Learn the science, practices, and techniques to manage forest ecosystems to protect and ensure their sustainable use. Graduates are involved in conservation planning, ecology, forest policy and protection, timber production, resource analysis, and more. This track is accredited by the Society of American Foresters (SAF) and successful completion qualifies a student for the SAF’s Candidate Certified Forester program.

**Communication Skills**
- Freshman Composition
- COMM 1101 Introduction to Public Speaking [CIV] (3 cr, F/S/Sm)
  or AECM 2421W Professional and Oral Communication for Agriculture, Food, and the Environment (3 cr, F/S)

**Physical and Biological Sciences**
- BIOL 1001 Introductory Biology: Evolutionary and Ecological Perspectives [BIOL] (4 cr, F/S)
  or BIOL 1009 General Biology [BIOL] (4 cr, F/S/Sm, prereq high school chemistry)
- PMB 2022 General Botany (3 cr, F/S, prereq one semester of college biology)
- SOIL 2125 Basic Soil Science [PHYS, ENV] (4 cr, F/S, prereq CHEM 1015/1017 or CHEM 1061)

**Mathematical Thinking**
- MATH 1151 Precalculus II [MATH] (3 cr, F/S/Sm, prereq MATH 1031 or 1051 or by placement)
  or MATH 1142 Short Calculus [MATH] (4 cr, F/S/Sm, prereq MATH 1031 or 1051 or by placement)
  or MATH 1271 Calculus I [MATH] (4 cr, F/S/Sm, prereq MATH 1151 or 1155 or by placement)
- ESPM 3012 Statistical Methods for Environmental Scientists and Managers [MATH] (4 cr, S, prereq 2 years high school math)
  or STAT 3011 Introduction to Statistical Analysis [MATH] (4 cr, F/S/Sm)

**Chemistry**
- CHEM 1015 Introductory Chemistry: Lecture (3 cr, F/S/Sm, prereq high school chemistry)
  and CHEM 1017 Introductory Chemistry: Lab (1 cr, F/S/Sm)
  or CHEM 1061 Chemical Principles I [PHYS] (3 cr, F/S/Sm, prereq CHEM 1101 or 1015 or placement)
  and CHEM 1065 Chemical Principles I Lab [PHYS] (1 cr, F/S/Sm)
  or CHEM 1071H Honors Chemistry I [PHYS] (1 cr, F) and CHEM 1075H Honors Chemistry I Lab [PHYS] (1 cr, F)

**Economics and Policy**
- ESPM 3261 Economics and Natural Resources Management [SOCS, ENV] (4 cr, S, prereq MATH 1031, 1051, 1142, 1155, or 1271 or ESPM 3012 or STAT 3011 or SOC 3811)
- ESPM 3241W Natural Resource and Environmental Policy [SOCS, CIV, WI] (3 cr, S)

**Major Professional Courses**
- FNRM 1001 Orientation and Information Systems (1 cr, F)
- FNRM 1101 Dendrology: Identifying Forest Trees and Shrubs (3 cr, F)
- FNRM 3131 Geographic Information Systems (GIS) for Natural Resources [TS] (4 cr, F/S, prereq soph, jr, sr, or UHP fr)
- FNRM 4232W Managing Recreational Lands [WI] (4 cr, S)
Liberal Education Requirements and Writing Intensive

<table>
<thead>
<tr>
<th>Required Credits</th>
<th>FEMC courses that fulfill requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diversified Core</strong></td>
<td></td>
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<tr>
<td>Arts/Humanities [AH]</td>
<td>3</td>
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<tr>
<td>Biological Science [BIOL]</td>
<td>4, must include lab or field experience</td>
</tr>
<tr>
<td>Historical Perspective [HIS]</td>
<td>3</td>
</tr>
<tr>
<td>Literature [LIT]</td>
<td>3</td>
</tr>
<tr>
<td>Mathematical Thinking [MATH]</td>
<td>3</td>
</tr>
<tr>
<td>Physical Science [PHYS]</td>
<td>4, must include lab or field experience</td>
</tr>
<tr>
<td>Social Sciences [SOCS]</td>
<td>3</td>
</tr>
</tbody>
</table>

**Designated Themes**

Four of the following five themes must be satisfied

- Civic Life and Ethics [CIV] | 3 | COMM 1101, ESPM 3241W |
- Diversity and Social Justice in the US [DSJ] | 3 |  |
- The Environment [ENV] | 3 | SOIL 2125, ESPM 3261 |
- Global Perspectives [GP] | 3 |  |
- Technology and Society [TS] | 3 | FNRM 3131 |

**Writing Intensive** [WI]: first year writing requirement and four writing intensive courses (two of which must be taken at the upper division level, one of which must be in your major)

**Forest Ecosystem Management and Conservation (FEMC) Core**

- FNRM 3104 Forest Ecology (4 cr, F, prereq BIOL 1001 or 1009, college chemistry recommended)
- FNRM 3114 Hydrology and Watershed Management (3 cr, F, prereq MATH 1151, BIOL 1001 or 1009, and CHEM 1015/1017 or CHEM 1061/1065)
- FNRM 3218 Measuring and Modeling Forests (3 cr, S, prereq MATH 1151 and ESPM 3012 or STAT 3011)
- FNRM 3262 Remote Sensing of Natural Resources and Environment (3 cr, F)
- FNRM 3411 Managing Forest Ecosystems: Silviculture (3 cr, F, prereq FNRM 3104 or consent of instructor; FEMC track students should take FNRM 5413 concurrently)
- FNRM 3412 Managing Forest Ecosystems: Silviculture Lab (1 cr, F, prereq FNRM major or minor; FNRM-FEMC track students should take FNRM 3411 concurrently or instructor consent)
- FNRM 3431 Timber Harvesting and Road Planning (2 cr, S, prereq FNRM 3411)
- FNRM 3471 Forest Management Planning (3 cr, F)
- ESPM 3202W Environmental Conflict Management, Leadership, and Planning [WI] (3 cr, S)
- PLPA 3003 Diseases of Forest and Shade Trees (3 cr, S)
- or ENT 4251 Forest and Shade Tree Entomology (3 cr, F)
- FW 2001W Introduction to Fisheries, Wildlife, and Conservation Biology [ENV] [WI] (3 cr, F, prereq BIOL 1001 or 1009)
- or FW 4102 Principles of Conservation Biology [ENV] (3 cr, S)
- or FW 4103 Principles of Wildlife Management (3 cr, S, prereq intro biology course, jr or sr)

**Introductory Cloquet Field Session in Assessment and Biology of Forests** at Cloquet Forestry Center, Cloquet, MN

- FNRM 2101 Identifying Forest Plants (1 cr, Summer registration)
- FNRM 2104 Measuring Forest Resources (1 cr, Summer registration)
- FNRM 2102 Northern Forests: Field Ecology (2 cr, Fall registration), prereq BIOL 1001 or 1009)
Advanced Field Session in Assessment and Management of Forest Resources

FNRM 3562 Field Remote Sensing (1 cr, Fall)
The following courses are taught at the Cloquet Forestry Center, Cloquet, MN during Spring Session
FNRM 4511 Field Silviculture (2 cr, Spring, prereq FNRM 3411)
FNRM 4515 Field Resource Survey (1 cr, Spring, prereq FNRM 3218 and 3262)
FNRM 4521 Field Timber Harvesting and Road Planning (2 cr, Spring, prereq FNRM 3411 and 3431)

Experiential Learning

FNRM 4232W Managing Recreational Lands fulfills this requirement
or FNRM 2102 Northern Forests: Field Ecology fulfills this requirement or other course approved by major coordinator

Interdisciplinary Learning

One of the following courses fulfills this requirement:

FW 2001W Introduction to Fisheries, Wildlife, and Conservation Biology [ENV] [WI] (3 cr)
AGRO 3203W Environment, Global Food Production, and the Citizen [GP, WI] (3 cr)
AGRO 3305 Agroecosystems of the World [GP] (3 cr)
ANSC 3203W Environment, Global Food Production, and the Citizen [GP, WI] (3 cr)
APEC 3202 An Introduction to the Food System: Analysis, Management, and Design (3 cr)
CFAN 2333 Insects, Microbes, and Plants [TS] (3 cr)
ESPM 1011 Issues in the Environment [ENV] (3 cr)
ESPM 2021 Environmental Sciences: Integrated Problem Solving (3 cr)
ESPM 3575 Wetlands (3 cr)
ESPM 4021W Problem Solving: Environmental Review [WI] (4 cr)
ESPM 4041W Problem Solving for Environmental Change [WI] (4 cr)
FNRM 4501 Urban Forest Management: Managing Greenspaces for People (3 cr)
FSCN 1102 Food: Safety, Risks, and Technology [CIV] (3 cr)
GCC 3001/5001 Can We Feed the World Without Destroying It? [ENV] (3 cr)
GCC 3007/5007 Toward Conquest of Disease [ENV] (3 cr)
GCC 5008 Policy and Science of Global Environmental Change [ENV] (3 cr)
GCC 3031/5031 The Global Climate Challenge: Creating an Empowered Movement for Change [CIV] (3 cr)
GCC 3013/5013 Making Sense of Climate Change: Science, Art and Agency [CIV] (3 cr)
GCC 3017/5017 World Food Problems: Agronomics, Economics and Hunger [GP] (3 cr)
GCC 3031/5031 The Global Climate Challenge: Creating an Empowered Movement for Change [CIV] (3 cr)
PLPA 2003 Plague, Famine, and Beer: The Impact of Microscopic Organisms on Human Civilization [HIS]
(SSM 4407W Sustainable Manufacturing Principles and Practices [WI] (3 cr)

Electives

At the University, 120 credits are required for graduation. After completing the major requirements, credits from any discipline may be used to reach 120 credits.

Minors and Certificates

Minors and certificates are an excellent way to further focus your studies in a related area of interest. The following are minors and certificates typically of interest to students in natural resources.

Environmental Sciences, Policy and Management (16 cr)
Fisheries and Wildlife (16-18 cr)
Geographic Information Science (16 cr)
Mass Communications-Emphasis in Public Relations (18 cr)
Park and Protected Area Management (18-20 cr)
Sustainable Tourism Certificate (12 cr in addition to FNRM 3101)
Sustainability Studies (15-18 cr)
Urban and Community Forestry (19-21 cr)
Study Abroad
The University encourages students to incorporate international study into their academic programs. In addition to those programs offered at the University level, the College of Food, Agricultural and Natural Resource Sciences also offers international programs specific to many of the majors housed within the college. Visit the Learning Abroad Center or CFANS International Programs Office to learn more about the many study abroad experiences available.

Subject/ Career Options
Students may also use their elective credits to develop additional coursework to further build knowledge and skill for employment. These are not required or equivalent to minors. See your advisor or faculty leader(s) noted for more information and assistance selecting courses. Subject and/or career option areas to consider include:

- Forest Ecology and Silviculture
- Forest Fire and Health
- Forest Operations
- Forest-Wildlife Habitat Management
- Geospatial Analysis

The Forest Ecology and Silviculture Option (Faculty: M. Windmuller-Campione, A. David, P. Bolstad, L. Frelich, R. Montgomery, P. Reich, M. Russell) is for students interested in ecological principals of forest ecosystems and the design of ecosystem management and restoration strategies. Coursework could include FNRM 3203 Forest Fire and Disturbance Ecology, FNRM 3204 Landscape Ecology and Management, FNRM 4511 Field Silviculture, EEB 4609W Ecosystem Ecology, EEB 4068 Plant Physiological Ecology, EEB 4611 Biogeochemical Processes, FNRM 3205/5205 Productivity and Ecology of Forest Soils, or HORT 5071 Ecological Restoration.

The Forest Fire and Health Option (Faculty: A. David, L. Frelich, M. Russell) is for students interested in forest fire and health for careers focused in these areas. Coursework could include FNRM 3203 Forest Fire and Disturbance Ecology, PLPA 3003 Diseases of Forest and Shade Trees, ENT 4251 Forest and Shade Tree Entomology, or the MNDNR issued Wildland Firefighting Course Certificate.

The Forest Operations Option (Faculty: C. Blinn, C. Edgar, H. Hoganson, M. Kilgore) is for students interested in managing forest land for investment returns and supplying forest products to associated markets. Both FNRM 4521 Field Timber Harvesting and Road Planning and BBE 1002 Biorenewable Resources should be taken. In addition, coursework could include ACCT 2050 Introduction to Financial Reporting, ESPM 3607 Natural Resources Consumption and Sustainability, ESPM 3603 Environmental Life Cycle Analysis, ESPM 4242 Natural Resources and Environmental Policy, or Math 1142 Short Calculus or Math 1271 Calculus I.

The Human Dimensions Option (Faculty M. Davenport, M. Dockry, M. Kilgore, F. Fleischman, S. Carlson, K. Nelson, I. Schneider) is for students interested in conflict management, sustainable land use planning, environmental policy and law governing natural resources, and outdoor recreation management. Coursework could include ESPM 2401 Environmental Education/Interpretation, ESPM 3202W Environmental Conflict Management, Leadership, and Planning, ESPM 3245 Sustainable Land Use Policy and Planning, ESPM 3271 Environmental Policy, Law and Human Behavior, ESPM 4256 Natural Resource Law and the Management of Public Lands and Waters, PHIL 3301 Environmental Ethics, SUST 3003 Sustainable People, Sustainable Planet, or FNRM 3206 Park and Protected Area Management Field Studies (prereq Soph or higher, 10-day session in Ely, MN).

The Resource Analysis, Measurements and Modeling Option (Faculty: C. Babcock, C. Edgar, M. Russell, J. Knight, J. Zobel) is for students interested in advancing their skills in measuring, monitoring and analyzing forest and related natural resources and their dynamics. Coursework could include the following three courses MATH 1142 Short Calculus or MATH 1271 Calculus I, FNRM 4515 Field Remote Sensing and Resource Survey, and FNRM 5228 Advanced Assessment and Modeling of Forests. In addition, one course from the following; ESPM 3211 Survey, Measurement and Modeling for environmental analysis, STAT 5302 Applied Regression Analysis (3 cr, F/S), or a credit or non-credit course in computer programming or database management.
The **Forest-Wildlife Habitat Management Option** (*Faculty: M. Windmuller-Campione, M. Russell, R. Montgomery, L. Frelich, J. Zobel*) is for students interested in advanced understanding of forest-wildlife habitat relationships and corresponding habitat management for a career supporting wildlife management. Students should take BIOL 2012 General Zoology, FW 4103 Principles of Wildlife Management, and FW 5603W Habitats and Regulation of Wildlife. Other courses could include FNRM 3203 Forest Fire and Disturbance Ecology, FNRM 3204 Landscape Ecology and Management, EEB 4129 or EEB 4839 Mammalogy, EEB 4134 or EEB 4844 Ornithology.

The **Hydrology Certification (AIH) Option** (*Faculty: D. Karwan*) is for students seeking employment as a certified hydrologist. The requirements are MATH 1271 and 1272 Calculus I and II, PHYS 1101W and 1102 Introductory College Physics I and II or PHYS 1301 and 1302 Physics for Scientists and Engineers. At least 6 additional credits must be taken from the following list: FNRM 5153 Forest and Wetland Hydrology, BBE 5513 Watershed Engineering, CE 4501 Hydrologic Design, CE 3502 Fluid Mechanics, ESPM 3111 Hydrology and Water Quality Field Methods, ESPM 4216 Contaminant Hydrology, and SOIL 5232 Vadose Zone Hydrology.

The **Geospatial Science Option** (*Faculty: P. Bolstad, J. Knight, C. Babcock, J. Zobel*) is for students seeking to emphasize Geographic Information Systems (GIS), remote sensing, Global Positioning System (GPS), and spatial analysis. This option will prepare students for graduate studies in geospatial science programs. Coursework could include ESPM 3031 Applied Global Positioning Systems for GIS, ESPM 4295W GIS in Environmental Science and Management, FNRM 3362/5362 Drones: Data Analysis and Operations, FNRM 3462/5462 Advanced Remote Sensing and Geospatial Analysis, GEOG 3531 Numerical Spatial Analysis, GIS 5555 Basic Spatial Analysis, or GIS 5578 GIS Programming.

The **International Forestry Option** (*Faculty: D. Current, F. Fleischman, R. Montgomery, P. Reich*) is for students interested in forestry and agroforestry in developing regions of the world addressing economic and/or environmental issues. Coursework could include ESPM 3607 Natural Resources Consumption and Sustainability, ESPM 3251 Natural Resources in Sustainable International Development, ESPM 3241W Natural Resources and Environmental Policy, or a study abroad experience.

**Graduate Study Option** (*Faculty: All*) Students interested in graduate school should strengthen their undergraduate core and take prerequisites for classes likely to be needed in graduate school. Students should meet with faculty in their area of interest to develop their coursework. Math, science and basic courses also help students prepare for the Graduate Record Exam (GRE).