ENVIRONMENTAL SCIENCES GRADUATE PROGRAM
AREA OF CONCENTRATION IN WATER RESOURCES

PURPOSE

The Area of Concentration in Water Resources is designed for students who have a strong natural science, policy, or management background and want to develop an understanding of water resources in relation to environmental issues. Water Resources is the study of spatial and temporal variations and movement of water within and between earth systems and the physical, chemical, biological, and social processes that affect and accompany the movement of water. Within the Water Resources track, students may choose to focus on integrated aspects of aquatic, terrestrial, atmospheric, marine and social systems.

PROGRAM OF STUDY

The Water Resources track includes courses in 7 categories: the ES Core courses, Methods and Numerical Skills courses, Basic Environmental Systems courses, Basic Human Systems courses, Science Focal Area courses, Elective courses and Thesis. Total credits required are a minimum of 45 Cr. for the M.S. and 108 Cr. for the Ph.D. degree. Typical Programs of Study will include minimum credits as follow:

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>M.S. &amp; M.A. Degrees</th>
<th>Ph. D. Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES Core Courses</td>
<td>9-12 Cr</td>
<td>10-12 Cr</td>
</tr>
<tr>
<td>Methods and Numerical Skills</td>
<td>6 Cr</td>
<td>9 Cr</td>
</tr>
<tr>
<td>Basic Environmental Systems</td>
<td>6 Cr</td>
<td>6 Cr</td>
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<tr>
<td>Basic Human Systems</td>
<td>6 Cr</td>
<td>6 Cr</td>
</tr>
<tr>
<td>Focal Area Courses</td>
<td>9 Cr</td>
<td>15 Cr</td>
</tr>
<tr>
<td>Electives</td>
<td>0 Cr</td>
<td>0-14 Cr</td>
</tr>
<tr>
<td>Thesis</td>
<td>9 Cr</td>
<td>45-59 Cr</td>
</tr>
<tr>
<td>Total</td>
<td>45 Cr</td>
<td>108 Cr</td>
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CORE COURSES

9-12 Cr. for the M.S and M.A. degree (required are ENSC 515, 520, 508 and one class from the approved list of core courses- below) and 10-12 Cr. for the Ph. D. degree. (required are ENSC 515, 520, 508 and classes from the approved list of core courses- below). These courses include Environmental Perspectives, Environmental Analysis, Environmental Profiles, and the Joint-Campus Workshop in Environmental Science, Studies, and Policy.

Approved Core Course List:
- ANTH 581 Natural Resources and Community Values
- ANTH 582 World Food and the Cultural Implications of International Development
- BI 570 Community Structure and Analysis
- BI 670 Community Structure and Analysis
- CE 513 GIS in Water Resources
- Comm 540 Theories of Conflict and Conflict Management
- EC 539 Public Policy Analysis
FOR 561 Forest Policy Analysis
FS520 Posing Researchable Questions
FS521 Natural Resource Research Plan
FS565 Forest Ecosystem Management
FS646 Ecosystem Analysis and Evaluation
FW515 Model Selection and Inference
GEO 520 Geography of Resource Use
H524 Health Data Analysis
H525 Intro Epidemiology
H526 Epidemiological Methods
H549 Health Risk Communication
H575 Evaluation
H576 Proposal Writing
HIST 569 History of the Pacific Northwest
LA 607 Experimental Seminar in Biocomplexity and Alternative Futures
MRM515 Coastal Resources Management
PS 574 Bureaucratic Politics and Policy
PS 575 Politics of Environmental Problems
PS 576 Science and Politics
SED 580 Research and Evaluation
SOC 581 Society and Natural Resources
Z582 Molecular Methods in Ecology and Evolution

METHODS AND NUMERICAL SKILLS

These courses are to ensure that students have sufficient skills in research methods including mathematics, statistics, and computer science.

CS 540 Database Management Systems
CS 515 Algorithms and Data Structures
GEO 541 Spatial Variation in Ecology and Earth Science
GEO 565 Geographic Information Systems
MTH 581 Mathematical Methods for Engineers and Scientists
MTH 582 Mathematical Methods for Engineers and Scientists
MTH 583 Mathematical Methods for Engineers and Scientists
ST 511 Methods of Data Analysis
ST 512 Methods of Data Analysis
ST 513 Methods of Data Analysis
ST 515 Design and Analysis of Planned Experiments
ST 522 Introduction to Mathematical Statistics
ST 531 Sampling Methods
ST 571 Environmental Sampling

BASIC ENVIRONMENTAL SYSTEMS

Basic Earth System courses are intended to develop basic knowledge of hydrologic concepts and elements of the hydrologic cycle.

ATS 520 Principles of Atmospheric Science
BEE 512 Physical Hydrology (cross listed as CE 512)
BEE 514 Groundwater Hydraulics (CE, GEO)
CE 556 Environmental Assessment
CSS 535 Soil Ecosystem Properties and Processes
FE 530 Watershed Processes
GEO 531 Applied Climatology
**BASIC HUMAN SYSTEMS**

Basic Human Systems courses are intended to develop basic knowledge of social and political concepts relating to water resources.

- AREC 553 Public Land and Resource Law
- ANTH 581 Natural Resources and Community Values
- FOR 562 Natural Resource Policy and Law
- GEO 522 Ecological Knowledge and Environmental Problems
- GEO 525 Water Resources Management in the United States
- HORT 590 Systems Thinking and Practice (H 590, BUS 565)
- H 511 Environmental Health Policy and Regulations
- SOC 580 Environmental Sociology

**FOCAL AREA COURSES**

Focal area courses are intended to develop depth of student understanding in water resources and related disciplines. The courses below are examples of 3 possible areas of focus that fall within water resources. The program of study is intended to be flexible to accommodate other areas of study, so that students may tailor their program to match their specific area of interest. Other examples of possible focal areas include Riparian Restoration, International Water Resources, Watershed Analysis, Remote Sensing Hydrology and Vegetation-Atmosphere Interactions.

**Hydrology**
- ATS 564 Interactions of Vegetation and the Atmosphere (FS)
- BOT 634 Plant-water Relations
- BEE 540 Field and Laboratory Techniques in Subsurface Hydrology (CE)
- BEE 542 Vadose Zone Transport
- BEE 525 Stochastic Hydrology (CE)
- BEE 544 Hydraulics of Open Channels
- BEE 549 Regional Hydrologic Modeling
- CE 543 Applied Hydrology CE 518 Groundwater Modeling (BRE)
- CE 545 Sediment Transport
- FE 532 Forest Hydrology
- FW 580 Stream Ecology
- GEO 583 Geomorphology of Mountain Streams
- GEO 691 Mass and Heat Transport in the Environment

**Water Quality and Land Use**
- CE 548 Water Quality Dynamics
- CSS 568 Soil Landscape Analysis
- CSS 585 Environmental Applications of Soil Science
- BEE 548 Nonpoint Source Pollution Assessment and Control
- BEE 571 Biosystems Modeling Techniques
- ENVE 531 Transport/Fate of Organic Chemicals in Environmental Systems
- ENVE 532 Aqueous Environmental Chemistry
- ENVE 541 Microbial Processes in Environmental Systems
- FE 535 Water Quality and Forest Land Use
- FE 630 Watershed Analysis
- FW 579 Wetlands and Riparian Ecology
- FW 580 Stream Ecology
- H 543 Environmental Sampling and Analysis
- RNG 555 Riparian Ecology and Management
Policy and Management
AREC 550 Environmental Economics
AREC 534 Environmental and Resource Economics (ECON)
AREC 551 Natural Resource Economics
FOR 563 Environmental Policy and Law Interactions
GEO 520 Advanced Topics in Water Resources Management
GEO 524 Water Resources Geography
GEO 529 Topics in Resource Geography
GEO 553 Resource Evaluation Methods / EIS
H 541 Environmental Health
MRM 515 Coastal Resources Management
RNG 555 Riparian Ecology and Management
SOC 556 Science and Technology in Social Context
SOC 581 Society and Natural Resources
SOC 585 Consensus and Natural Resources (ANS/FW/HORT/PS)
STC 520 Foundations of Scientific and Technical Communication (WR)
STC 562 Science Writing (WR)

ELECTIVE COURSES

0 Credits for M.S. and M.A. degrees and 0-14 Credit for Ph.D. degree. Students will work with their graduate advisor and committee to select elective courses to develop necessary background and to add depth to the student's Program of Study.

THESIS:

The thesis requirement includes 9 Cr for a M.S. and M.A. degree and 45-59 Cr for a Ph. D. degree.