Master of Public Policy (MPP) specifically prepares students for careers in the public, nonprofit, and international sectors and offers training for “in-service” students (already employed) desiring professional growth and advancement. The program accepts students with backgrounds in related academic disciplines. The degree is designed to be a generalist program, with an emphasis on analytic skills and policy knowledge.

To see details outlined in a brochure, go to <http://oregonstate.edu/cla/mpp/>.

MPP CORE CURRICULUM

Required Core Courses (35)

ECON 524. Introduction to Econometrics (4)
ECON 539. Public Policy Analysis (4)
MPP 507. Seminar: Professional Development (1)
PS 571. Public Policy Theory (4)
PS 572. Public Administration (4)
PS 501/SOC 501. Research and Scholarship (MPP Essay) (6)
SOC 515. Understanding Social Research (4)
SOC 516. Conducting Social Research (4)
SOC 519. Applied Research Methods (4)

Additional Requirements (10):

Pre-Service Students: MPP/SOC 510. Internship (10)

OR

Students with Prior Relevant Work Experience: Additional approved course work (10)

Total=45 core credits

ENVIRONMENTAL POLICY CONCENTRATION

Minimum 18 credits

of the following courses:

AREC 534. Environmental and Resource Economics (3)
AREC 550. Environmental Economics (3)
AREC 551. Natural Resource Economics (3)
AREC 552. Marine and Fishery Economics (3)
MRM 515. Coastal Resources Management (4)
PS 549. Topics in Comparative Politics (Global Environmental Politics and Policy) (4)
PS 574. Natural Resource Policy and Bureaucratic Politics (4)
PS 575. Environmental Politics and Policy (4)
PS 576. Science and Politics (4)
PS 577. International Environmental Politics and Policy (4)
SOC 556. Science and Technology in Social Context (4)
SOC 575. Rural Sociology (4)
SOC 580. Environmental Sociology (4)
SOC 581. Society and Natural Resources (4)
Other pertinent courses at OSU may be selected subject to approval of the committee. Decisions about the elective course of study will be based on matching the student's needs and preparation with the MPP program.

INTERNATIONAL POLICY CONCENTRATION

Minimum 18 credits

of the following courses:

AREC 533. International Agricultural Development (3)
AREC 543. Applied Trade Analysis (4)
ECON 540. International Trade and Policy (4)
ECON 541. International Finance Theory and Policy (4)
ECON 555. Economic Development (4)
PS 546. East Asian Political Economy (4)
PS 549. Topics in Comparative Politics (4)
PS 551. American Foreign Policy (4)
PS 552. Alternative International Futures (4)
PS 554. International Law and Organizations (4)

- PS 556. International Politics of Asia Pacific (4)
 PS 557. US-China Relations (4)
 PS 559. Topics in International Relations (4)
 PS 577. International Environmental Politics and Policy (4)
 SOC 521. Social Change and Modernization (3)
 SOC 560. Comparative Societies (4)
 SOC 566. International Development: Gender Issues (4)

Other pertinent courses at OSU may be selected subject to approval of the committee. Decisions about the elective course of study will be based on matching the student's needs and preparation with the MPP program.

RURAL POLICY CONCENTRATION

Minimum 18 credits of the following courses:

- AREC 554. Rural Development Economics and Policy (3)
 ANTH 581. Natural Resources and Community Values (3)
 ANTH 582. World Food and Culture Implications of Intl Ag Dev (3)
 ANTH 584. Wealth and Poverty (3)
 FOR 561. Forest Policy Analysis (3)
 GEO 520. Geography of Resource Use (3)
 GEO 523. Land Use (3)
 GEO 552. Principles and Practices of Rural and Resource Planning (3)
 HDFS 547. Families and Poverty (3)
 SNR 511, 520, 521, 522. Sustainable Natural Resource sequence [via *Ecampus only*]
 SOC 554. Leisure and Culture (4)
 SOC 560. Comparative Societies (4)
 SOC 566. International Development-Gender Issues (4)
 SOC 575. Rural Sociology (4)
 SOC 581. Society and Natural Resources (4)
 SOC 585. Consensus and Natural Resources (3)

Other pertinent courses at OSU may be selected subject to approval of the MPP Committee. Decisions about the elective course of study will be based on matching the student's needs and preparation with the MPP program.

SCIENCE POLICY CONCENTRATION

Minimum 18 credits of the following courses:

Required

- PS 576. Science and Politics (4)
 SOC 556. Science and Technology in Social Context (4)

Electives

- HSTS 518. Science and Society (4)
 HSTS 519. Studies in Scientific Controversy: Method and Practice of (4)
 HSTS 521. Technology and Change (4)
 HSTS 522. Historical Studies of Science and Politics (4)
 PHL 547. Research Ethics (3)
 PHL 570. Philosophy of Science (3)
 PHL 574. Philosophy of Biology (4)
 SOC 521. Social Change and Modernization (3)

- WRP 524. Sociotechnological Aspects of Water Resources (3)

Other pertinent courses at OSU may be selected subject to approval of the MPP Committee. Decisions about the elective course of study will be based on matching the student's needs and preparation with the MPP program.

SOCIAL POLICY CONCENTRATION

Minimum 18 credits of the following courses:

- AREC 554. Rural Development Economics and Policy (3)
 ECON 535. The Public Economy (4)
 ECON 565. Transportation Economics (4)
 PS 514. Interest Groups (4)
 PS 515. Politics and the Media (4)
 PS 516. Public Opinion and Politics (4)
 PS 524. Administrative Law (4)
 PS 579. Topics in Public Policy and Public Administration (4)
 SOC 518. Qualitative Sociology (4)
 SOC 526. Social Inequality (4)
 SOC 532. Sociology of Aging (4)
 SOC 537. Race and Ethnic Relations (4)
 SOC 539. Welfare and Social Services (4)
 SOC 548. Law and Society (3)
 SOC 550. Sociology of Education (4)
 SOC 575. Rural Sociology (4)

Other pertinent courses at OSU may be selected subject to approval of the MPP Committee. Decisions about the elective course of study will be based on matching the student's needs and preparation with the MPP program.

WATER RESOURCES PROGRAMS

Mary Santelmann, *Director*
 Water Resources Graduate Program
 116 Gilmore Hall
 Department of Geosciences
 Oregon State University
 Corvallis, OR 97331
 541-737-1215
 E-mail: santelmm@geo.oregonstate.edu
 Website: <http://oregonstate.edu/gradwater/>

Graduate Majors

Water Resources Engineering (MS, PhD)

Graduate Areas of Concentration

- Groundwater Engineering*
Surface Water Engineering
Watershed Engineering

Water Resources Policy and Management (MS)

Graduate Area of Concentration

Water Resources Science (MS, PhD)

Graduate Area of Concentration

Water Resources Science

Graduate Minors

Water Resources

Water Resources Engineering Water Resources Policy and Management Water Resources Science

Graduate Certificate

Water Resources Policy and Management

WATER RESOURCES ENGINEERING (MS, PhD)

Graduate Areas of Concentration

Groundwater engineering, surface water engineering, watershed engineering

Core Courses (6 credits)

- WRP/WRS 507. Seminar: Water Resources (1)
 WRP/WRE/WRS 505. Reading and Conference: Water Resources Journal Club (1)
 WRP/WRE/WRS 507. Seminar: Water Resources Seminar and Journal Club (1)
 WRP 524. Socio-technological Aspects of Water Resources (3)

Groundwater Engineering

- BEE 512. Physical Hydrology (3)
 BEE/CE/GEO 514. Groundwater Hydraulics (3)
 BEE 533. Irrigation System Design (4)
 BEE 542. Vadose Zone Transport (4)
 BEE 571. Biosystems Modeling Techniques (3)
 ENVE 554. Groundwater Remediation (4)
 GPH 665. Geophysical Field Techniques (3)

Surface Water Engineering

- BEE 512. Physical Hydrology (3)
 BEE 533. Irrigation System Design (4)
 BEE 544. Open Channel Hydraulics (4)
 BEE 546. River Engineering (4)
 BEE 571. Biosystems Modeling Techniques (3)
 CE 518. Groundwater Modeling (4)
 CE 543. Applied Hydrology (4)
 CE 641. Ocean Engineering Wave Mechanics (3)
 FE 536. Forest Erosion Processes (3)
 FE 537. Hillslope Hydrology (1-16)

Watershed Engineering

- ATS/FS 564. Interactions of Vegetation and Atmosphere (3)
 BEE 512. Physical Hydrology (3)
 BEE 525. Stochastic Hydrology (3)
 BEE 548. Nonpoint Source Pollution Assessment and Control (3)
 BEE 549. Regional Hydrologic Modeling (3)
 BEE 571. Biosystems Modeling Techniques (3)
 CE 517. Hydraulic Engineering Design (4)
 CE 545. Sediment Transport (4)
 CE 547. Water Resources Engineering I: Principles of Fluid Mechanics (4)
 CE 548. Water Quality Dynamics (3)
 CE 556. Environmental Assessment (4)
 ENVE 521. Water and Wastewater Characterization (4)
 ENVE 531. Transport and Fate of Organic Chemicals in Environmental Systems (4)
 ENVE 532. Aqueous Environmental Chemistry (4)
 ENVE 534. Physical and Chemical Processes for Water Quality Control (4)
 FE 530. Watershed Processes (4)
 FE 532. Forest Hydrology (3)
 FE 533. Forest Hydrology Laboratory (1)
 FE 535. Water Quality and Forest Land Use (3)
 FE 630. Special Topics in Forest Hydrology (1-3)
 FS 561. Physiology of Woody Plants (3)

WATER RESOURCES POLICY AND MANAGEMENT (MS)**Graduate Area of Concentration***Water resources policy and management***Core Courses (6 credits)**

WRP/WRS 507. Seminar: Water Resources (1)
 WRP/WRE/WRS 505. Reading and Conference: Water Resources Journal Club (1)
 WRP/WRE/WRS 507. Seminar: Water Resources Seminar and Journal Club (1)
 WRP 524. Socio-technological Aspects of Water Resources (3)

Methods and Numerical Skills (9 cr)

CS 540. Database Management Systems (4)
 GEO 541. Spatio-Temporal Variation in Ecological and Earth Science (4)
 GEO 565. Geographical Information Systems (3)
 GEO 553. Research Evaluation Methods/EIS (3)
 ST 511. Methods of Data Analysis (4)
 ST 512. Methods of Data Analysis (4)
 ST 513. Methods of Data Analysis (4)
 ST 531. Sampling Methods (3)
 ST 573. Environmental Sampling (3)
 SOC 519. Applied Research Methods (4)

Basic Water Science (6 credits)

ATS 520. Principles of Atmospheric Science (4)
 BEE 512. Physical Hydrology (3)
 BEE 514. Groundwater Hydraulics (3)
 CE 556. Environmental Assessment (4)
 CSS 535. Physics of Soil Ecosystems (3)
 FE 530. Watershed Processes (4)
 GEO 530. Geochemistry (3)
 GEO 531. Applied Climatology (3)
 GEO 532. Applied Geomorphology (3)
 GEO 539. Topics in Physical Geography: Snow Hydrology (3)
 GEO 548. Field Research in Geomorphology and Landscape Ecology (3)
 GEO 582. Geomorphology of Forests and Streams (3)

Policy and Management (15 credits)

ANTH 576. Community Impact Anthropology (3)
 ANTH 577. Cultural Ecology (3)
 ANTH 585. Uses of Anthropology (3)
 ANTH 591. Ethnographic Methods (4)
 AREC 505. Reading and Conference: Resource Economics (3)
 or AREC 507. Seminar: Resource Economics (3)
 AREC 512. Microeconomic Theory I (4)
 AREC 523. Statistics for Econometrics (4)
 AREC 525. Econometric Methods (4)
 AREC 526. Applied Econometrics (4)
 AREC 534. Environmental and Resource Economics (3)
 AREC 543. Applied Trade Analysis (4)
 AREC 550. Environmental Economics (3)
 AREC 551. Natural Resource Economics (3)
 AREC 553. Public Land and Resource Law (4)
 COMM 540. Theories of Conflict and Conflict Management (3)
 COMM 546. Communication in International Conflict and Disputes (3)
 FOR 562. Natural Resource Policy and Law Interactions (3)
 FOR 563. Environmental Policy and Law Interactions (3)

GEO 520. Geography of Resource Use (3)
 GEO 524. International Water Resources Management (3)
 GEO 525. Water Resource Management in the U.S. (3)
 GEO 529. Topics in Resource Geography: Water Resources Management (3)
 GEO 532. Applied Geomorphology (3)
 MRM 515. Coastal Resources Management (4)
 PS 571. Public Policy Theory (4)
 PS 572. Public Administration (4)
 PS 574. Natural Resource Policy and Bureaucratic Politics (4)
 PS 575. Environmental Politics and Policy (4)
 PS 576. Science and Politics (4)
 PS 577. International Environmental Politics and Policy (4)
 SOC 556. Science and Technology in Social Context (4)
 SOC 581. Society and Natural Resources (4)
 SOC 585. Consensus and Natural Resources (3) (Also offered as ANS, FW)

WATER RESOURCES SCIENCE (MS, PhD)**Graduate Area of Concentration***Water resources science***Core Courses (6 credits)**

WRP/WRS 507. Seminar: Water Resources (1)
 WRP/WRE/WRS 505. Reading and Conference: Water Resources Journal Club (1)
 WRP/WRE/WRS 507. Seminar: Water Resources Seminar and Journal Club (1)
 WRP 524. Socio-technological Aspects of Water Resources (3)

**Water Resources Science Courses
Select 12 credits for the MS or 15 credits for the PhD from below:**

ATS 520. Principles of Atmospheric Science (4)
 ATS/FS 564. Interaction of Vegetation and Atmosphere (3)
 BEE 512. Physical Hydrology (3)
 BEE 525. Stochastic Hydrology (3)
 BEE 533. Drainage (Irrigation) System Design (4)
 BEE 542. Vadose Zone Transport (4)
 BEE 544. Open Channel Hydraulics (4)
 BEE 546. River Engineering (4)
 BEE 548. Nonpoint Source Pollution Assessment and Control (3)
 BEE 549. Regional Hydrologic Modeling (3)
 CE 517. Hydraulic Engineering Design (4)
 CE 518. Groundwater Modeling (4)
 CE 543. Applied Hydrology (4)
 CE 548. Water Quality Dynamics (3)
 CSS 523. Principles of Stable Isotopes (3)
 CSS 535. Physics of Soil Ecosystems (3)
 CSS 536. Vadose Zone Hydrology Lab (1)
 CSS 545. Geochemistry of Soil Ecosystems (4)
 CSS 546. Soil Geochemistry Lab (1)
 CSS 555. Biology of Soil Ecosystems (4)
 ENVE 521. Water and Wastewater Characterization (4)
 ENVE 534. Physical and Chemical Processes for Water Quality Control (4)
 ENVE 554. Groundwater Remediation (4)
 FE 530. Watershed Processes (4)
 FE 532. Forest Hydrology (3)
 FE 533. Forest Hydrology Laboratory (1)

FE 537. Hillslope Hydrology (4)
 FE 630. Special Topics in Forest Hydrology (1-3)
 FS 561. Physiology of Woody Plants (3)
 FW 556. Limnology (5)
 FW 579. Wetlands and Riparian Ecology (3)
 FW 580. Stream Ecology (3)
 GEO 530. Geochemistry (3)
 GEO 531. Applied Climatology (3)
 GEO 532. Applied Geomorphology (3)
 GEO 539. Topics in Physical Geography: Snow Hydrology (3)
 GEO 544. Remote Sensing (3)
 GEO 548. Advanced Field Research in Geomorphology and Landscape Ecology (3)
 GEO 582. Geomorphology of Forests and Streams (3)
 GEO 589. Role of Fluids in Geologic Processes (3)
 GEO 691. Mass and Heat Transport in the Environment (4)
 GPH 665. Geophysical Field Techniques (3)
 MB 548. Microbial Ecology (3)
 OC 670. Geophysical Fluid Dynamics (4)
 RNG 555. Riparian Ecology and Management (3)

Total=18-21**WATER RESOURCES GRADUATE MINOR****Graduate Areas of Concentration***Hydrology, water quality, water resources planning and management*

A minor in water resources for Master of Science, Master of Arts, and Doctor of Philosophy degree programs is offered with specialization in hydrology, water quality, or water resources planning and management. The first two options are technically oriented, while the third gives added socioeconomic emphasis. Seminars, readings, and conferences are offered by Water Resources Graduate Program.

The minor options are structured around core groups of courses and complementary courses designed to broaden the student's education. University departments that offer courses related to water resources include the Departments of Agricultural and Resource Economics; Anthropology; Biochemistry and Biophysics; Biological and Ecological Engineering; Botany and Plant Pathology; Business Administration; Chemistry; Crop and Soil Science; Economics; Entomology; Fisheries and Wildlife; Forest Engineering; Forest Resources; Geosciences; Mathematics; Microbiology; Political Science; Public Health; Rangeland Ecology and Management; Statistics; and Zoology; the School of Chemical, Biological, and Environmental Engineering; the School of Civil and Construction Engineering; the School of Mechanical, Industrial, and Mechanical Engineering; and the College of Oceanic and Atmospheric Sciences. About 20 departments conduct teaching or research programs in water resources.

For more information, contact gradwater_director@oregonstate.edu or visit <http://oregonstate.edu/gradwater>.

WATER RESOURCES ENGINEERING GRADUATE MINOR

Graduate Areas of Concentration
Groundwater engineering, surface water engineering, watershed engineering

A minor in water resources engineering for Master of Science, Master of Arts, and Doctor of Philosophy degree programs is offered with specialization in groundwater engineering, surface water engineering, or watershed engineering. Seminars, courses, and reading and conference courses in water resources engineering are offered by Water Resources Graduate Program.

The minor options are structured around courses designed to broaden the student's education in one of the above areas of concentration. University departments that offer courses related to water resources engineering include the departments of Biochemistry and Biophysics; Biological and Ecological Engineering; Botany and Plant Pathology; Chemistry; Crop and Soil Science; Forest Engineering; Forest Resources; Geosciences; Mathematics; Public Health; Rangeland Ecology and Management; Statistics; the School of Chemical, Biological, and Environmental Engineering; the School of Civil and Construction Engineering; the School of Mechanical, Industrial, and Mechanical Engineering; and the College of Oceanic and Atmospheric Sciences. About 20 departments conduct teaching or research programs in water resources.

For more information, contact gradwater_director@oregonstate.edu or visit <http://oregonstate.edu/gradwater>.

WATER RESOURCES POLICY AND MANAGEMENT GRADUATE MINOR

Graduate Areas of Concentration
Water resources policy and management

A minor in water resources policy and management for Master of Science, Master of Arts, and Doctor of Philosophy degree programs is offered with specialization in the human dimensions of water resources policy and management. Seminars, readings, and conferences in Water Resources Policy and Management are offered by Water Resources Graduate Program and several affiliated departments.

The minor options are structured around courses designed to broaden the student's education in water resources policy and management. University departments that offer courses related to water resources policy and management include the departments of Agricultural and Resource Economics; Anthropology;

Business Administration; Economics; Fisheries and Wildlife; Forest Resources; Geosciences; Political Science; Public Health; Rangeland Ecology and Management; Statistics; and Zoology; and the College of Oceanic and Atmospheric Sciences.

For more information, contact gradwater_director@oregonstate.edu or visit <http://oregonstate.edu/gradwater>.

WATER RESOURCES SCIENCE GRADUATE MINOR

Graduate Areas of Concentration
Water resources science

A minor in water resources science for Master of Science, Master of Arts, and Doctor of Philosophy degree programs is offered with specialization in hydrology or geochemistry. Seminars, readings, and conferences are offered by Water Resources Graduate Program.

The minor options are structured around courses designed to broaden the student's education in water resources science, specifically in hydrology or geochemistry. University departments that offer courses related to water resources science include the departments of Biochemistry and Biophysics; Biological and Ecological Engineering; Botany and Plant Pathology; Chemistry; Crop and Soil Science; Entomology; Fisheries and Wildlife; Forest Engineering; Forest Resources; Geosciences; Mathematics; Microbiology; Public Health; Rangeland Ecology and Management; Statistics; and Zoology; the School of Chemical, Biological, and Environmental Engineering; the School of Civil and Construction Engineering; the School of Mechanical, Industrial, and Mechanical Engineering; and the College of Oceanic and Atmospheric Sciences. About 20 departments conduct teaching or research programs in water resources.

For more information, contact gradwater_director@oregonstate.edu or visit <http://oregonstate.edu/gradwater>.

WATER RESOURCES ENGINEERING

- WRE 501. RESEARCH (1-16).**
- WRE 503. THESIS (1-16).**
- WRE 505. READING AND CONFERENCE (1-16).**
- WRE 506. PROJECTS (1-16).**
- WRE 507. SEMINAR (1-16).**
- WRE 508. WORKSHOP (1-16).**
- WRE 510. INTERNSHIP (1-16).**
- WRE 599. SPECIAL TOPICS (1-16).**
- WRE 601. RESEARCH (1-16).**
- WRE 603. THESIS (1-16).**
- WRE 605. READING AND CONFERENCE (1-16).**
- WRE 607. SEMINAR (1-16).**
- WRE 608. WORKSHOP (1-16).**
- WRE 610. INTERNSHIP (1-16).**
- WRE 699. SPECIAL TOPICS (1-16).**

WATER RESOURCES POLICY

- WRP 501. RESEARCH (1-16).**
- WRP 503. THESIS (1-16).**
- WRP 505. READING AND CONFERENCE (1-16).**
- WRP 506. PROJECTS (1-16).**
- WRP 507. SEMINAR (1-16).** This course is repeatable for a maximum of 16 credits.
- WRP 508. WORKSHOP (1-16).**
- WRP 509. PRACTICUM (1-16).** This course is repeatable for a maximum of 16 credits.
- WRP 510. INTERNSHIP (1-16).**
- WRP 524. SOCIOTECHNOLOGICAL ASPECTS OF WATER RESOURCES (3).** Core curriculum, graduate-level course in the Water Resources Graduate Program focusing on an interdisciplinary approach to water resources research that integrates the human and the technological dimensions of water resource issues. It is comprised of lecture and discussion sessions with guest lectures by visiting seminar speakers.
PREREQS: Graduate student standing.
- WRP 599. SPECIAL TOPICS (1-16).**

WATER RESOURCES SCIENCE

- WRS 501. RESEARCH (1-16).**
- WRS 503. THESIS (1-16).**
- WRS 505. READING AND CONFERENCE (1-16).**
- WRS 506. PROJECTS (1-16).**
- WRS 507. SEMINAR (1-16).**
- WRS 508. WORKSHOP (1-16).**
- WRS 510. INTERNSHIP (1-16).**
- WRS 599. SPECIAL TOPICS (1-16).**
- WRS 601. RESEARCH (1-16).**
- WRS 603. THESIS (1-16).**
- WRS 605. READING AND CONFERENCE (1-16).**
- WRS 606. PROJECTS (1-16).**
- WRS 607. SEMINAR (1-16).**
- WRS 608. WORKSHOP (1-16).**
- WRS 610. INTERNSHIP (1-16).**
- WRS 699. SPECIAL TOPICS (1-16).**