Twin Cities Campus

Environmental Sciences, Policy and Management B.S.

College of Food, Agri & Natural Resource Sciences

College of Food, Agricultural and Natural Resource Sciences

- Program Type: Baccalaureate
- Requirements for this program are current for Summer 2013
- Required credits to graduate with this degree: 120
- Required credits within the major: 46
- This program requires summer terms.
- Degree: Bachelor of Science

The environmental sciences, policy and management (ESPM) major is designed to address the needs posed by the complexity of environmental and renewable resource issues that are faced on a state, national, and global level. This interdisciplinary, environmental major prepares graduates to solve environmental problems from an integrated knowledge base.

The mission of the ESPM major is to

* improve the basis for environmental decision-making by integrating physical, biological, and social sciences with policy analysis and management;

* educate the next generation of environmental professionals and leaders;

* foster innovative approaches for the education of environmental professionals;

* facilitate science/social science/policy linkages within and beyond the University.

Students complete a set of common "integrated core" courses that focus on integrated problem solving using environmental sciences, policy, ethics, management models, and communication theory. Students also incorporate classroom and fieldwork.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Admission Requirements

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

Program Requirements

All students complete Required Courses below and choose one of the following ESPM tracks: conservation and resource management (CRM); corporate environmental management (CEM); environmental education and communication (EEC); policy, planning, law and society (PPLS); and environmental science (ES).

Students are strongly encouraged to have an international experience before graduation. Courses completed during an international experience (study, work, volunteer, research) can meet program requirements, liberal education requirements, and/or electives. Discussion with an adviser prior to commencing an international experience is required to plan how courses meet requirements in the ESPM major.

All major requirements must be taken A-F (unless only offered S-N), and students must earn a grade of at least C-.

Communication Skills

COMM 1101 - Introduction to Public Speaking [CIV] (3.0 cr)
or AECM 2421W - Professional and Oral Communication for Agriculture, Food & the Environment [WI] (3.0 cr)

Biological Sciences

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BIOL 1001 - Introductory Biology: Evolutionary and Ecological Perspectives [BIOL] (4.0 cr)
or BIOL 1009 - General Biology [BIOL] (4.0 cr)

Integrated ESPM Core
ESPM 1011 - Issues in the Environment [ENV] (3.0 cr)
ESPM 2021 - Environmental Sciences: Integrated Problem Solving (3.0 cr)
ESPM 3000 - Seminar on Current Issues for ESPM (1.0 cr)
ESPM 1001 - Freshmen Orientation to Environmental Sciences, Policy, and Management (1.0 cr)
or ESPM 1002 - Transfer Orientation Seminar (1.0 cr)
ESPM 4021W - Problem Solving: Environmental Review [WI] (4.0 cr)
or ESPM 4041W - Problem Solving for Environmental Change [WI] (4.0 cr)

Program Sub-plans
Students are required to complete one of the following sub-plans.

Corporate Environmental Management
The CEM track provides graduates with the fundamental skills to systematically determine the environmental burdens associated with a firm's products or manufacturing processes and to identify opportunities that generate value from environmental risk reduction, regulatory compliance programs, and other alternatives for improving environmental performance. The CEM track prepares students for positions in growing environmental, health, and safety organizations housed within private enterprises, consultancies, and governmental institutions, as well as for graduate study in business, public policy, environmental sciences, and industrial ecology.

Student experiences within this track focus on analytical tools; the business, legal, regulatory, and ethical framework in which industrial firms operate; physical, chemical, and biological mechanisms associated with industrial emissions; techniques used to reduce the environmental impacts of industrial activity; and effective communication.

Social Sciences
ESPM 3261 - Economics and Natural Resources Management [SOCS, ENV] (4.0 cr)
or APEC 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
or ECON 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
ESPM 3241W - Natural Resource and Environmental Policy [SOCS, CIV, WI] (3.0 cr)
or ESPM 3271 - Environmental Policy, Law, and Human Behavior [CIV, SOCS] (3.0 cr)
Prerequisite CEM Courses
ACCT 2051 - Introduction to Financial Reporting (4.0 cr)
MATH 1271 - Calculus I [MATH] (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
MGMT 3001 - Fundamentals of Management (3.0 cr)
PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
CEM Track Required Courses
CEGE 3501 - Introduction to Environmental Engineering [ENV] (3.0 cr)
ESPM 3602 - Regulations and Corporate Environmental Management (3.0 cr)
ESPM 3603 - Environmental Life Cycle Analysis (3.0 cr)
ESPM 3604 - Environmental Management Systems and Strategy (3.0 cr)
ESPM 3606W *{Inactive}*[WI] (3.0 cr)
ESPM 5019 *{Inactive}*(2.0 cr)
ESPM 4096 *{Inactive}*(1.0 cr)
or ESPM 3111 - Hydrology and Water Quality Field Methods (3.0 cr)
or Appropriate study abroad
or FNRM 2101 - Identifying Forest Plants (1.0 cr)
with FNRM 2102 - Northern Forests Field Ecology (2.0 cr)
with FNRM 2104 - Measuring Forest Resources (1.0 cr)
Track Contract Courses
Take 12 or more credit(s) from the following:
•ESPM 3202W - Environmental Conflict Management, Leadership, and Planning [WI] (3.0 cr)
•ESPM 3605 - Recycling: Extending Raw Materials [TS] (3.0 cr)
•ESPM 3607 - Natural Resources Consumption and Sustainability [GP] (3.0 cr)
•ESPM 3656 *{Inactive}*(3.0 cr)
•ESPM 4216 - Contaminant Hydrology (3.0 cr)

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•ESPM 4601 - Environmental Pollution (3.0 cr)
•ESPM 4607 - Industrial Biotechnology and the Environment (3.0 cr)
•BBE 4608 - Environmental and Industrial Microbiology (3.0 cr)
•ESPM 4609 *{Inactive}*[CIV] (3.0 cr)
•AFEE 3361 *{Inactive}*[GP] (3.0 cr)
•APEC 3611W - Environmental and Natural Resource Economics [ENV, WI] (3.0 cr)
•BBE 2201 - Renewable Energy and the Environment [TS] (3.0 cr)
•BBE 3023 - Ecological Engineering Principles (3.0 cr)
•BBE 3033 - Material and Energy Balances in Biological Systems (3.0 cr)
•SSM 4504W - Sustainable Products Systems Management [WI] (3.0 cr)
•BBE 4535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
•BBE 4744 - Engineering Principles for Biological Scientists (4.0 cr)
•ENT 5121 - Applied Experimental Design (4.0 cr)

Conservation and Resource Management

Students in the CRM track are involved in what Thoreau suggested was "environmental wisdom," or the ability to make effective decisions about the environment by synthesizing natural and human created facts and information. Students integrate this understanding with diverse economic and social insight to make effective decisions for the environment and society.

This track prepares students for technical support, operational, and managerial positions in diverse aspects of resource conservation and management with local, state, and federal agencies and the private sector. This track also prepares students for graduate study in a wide range of areas.

Students solve problems in field settings and communicate their understanding, synthesis, and decision-making to diverse audiences. They gain experience in the actual implementation of decisions. Students may also develop special skills through electives (e.g., geographic information systems, geospatial analysis).

Social Sciences
ESPM 3261 - Economics and Natural Resources Management [SOCS, ENV] (4.0 cr)
or APEC 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
or ECON 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
ESPM 3241W - Natural Resource and Environmental Policy [SOCS, CIV, WI] (3.0 cr)
or ESPM 3271 - Environmental Policy, Law, and Human Behavior [CIV, SOCS] (3.0 cr)
CRM Core Courses
MATH 1142 - Short Calculus [MATH] (4.0 cr)
or MATH 1271 - Calculus I [MATH] (4.0 cr)
ESPM 3012 - Statistical Methods for Environmental Scientists and Managers [MATH] (4.0 cr)
or STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
PMB 2022 - General Botany (3.0 cr)
or BIOL 2012 *{Inactive}*(4.0 cr)
or ESPM 3108 - Ecology of Managed Systems [ENV] (3.0 cr)
or ESPM 3101 *{Inactive}*(3.0 cr)
or ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
or FNRM 1101 - Dendrology: Identifying Forest Trees and Shrubs (3.0 cr)
or FNRM 3104 - Forest Ecology (4.0 cr)
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
or BIOC 2011 - Biochemistry for the Agricultural and Health Sciences (3.0 cr)
CHEM 1015 - Introductory Chemistry: Lecture [PHYS] (3.0 cr)
CHEM 1017 - Introductory Chemistry: Laboratory [PHYS] (1.0 cr)
or BIOC 2011 - Biochemistry for the Agricultural and Health Sciences (3.0 cr)
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
SOIL 1125 *{Inactive}*[ENV] (4.0 cr)
or SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)
Internship
Requires approval and supervision by faculty adviser from track.
ESPM 4096 *{Inactive}*(1.0 cr)
CRM Contract Courses
Courses taken to meet other requirements cannot be double counted here, nor can courses count for multiple groups. Course selections from contract area must be made through a faculty adviser. A contract is required.
Take 36 or more credit(s) including 4 or more sub-requirements(s) from the following:
Conservation and Management
Take 10 or more credit(s) from the following:

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- ESPM 3101 *{Inactive}*(3.0 cr)
- ESPM 3108 - Ecology of Managed Systems [ENV] (3.0 cr)
- ESPM 3221 - Soil Conservation and Land-Use Management (3.0 cr)
- ESPM 3575 - Wetlands (3.0 cr)
- ESPM 3602 - Regulations and Corporate Environmental Management (3.0 cr)
- ESPM 3603 - Environmental Life Cycle Analysis (3.0 cr)
- ESPM 3607 - Natural Resources Consumption and Sustainability [GP] (3.0 cr)
- ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
- ESPM 3656 *{Inactive}*(3.0 cr)
- ESPM 4061W - Water Quality and Natural Resources [ENV, WI] (3.0 cr)
- ESPM 4216 - Contaminant Hydrology (3.0 cr)
- ESPM 4601 - Environmental Pollution (3.0 cr)
- BBE 4608 - Environmental and Industrial Microbiology (3.0 cr)
- ESPM 4609 *{Inactive}*[CIV] (3.0 cr)
- SSM 4504W - Sustainable Products Systems Management [WI] (3.0 cr)
- BBE 4535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
- EEB 3603 - Science, Protection, and Management of Aquatic Environments (3.0 cr)
- ENT 3925 *{Inactive}*(3.0 cr)
- ENT 4251 - Forest and Shade Tree Entomology (3.0 cr)
- FNRM 3104 - Forest Ecology (4.0 cr)
- FNRM 3114 - Hydrology and Watershed Management (3.0 cr)
- FNRM 3411 - Managing Forest Ecosystems: Silviculture (3.0 cr)
- FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
- FW 4102 - Principles of Conservation Biology [ENV] (3.0 cr)
- FW 4103 - Principles of Wildlife Management (3.0 cr)
- FW 5604W *{Inactive}*[WI] (3.0 cr)
- HORT 5071 - Ecological Restoration (4.0 cr)
- SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
- SOIL 5555 - Wetland Soils (3.0 cr)

- Minimum of 7 credits which must include one course in the sub-requirement list.

  Take 1 or more course(s) totaling 7 or more credit(s) including exactly 1 sub-requirements(s) from the following:
  - ESPM 3031 - Applied Global Positioning Systems for Geographic Information Systems (3.0 cr)
  - ESPM 3211 - Survey, Measurement, and Modeling for Environmental Analysis (3.0 cr)
  - ESPM 4021W - Problem Solving: Environmental Review [WI] (4.0 cr)
  - ESPM 4295W - GIS in Environmental Science and Management [WI] (4.0 cr)
  - FNRM 3218 - Measuring and Modeling Forests (3.0 cr)
  - FNRM 3262 - Remote Sensing and Geospatial Analysis of Natural Resources and Environment (3.0 cr)
  - FNRM 5462 - Advanced Remote Sensing and Geospatial Analysis (3.0 cr)
  - FW 5051 - Analysis of Populations (4.0 cr)
  - GIS 5571 - ArcGIS I (3.0 cr)
  - Must register for one of these two courses.
    - FNRM 3131 - Geographical Information Systems (GIS) for Natural Resources [TS] (4.0 cr)

    or GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
- Take 1 or more course(s) totaling 2 - 3 credit(s) from the following:
  - ESPM 3031 - Applied Global Positioning Systems for Geographic Information Systems (3.0 cr)
  - ESPM 3111 - Hydrology and Water Quality Field Methods (3.0 cr)
  - PMB 4321 - Minnesota Flora (3.0 cr)
  - SOIL 3993 - Directed Study (1.0 - 4.0 cr)
  - SOIL 4511 - Field Study of Soils (2.0 cr)
  - FNRM 2101 - Identifying Forest Plants (1.0 cr)

    with FNRM 2102 - Northern Forests Field Ecology (2.0 cr)

    with FNRM 2104 - Measuring Forest Resources (1.0 cr)
- Take 3 or more credit(s) from the following:
  - ESPM 3202W - Environmental Conflict Management, Leadership, and Planning [WI] (3.0 cr)
  - ESPM 3241W - Natural Resource and Environmental Policy [SOCS, CIV, WI] (3.0 cr)
  - ESPM 3271 - Environmental Policy, Law, and Human Behavior [CIV, SOCS] (3.0 cr)
  - ESPM 3602 - Regulations and Corporate Environmental Management (3.0 cr)
  - ESPM 3604 - Environmental Management Systems and Strategy (3.0 cr)
  - ESPM 4242 - Methods for Environmental and Natural Resource Policy Analysis (3.0 cr)

Environmental Education & Communication

Students in the EEC track gain a solid base of knowledge in the environmental sciences, environmental ethics, and the social context of environmental issues, and they develop a practical set of skills for teaching effectively in informal settings and for communicating clearly in written, oral, and electronic forms. This track prepares students to work at government agencies, nature centers, parks, non-governmental organizations, and similar institutions, and is appropriate for students who wish to gain a broad understanding of environmental issues and the choices humans can make to mitigate unwanted impacts of human behavior on the environment.

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Students may specialize in a content area through a minor, study abroad experience in ESPM topics, and/or a student designed content area. Students are encouraged to make choices that strengthen their expertise in an area and/or provide comparative understanding from another culture or discipline.

Courses listed in the track but not taken are good possibilities for use in a content area, as are courses listed below. ESPM students should see their adviser for a list of minors.

Mathematical Thinking
STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
or SOC 3811 - Social Statistics [MATH] (4.0 cr)
or ESPM 3012 Statistical Methods. Take only if your CLE mathematical thinking requirement is satisfied by another course.
Physical Science
CHEM 1015 - Introductory Chemistry: Lecture [PHYS] (3.0 cr)
CHEM 1017 - Introductory Chemistry: Laboratory [PHYS] (1.0 cr)
Social Sciences
ESPM 3261 - Economics and Natural Resources Management [SOCS, ENV] (4.0 cr)
or APEC 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
or ECON 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
ESPM 3241W - Natural Resource and Environmental Policy [SOCS, CIV, WI] (3.0 cr)
or ESPM 3271 - Environmental Policy, Law, and Human Behavior [CIV, SOCS] (3.0 cr)
Education and Communication
ESPM 2401 *{Inactive}*(3.0 cr)
COMM 3441 - Introduction to Organizational Communication (3.0 cr)
or COMM 3451W - Intercultural Communication: Theory and Practice [WI] (3.0 cr)
or ENGL 3501 - Public Discourse: Coming to Terms with the Environment [LITR, ENV] (3.0 cr)
or WRIT 3152W - Writing on Issues of Science and Technology [WI] (3.0 cr)
or WRIT 3221W - Communication Modes and Methods [WI] (3.0 cr)
or WRIT 3701W - Rhetorical Theory for Writing Studies [WI] (3.0 cr)
or WRIT 5664 - Science, Medical, and Health Writing (3.0 cr)
ESPM 4811 - Environmental Interpretation (3.0 cr)
or CI 5534 *{Inactive}*(3.0 cr)
or CI 5537 *{Inactive}*(3.0 cr)
or CI 5747 *{Inactive}*(3.0 cr)
or REC 4301 *{Inactive}*(4.0 cr)
or REC 4311 *{Inactive}*(3.0 cr)
EPSY 5243 - Principles and Methods of Evaluation (3.0 cr)
or OLPD 5501 - Principles and Methods of Evaluation (3.0 cr)
or REC 3281 *{Inactive}*(4.0 cr)
or FNRM 5259 - Visitor Behavior Analysis (3.0 cr)
Human Dimensions
ESPM 3011W - Ethics in Natural Resources [CIV, WI] (3.0 cr)
or PHIL 3301 - Environmental Ethics [ENV] (4.0 cr)
Take 2 or more course(s) from the following:
•ESPM 3607 - Natural Resources Consumption and Sustainability [GP] (3.0 cr)
•ESPM 3202W - Environmental Conflict Management, Leadership, and Planning [WI] (3.0 cr)
•ESPM 3245 - Sustainable Land Use Planning and Policy [ENV] (3.0 cr)
•GEOG 3371W - Cities, Citizens, and Communities [DSJ, WI] (3.0 cr)
•GEOG 3376 - Political Ecology [ENV] (3.0 cr)
•HSCI 3244 - Nature's History: Science, Humans, and the Environment [HIS, ENV] (3.0 cr)
•SOC 3451W - Cities & Social Change [WI] (3.0 cr)
•SOC 4311 - Power, Justice & the Environment [DSJ] (3.0 cr)
•WRIT 3315 - Writing on Issues of Land and the Environment [AH, DSJ] (3.0 cr)
•CSCL 3322 - Visions of Nature: The Natural World and Political Thought [ENV] (3.0 cr)
Natural Sciences
Ecology
BIOL 3407 *{Inactive}*(3.0 cr)
or BIOL 3408W *{Inactive}*[WI] (3.0 cr)
or EEB 3001 - Ecology and Society [ENV] (3.0 cr)
or FNRM 3104 - Forest Ecology (4.0 cr)
or FW 2003 - Introduction to Marine Biology (3.0 cr)
Physical Environment
ESPM 4061W - Water Quality and Natural Resources [ENV, WI] (3.0 cr)
or BBE 2201 - Renewable Energy and the Environment [TS] (3.0 cr)
or EEB 3603 - Science, Protection, and Management of Aquatic Environments (3.0 cr)
or EEB 5601 - Limnology (3.0 cr)

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or FNRM 3114 - Hydrology and Watershed Management (3.0 cr)
or ESCI 1001 - Earth and Its Environments [PHYS, ENV] (4.0 cr)
or PHYS 1001W - Energy and the Environment [PHYS, ENV, WI] (4.0 cr)
or SOIL 1125 *{Inactive}*[ENV] (4.0 cr)

Organismal Biology

Take 3 or more course(s) including 2 or more sub-requirements(s) from the following:

Plant

Take 1 or more course(s) from the following:

- PMB 2022 - General Botany (3.0 cr)
- FNRM 1101 - Dendrology: Identifying Forest Trees and Shrubs (3.0 cr)
- PMB 4321 - Minnesota Flora (3.0 cr)
- PMB 4511 - Flowering Plant Diversity (3.0 cr)

Animal

Take 1 or more course(s) from the following:

- BIOL 2012 *{Inactive}*(4.0 cr)
- EEB 4129 - Mammalogy (4.0 cr)
- EEB 4134 - Introduction to Ornithology (4.0 cr)
- ENT 1005 - Insect Biology with Lab [BIOL] (4.0 cr)
- ENT 4361 - Aquatic Insects (3.0 cr)
- FW 4101 - Herpetology (4.0 cr)
- FW 4136 - Ichthyology (4.0 cr)

Complex Human and Natural Systems

ESPM 3108 - Ecology of Managed Systems [ENV] (3.0 cr)
or EEB 5146 *{Inactive}*(3.0 cr)
or FNRM 4501 - Urban Forest Management: Managing Greenspaces for People (3.0 cr)
or FNRM 5146 *{Inactive}*(3.0 cr)
or FW 2001W - Introduction to Fisheries, Wildlife, and Conservation Biology [ENV, WI] (3.0 cr)
or FW 4102 - Principles of Conservation Biology [ENV] (3.0 cr)
or HORT 5071 - Ecological Restoration (4.0 cr)
or LA 3501 - Environmental Design and Its Biological and Physical Context [ENV] (3.0 cr)
or URBS 3751 - Understanding the Urban Environment [ENV] (3.0 cr)

Field Experience

ESPM 4096 *{Inactive}*(1.0 cr)
or FNRM 2101 - Identifying Forest Plants (1.0 cr)
with FNRM 2102 - Northern Forests Field Ecology (2.0 cr)
with FNRM 2104 - Measuring Forest Resources (1.0 cr)

Environmental Science

The ES track focuses on the application and integration of basic and applied sciences to solve complex environmental problems. Students can earn professional licenses and certification in several areas and will be qualified to work as soil scientists, hydrologists, water quality and wetland ecology scientists, environmental remediation scientists, climatologists, and atmospheric scientists. Graduates find jobs with environmental regulatory agencies, private consulting firms, and nonprofit organizations. This track provides a diverse basic and applied science background that also prepares students for scientific research through advanced graduate studies.

Students in this track use an understanding of biology, chemistry, physics, and mathematics to develop a broad knowledge base in soil, hydrologic, atmospheric, and biological sciences. Students study the interaction between science and the functioning of urban, forested, and agricultural lands, as well as hydrologic, atmospheric, soil, and wetland resources.

Social Sciences

ESPM 3261 - Economics and Natural Resources Management [SOCS, ENV] (4.0 cr)
or APEC 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
or ECON 1101 - Principles of Microeconomics [SOCS, GP] (4.0 cr)
ESPM 3241W - Natural Resource and Environmental Policy [SOCS, CIV, WI] (3.0 cr)
or ESPM 3271 - Environmental Policy, Law, and Human Behavior [CIV, SOCS] (3.0 cr)

Additional Basic Science and Math Courses

ESPM 3131 - Environmental Physics (3.0 cr)
PHYS 1101W - Introductory College Physics I [PHYS, WI] (4.0 cr)
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
MATH 1142 - Short Calculus [MATH] (4.0 cr)
or MATH 1271 - Calculus I [MATH] (4.0 cr)
BIOC 2011 - Biochemistry for the Agricultural and Health Sciences (3.0 cr)
or BIOL 2012 *{Inactive}*(4.0 cr)
or PMB 2022 - General Botany (3.0 cr)

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ESPM 3012 - Statistical Methods for Environmental Scientists and Managers [MATH] (4.0 cr)
or STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)

Applied Sciences and Technology Courses

ESPM 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
ESPM 4096 *{Inactive}*(1.0 cr)
FNRM 3114 - Hydrology and Watershed Management (3.0 cr)
ESCI 1001 - Earth and Its Environments [PHYS, ENV] (4.0 cr)
SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)
FNRM 3131 - Geographical Information Systems (GIS) for Natural Resources [TS] (4.0 cr)
or GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
ESPM 3108 - Ecology of Managed Systems [ENV] (3.0 cr)
or BIOL 3407 *{Inactive}*(3.0 cr)
or BIOL 3408W *{Inactive}*[WI] (3.0 cr)
or FNRM 3104 - Forest Ecology (4.0 cr)
Take 2 or more credit(s) from the following:
- ESPM 3031 - Applied Global Positioning Systems for Geographic Information Systems (3.0 cr)
- ESPM 3111 - Hydrology and Water Quality Field Methods (3.0 cr)
- PMB 4321 - Minnesota Flora (3.0 cr)
- SOIL 3521 - Soil Judging (1.0 cr)
- SOIL 3993 - Directed Study (1.0 - 4.0 cr)
- SOIL 4511 - Field Study of Soils (2.0 cr)
- FNRM 2101 - Identifying Forest Plants (1.0 cr)
  with FNRM 2102 - Northern Forests Field Ecology (2.0 cr)
  with FNRM 2104 - Measuring Forest Resources (1.0 cr)

ES Contract Courses

Students must develop a contract with their faculty adviser to create an area of specialization. All track electives must be upper division. Depending on the selected courses, students have the opportunity to become certified or licensed as a professional soil scientist, hydrologist, wetland delineator, erosion control specialist, or site evaluator for individual sewage treatment system. Below are sample courses that could be taken to complete a contract; it is not a comprehensive list.

Take 15 - 21 credit(s) from the following:
Take 0 - 21 credit(s) from the following:
- ESPM 3221 - Soil Conservation and Land-Use Management (3.0 cr)
- ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
- ESCI 4703 - Glacial Geology (4.0 cr)
- SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
- SOIL 3521 - Soil Judging (1.0 cr)
- SOIL 4511 - Field Study of Soils (2.0 cr)
- LAAS 5515 - Soil Formation: Earth Surface Processes and Biogeochemistry (3.0 cr)
- SOIL 5555 - Wetland Soils (3.0 cr)
- ESPM 3656 *{Inactive}*(3.0 cr)

•Take 0 - 21 credit(s) from the following:
- ESPM 4061W - Water Quality and Natural Resources [ENV, WI] (3.0 cr)
- ESPM 4216 - Contaminant Hydrology (3.0 cr)
- EEB 3603 - Science, Protection, and Management of Aquatic Environments (3.0 cr)
- EEB 5605 *{Inactive}*(2.0 cr)
- FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
- FW 5604W *{Inactive}*[WI] (3.0 cr)
- PUBH 6190 - Environmental Chemistry (3.0 cr)
- WRS 5101 - Water Policy (3.0 cr)

•Take 0 - 21 credit(s) from the following:
- ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
- ESPM 5402 - Biometeorology (3.0 cr)
- AGRO 3203W - Environment, Global Food Production, and the Citizen [GP, WI] (3.0 cr)
- AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
- AGRO 4605 - Strategies for Agricultural Production and Management (3.0 cr)
- AGRO 5321 - Ecology of Agricultural Systems (3.0 cr)
- PMB 3002 - Plant Biology: Function (2.0 cr)
- PMB 3005W - Plant Function Laboratory [WI] (2.0 cr)
- PMB 3007W - Plant, Algal, and Fungal Diversity and Adaptation [WI] (4.0 cr)
- EEB 3963 *{Inactive}*(3.0 cr)
- EEB 4609W - Ecosystem Ecology [ENV, WI] (3.0 cr)
- EEB 4611 - Biogeochemical Processes (3.0 cr)
- ENT 4361 - Aquatic Insects (3.0 cr)
- FNRM 3104 - Forest Ecology (4.0 cr)
- FNRM 3203 - Forest Fire and Disturbance Ecology (3.0 cr)
- FNRM 3204 - Landscape Ecology and Management (3.0 cr)

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- FNRM 3411 - Managing Forest Ecosystems: Silviculture (3.0 cr)
- FNRM 5146 *{Inactive}*(3.0 cr)
- FW 3565 *{Inactive}*(2.0 cr)
- HORT 5071 - Ecological Restoration (4.0 cr)
- LA 3204 - Holistic Landscape Ecology and Bioregional Practice (3.0 cr)
- PMB 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)

•Take 0 - 21 credit(s) from the following:
- BIOL 3407 *{Inactive}*(3.0 cr)
  or BIOL 3408W *{Inactive}*[WI] (3.0 cr)

•Take 0 - 21 credit(s) from the following:
- ESPM 3425 - Atmospheric Pollution: From Smog to Climate Change (3.0 cr)
- ESPM 5402 - Biometeorology (3.0 cr)
- ESCI 3002 - Climate Change and Human History [ENV] (3.0 cr)
- GEOG 5423 *{Inactive}*(3.0 cr)
- GEOG 5426 - Climatic Variations (3.0 cr)
- GEOG 5565 *{Inactive}*(3.0 cr)
- ME 5115 *{Inactive}*(4.0 cr)

•Take 0 - 21 credit(s) from the following:
- ESPM 3211 - Survey, Measurement, and Modeling for Environmental Analysis (3.0 cr)
- ESPM 3603 - Environmental Life Cycle Analysis (3.0 cr)
- ESPM 4216 - Contaminant Hydrology (3.0 cr)
- ESPM 4295W - GIS in Environmental Science and Management [WI] (4.0 cr)
- ESPM 4601 - Environmental Pollution (3.0 cr)
- ESPM 5601 *{Inactive}*(3.0 cr)
- CEGE 3501 - Introduction to Environmental Engineering [ENV] (3.0 cr)
- CHEM 2301 - Organic Chemistry I (3.0 cr)
- ENT 5241 *{Inactive}*(3.0 cr)
- FNRM 3218 - Measuring and Modeling Forests (3.0 cr)
- FNRM 3262 - Remote Sensing and Geospatial Analysis of Natural Resources and Environment (3.0 cr)
- FNRM 5462 - Advanced Remote Sensing and Geospatial Analysis (3.0 cr)
- GEOG 3401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
- GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
- GEOG 5563 - Advanced Geographic Information Science (3.0 cr)
- GIS 5571 - ArcGIS I (3.0 cr)
- PUBH 6103 *{Inactive}*(2.0 cr)
- PUBH 6104 *{Inactive}*(2.0 cr)
- PUBH 6105 *{Inactive}*(2.0 cr)
- PUBH 6132 - Air, Water, and Health (2.0 cr)
- PUBH 6171 *{Inactive}*(3.0 cr)
- PUBH 6175 - Environmental Measurements Laboratory (2.0 cr)

Policy, Planning, Law and Society

The PPLS track focuses on developing understanding and problem-solving skills germane to the interaction between human and natural systems. Students will be well prepared for policy development and analysis, strategy development, and decision-making in a range of positions and institutional settings. Example positions include those as a policy analyst, community planner, social researcher, or lawyer in public agencies, with legislative bodies, consulting firms, and conservation organizations. This track also prepares students for graduate study in policy, planning, and law programs.

Students study concepts, issues, and problem solving approaches that address the policy, legal, economic, political, planning and sociological aspects of environment and natural resource management. This study includes ethics and conflict management. The track further emphasizes an interdisciplinary approach for examining problems, such as sustainable land use planning, resource conservation and management, law, and environmental protection at a range of political levels and spatial scales and developing effective and innovative solutions. Students develop skill in integrating knowledge from the physical, biological, and social sciences to develop policy and planning alternatives and appropriate strategies to provide real solutions to complex problems.

Physical Science
- CHEM 1015 - Introductory Chemistry: Lecture [PHYS] (3.0 cr)
- CHEM 1017 - Introductory Chemistry: Laboratory [PHYS] (1.0 cr)

PPLS Core and Contract Courses
- ESPM 3241W - Natural Resource and Environmental Policy [SOCS, CIV, WI] (3.0 cr)
- ESPM 3261 - Economics and Natural Resources Management [SOCS, ENV] (4.0 cr)
- ESPM 3271 - Environmental Policy, Law, and Human Behavior [CIV, SOCS] (3.0 cr)

Policy and Planning
- ESPM 3202W - Environmental Conflict Management, Leadership, and Planning [WI] (3.0 cr)
- ESPM 3245 - Sustainable Land Use Planning and Policy [ENV] (3.0 cr)
- ESPM 4242 - Methods for Environmental and Natural Resource Policy Analysis (3.0 cr)

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ESPM 4256 - Natural Resource Law and the Management of Public Lands and Waters (3.0 cr)
Choice of ESPM 3251 (Natural Resources in Sustainable International Development) or an equivalent study abroad course.
ESPM 3251 - Natural Resources in Sustainable International Development [GP] (3.0 cr)
or Appropriate Study Abroad
Field Session Options
ESPM 4096 *{Inactive}*(1.0 cr)
or **Cloquet Field Session**
FNRM 2101 - Identifying Forest Plants (1.0 cr)
with FNRM 2102 - Northern Forests Field Ecology (2.0 cr)
with FNRM 2104 - Measuring Forest Resources (1.0 cr)

Methods
Choose 6-8 credits from the following.
ESPM 3211 - Survey, Measurement, and Modeling for Environmental Analysis (3.0 cr)
or POL 3085 - Quantitative Analysis in Political Science [MATH] (4.0 cr)
or PSY 3001W - Introduction to Research Methods [WI] (4.0 cr)
or FNRM 5259 - Visitor Behavior Analysis (3.0 cr)
or Take exactly 1 course(s) from the following:
•FNRM 3131 - Geographical Information Systems (GIS) for Natural Resources [TS] (4.0 cr)
•GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
ESPM 3012 - Statistical Methods for Environmental Scientists and Managers [MATH] (4.0 cr)
or STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
or SOC 3811 - Social Statistics [MATH] (4.0 cr)

Ecology and Management
Choose 3 credits from the following.
ESPM 3108 - Ecology of Managed Systems [ENV] (3.0 cr)
or ESPM 3656 *{Inactive}*(3.0 cr)
or ESPM 3575 - Wetlands (3.0 cr)
or FNRM 3104 - Forest Ecology (4.0 cr)
Choose 6-8 credits from the following.
ESPM 3603 - Environmental Life Cycle Analysis (3.0 cr)
or ESPM 3604 - Environmental Management Systems and Strategy (3.0 cr)
or ESPM 4021W - Problem Solving: Environmental Review [WI] (4.0 cr)
or ESPM 4061W - Water Quality and Natural Resources [ENV, WI] (3.0 cr)
or BBE 2201 - Renewable Energy and the Environment [TS] (3.0 cr)
or FNRM 3114 - Hydrology and Watershed Management (3.0 cr)
or FNRM 3411 - Managing Forest Ecosystems: Silviculture (3.0 cr)
or FNRM 5146 *{Inactive}*(3.0 cr)
or FNRM 3101 - Park and Protected Area Tourism (3.0 cr)
or FNRM 4232W - Managing Recreational Lands [WI] (4.0 cr)
or SOIL 1125 *{Inactive}*[ENV] (4.0 cr)
or SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)

PPLS Contract Courses
Students must specialize in a content area to strengthen their expertise, through a minor, appropriate study abroad experience, and/or a student designed area. Courses listed in the track but not taken are good choices for use in a content area, as are courses listed below. PPLS students should see their adviser for a list of appropriate minors. Submit a contract for 12 credits of 3XXX or above credits, completed through prior consultation with your faculty adviser.
Take 12 or more credit(s) from the following:
•ESPM 3xxx
•AGRO 3xxx
•APEC 3xxx
•BBE 3xxx
•COMM 3xxx
•ECON 3xxx
•ENT 3xxx
•FR 3xxx
•FW 3xxx
•GEOG 3xxx
•GLOS 3xxx
•MGMT 3xxx
•POL 3xxx
•RRM 3xxx
•SOIL 3xxx
•WRIT 3xxx
•WRS 3xxx

Honors UHP

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This is an honors sub-plan.

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements, in addition to degree program requirements. For any course required in a degree program, UHP students must register for the honors version if one is offered. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements.

As part of their honors program, CFANS students complete CFAN 3100H; they must submit their project for this faculty-mentored honors experience to the honors committee for approval prior to registration.

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