Six Major Curricula

CNR offers six major curricula leading to the bachelor of science (B.S.) degree: (1) fisheries and wildlife (with specializations in fisheries, wildlife, and conservation biology); (2) forest products (with specializations in marketing, production management, paper science and engineering, and wood science); (3) forest resources (with tracks in forest management and forest science); (4) natural resources and environmental studies; (5) recreation resource management; and (6) urban forestry. Because the first year of coursework is somewhat similar, students may transfer between curricula at the end of their freshman year with little or no credit loss.

Academic Policies

Adviser—Each student, with adviser assistance, is responsible for learning curricular and graduation requirements and developing a course program and timetable to meet them. Freshmen and first-year transfer students in the forest resources, fisheries and wildlife, natural resources and environmental studies, recreation resource management, and urban forestry curricula are assigned an adviser in the CNR Office for Student Affairs. Forest products students are assigned a faculty adviser within that department.

Credit Load—The typical course load for each quarter is 14 to 18 credits, but may vary according to individual ability and circumstances. A credit requires an average of three hours of work per week, including class, laboratory, and preparation time. To carry more than 21 credits, a student must have at least a B average the previous quarter and permission from the department Student Scholastic Standing Committee.

Repeating Courses—Students may repeat a course even if a passing grade was received. The grade received for the course the second time becomes the permanent grade. The original grade and credits are not included in the student’s cumulative number of completed credits or grade point average (GPA). It is the student’s responsibility to report any repeated courses to the CNR Office for Student Affairs.

Auditing—Students who audit a course pay regular tuition and fees, but do not take examinations or earn grades or credits.

Extra Credit—Students may register for one to three extra credits in some courses with the instructor’s approval. The extra work is mutually agreed upon and conducted independently of class. Contact the CNR Office for Student Affairs for more information.

Independent Study—With the instructor’s approval, students may take regularly offered courses through independent study without attending class. Contact the CNR Office for Student Affairs for more information.

Class Attendance—When students willfully miss class, instructors are under no obligation to help them make up work. However, the following reasons justify absences and makeup requests: (a) illness certified by the Boynton Health Service or another physician; (b) death or serious illness in the immediate family; (c) participation, certified by the Office for Student Affairs (Office of the Registrar—St. Paul, 190 Coffey Hall), in University-approved cocurricular activities; and (d) approval of the absence by the department Student Scholastic Standing Committee, which becomes involved only in emergencies or as an appeal agency.

Class Standing—Students are classified according to the number of credits they have completed: freshmen—45 credits or fewer, sophomores—46 to 90 credits, juniors—91 to 135 credits, seniors—136 credits or more. Freshmen and sophomores are considered lower division; juniors and seniors, upper division.

Registration—The quarterly Class Schedule contains general registration and refund information.

Students who find it necessary to cancel or add courses after registering for the quarter should refer to the Class Schedule for instructions.

If a student withdraws from the college at any time, all classes should be officially canceled.
Grading—Two grading options, A-B-C-D-F and S-N, are offered, although use of the S-N option is limited. A grading option is chosen for each course at the time of registration. The following restrictions on the use of the S-N option apply to CNR students.

1. A maximum of 25 percent of the residence credits presented for the baccalaureate degree may be in courses in which a grade of S was received.

2. All required courses must be taken A-F. Prerequisites for required courses and courses in the major must also be taken A-F unless an exception is made.

University grading policies and letter definitions are explained in the Class Schedule.

Honor System—Under an honor system adopted on the St. Paul campus, students accept responsibility for the supervision of student behavior during examinations and pledge not to give or receive aid. A student or faculty member who observes an act of dishonesty may report the incident to the college Honor Case Commission, a committee of the Student-Faculty Board. For more information about how the honor system works, contact the CNR Office for Student Affairs.

Satisfactory Progress—Students in CNR are expected to meet certain minimum academic standards. Students not meeting these standards are subject to probation and suspension by their department Student Scholastic Standing Committee. The following chart details conditions under which these actions will be taken.

The Student Scholastic Standing Committee places a student on probation and informs him or her that repeated low academic performance will lead to a suspension. A suspension lasts two academic quarters, and reinstatement in the program requires a petition to the department Student Scholastic Standing Committee. Students placed on probation or suspension may appeal the action.

The Itasca session is not considered as a separate quarter. Itasca grades are included with fall quarter grades.

Students who are performing poorly academically should contact their adviser as soon as possible to correct the problem. Probation and suspension are rarely waived.

To appeal a suspension, the student must obtain a Petition for Reinstatement from the CNR Office for Student Affairs. The petition must be completed and turned in to the chair of the department Student Scholastic Standing Committee, along with any supporting documents. The final decision rests with the department Student Scholastic Standing Committee that will act on the petition and inform the student in writing.

Policy Waivers—Occasionally it may be to the educational advantage of both the student and the department to waive an academic policy or
curricular requirement, provided the basic spirit of the regulation is maintained. A student may petition for a departure from normal procedure. If approved by the adviser, the petition is routed to the department Student Scholastic Standing Committee for a final decision. Contact the CNR Office for Student Affairs for more information.

Graduation Requirements

To receive the bachelor of science (B.S.) degree, CNR students must meet the following requirements.

1. Complete a minimum of 192 credits (180 for natural resources and environmental studies), including required and elective courses in the chosen curriculum. No more than 9 credits in physical education may be applied toward the degree. No more than 9 credits in music may be applied as elective credits toward the degree.

2. Achieve a GPA of 2.00 or higher with no more than 5 credits of D in required forest resources, forest products, natural resources and environmental studies or fisheries and wildlife designator courses and 5 credits of D in other required courses.

3. Satisfy liberal education requirements (see below).

4. Satisfy residence and other general University requirements for graduation.

Note: Transfer students must complete a minimum of 45 credits, 30 during the senior year, while attending CNR.

Graduation with Honors—The B.S. degree may be earned “with distinction” or “with high distinction.” Students who achieve a GPA of at least 3.85 may be recommended to the faculty for graduation with high distinction. The recommendation is made on the basis of scholarship and other evidence of satisfactory achievement in the curriculum. Students who achieve a GPA between 3.35 and 3.85 may be recommended for graduation with distinction. Fisheries and wildlife majors who qualify may enroll in an honors program in which the B.S. degree may be earned cum laude, magna cum laude, and summa cum laude. (See Honors Program, page 23.)

Transfer students who have completed less than half the credits required for graduation while attending CNR are not eligible to graduate with honors.

Quality Credits—The number of free elective credits required for graduation may be decreased by one for every five grade points in excess of those required to reach a GPA of 3.35. Free electives may be chosen without regard to curricular or college requirements. No more than one-twelfth of the total number of credits required for graduation may be gained through quality credits.

Special Examinations for Credit—Currently enrolled students who believe their knowledge of a subject is equal to that required to complete a particular course may request to take an examination for credit. If the Student Scholastic Standing Committee and the department approve, arrangements can be made with an appropriate instructor to take an examination. Usually no grade is assigned. A $30 fee is assessed for each examination. Credit by special examination is not granted for language or mathematics courses taken in high school.

College Level Examination Program (CLEP)—Students may earn credit for the CLEP social science and humanities examinations prepared by the College Entrance Examination Board. CLEP also offers a number of subject examinations for credit. Information may be obtained from the CNR Office for Student Affairs.

CNR accepts CLEP scores at the 75th percentile or higher for exemption from up to 8 credits in a selected number of courses.

Computer Competency—Computer skills are necessary for today’s student. As a student in CNR, you will use computer applications in your coursework regardless of the major you choose. You will be expected to have basic computer competency in word processing, spreadsheets, database management, and telecommunications. Your level of computer competency will be assessed in the advising process. If you lack needed skills, you will be given advice on which courses you will be required to take in order to learn those skills.
Liberal Education Requirements

Effective for all freshmen with fewer than 39 credits enrolling from fall 1994 to summer session II 1996. Beginning fall 1996, the liberal education requirements apply to all students entering a baccalaureate degree program, regardless of prior credits.

A liberal education introduces you to the modes of inquiry and subject matter of the major branches of knowledge, including the factual information and theoretical or artistic constructs that form their foundations; the “ways of knowing”—the kinds of questions asked and how insight, knowledge, and data are acquired and used; the changes over time of their central ideas or expressive forms; and the interrelationships among them and with human society in general.

To these ends, study by all undergraduate students on the Twin Cities campus is guided by a common framework.

The Diversified Core Curriculum

Physical and Biological Sciences. Comprehension of physical and biological principles; understanding of and ability to use the methods of scientific inquiry—the ways in which scientists investigate physical and biological phenomena; and appreciation of the importance of science and the value of a scientific perspective.

Requirement: A minimum of three courses totaling at least 12 credits, including one course with a laboratory or field experience in the physical sciences and one course with a laboratory or field experience in the biological sciences.

History and Social Sciences. Knowledge of how historians and social scientists describe and analyze human experiences and behavior; study of the interrelationships among individuals, institutions, structures, events, and ideas; understanding of the roles individuals play in their historical, cultural, social, economic, and political worlds.

Requirement: A minimum of three courses totaling at least 12 credits, including one course with historical perspective.

Arts and Humanities. Understanding of approaches to the human condition through works of art, literature, and philosophy; knowledge of how artists create and humanistic scholars think; ability to make aesthetic judgments.

Requirement: A minimum of three courses totaling at least 12 credits including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

Mathematical Thinking. Acquisition of mathematical modes of thinking; ability to evaluate arguments, detect fallacious reasoning, and evaluate complex reasoning chains; appreciation of the breadth of applications of mathematics and its foundations.

Requirement: A minimum of one course totaling at least four credits.

The Designated Themes of Liberal Education

The designated themes of liberal education offer a dimension to liberal learning that complements the diversified core curriculum. Each of the themes focuses on an issue of compelling importance to the nation and the world, the understanding of which is informed by many disciplines and interdisciplinary fields of knowledge.

Requirement: A minimum of six courses (or five courses if one includes an approved practicum), including one course in each of the following:

- **Cultural Diversity.** Understanding of the roles gender, ethnicity, and race play in structuring the human experience in and developing the social and cultural fabric of the United States.
- **International Perspectives.** Comprehension of the ways in which you are part of a rapidly changing global environment dominated by the internationalization of most human endeavors.
- **Environment.** Knowledge of the interaction and interdependence of the biophysical systems of the natural environment and human social and cultural systems.
- **Citizenship and Public Ethics.** Reflection on and determination of a clearer sense of your present and future civic relationships and your obligations to the community.
- **Writing Skills**

The ability to communicate effectively is a hallmark of a liberally educated individual and a key to a successful and satisfying life. To encourage refining of writing skills, the liberal education curriculum includes both writing courses and writing across the curriculum.

Requirement: Writing skills requirements are being revised. Until the new requirements are in effect, all students will complete the writing requirement specified by the college awarding their baccalaureate degree.

You may satisfy the liberal education requirements with a number of courses and credits different from those of other students because some courses serve multiple goals in the curriculum; e.g., some courses will satisfy a diversified core requirement and a designated theme requirement, and other courses will satisfy the requirements for each of two themes. Thus, you may satisfy the designated theme requirements with a smaller number of courses than is stated in the requirement. Each quarter, the Class Schedule will publish the requirements and list all courses that satisfy them. In addition, the Class Schedule will list which of these courses are offered that quarter and which are tentatively scheduled for the subsequent quarters during the academic year.

Minnesota Transfer Curriculum

If you complete the Minnesota Transfer Curriculum at any participating Minnesota college or university, you fulfill the University’s Twin Cities campus liberal education requirements. However, you will still need to complete a portion of the writing skills requirements. Contact your college advising office concerning these requirements. For more information on using transfer credits for the liberal education requirements, contact the Office of Admissions (612/625-2008).
Itasca Session—Forest resources, urban forestry, and fisheries and wildlife majors are required to complete a 3½-week Lake Itasca Forestry and Biological Station summer term. To attend, students must have completed 40 credits and attained a minimum cumulative GPA of 2.00. Forest resources and urban forestry students must also have completed the following courses with a grade of C or better: Biol 1103, Chem 1001 or 1051, and Math 1008 (students with a C or better in high school trigonometry are exempt from Math 1008). Fisheries and wildlife students must have completed the following courses with a grade of C or better: Biol 1009, 1103, 1106, and 5041 or 3008. The session is also open to students not enrolled in CNR.

All transfer students must provide the CNR Office for Student Affairs with transcripts of all coursework and an application by July 15 before the start of the Itasca Session they wish to attend.

Cloquet Session—Students in forest resources are required to complete the Cloquet Forestry Session in the fall of their senior year. To attend, students must have attained a minimum cumulative GPA of 2.00 at the end of the preceding quarter and completed the Itasca Session and FR 1100, 3103, 3300, 5100, 5114, 5200, 5212, 5215, 5218, 5232, Soils 1020, and FW 3054.

Special Learning Opportunities

Minnesota-Idaho Student Exchange—Forest resources students at the University of Minnesota may study timber harvesting in Idaho during their senior year under an exchange agreement with the University of Idaho. Minnesota students return from this study in Idaho to be awarded their baccalaureate degree from the Department of Forest Resources. In turn, Idaho students take coursework in paper science and engineering at the University of Minnesota.

Forest Products Cooperative Education Program—Students in this program alternate periods of employment in their career fields with periods of academic study. The program leads to a B.S. in forest products, with a specialization in paper science and engineering, production management, marketing, or wood science. Full-time students who have declared a major in forest products and who have a 2.70 GPA may apply.

Students must complete at least two quarters of academic study before their first quarter of work. At the end of each work quarter, students must submit a written report on their work assignments and learning experiences to a faculty member. Successful reports are graded S (satisfactory) and one credit is awarded for completing a work quarter. Continuation of the program is based on indication of normal progress toward the degree, a 2.50 cumulative GPA, and satisfactory work progress. For more information, contact Dr. Joseph Massey, Department of Forest Products head, 209 Kauert Laboratory (612/624-7459).

Fisheries and Wildlife Field Trip—Fisheries and wildlife majors are eligible to participate in a field trip during spring break of their senior year. Selection for participation is competitive, based on previous academic performance. Students travel with a faculty member or graduate student(s) to the western United States to observe and discuss ongoing fisheries and wildlife management activities. Local agency personnel provide on-site information. Selected students register for one credit of FW 5565—Fisheries and Wildlife Ecology and Management: Field Trip either during winter or spring quarters.

Study Abroad—CNR students have many opportunities to study abroad. Study in English is possible at a number of sites. If a University of Minnesota program does not meet a student’s needs, many other options are available.

Identifying Study Abroad Opportunities—The Study Abroad Catalog describes the broad range of opportunities for University of Minnesota students to study in another country as part of their degree program. Students can learn more about these options through an advising appointment at the International Study and Travel Center (ISTC), 102 Nicholson Hall ((612) 626-9000). After identifying one or more options of interest, students should see a Global Campus adviser in 106 Nicholson Hall ((612) 625-3379) for detailed program information and credit and financial aid planning.
Study Abroad Opportunities in Natural Resources—Two types of study abroad that can especially enhance degree work in CNR are field study and integrated classroom study. Minnesota Studies in International Development (MSID) is a field study program offering two-quarter winter/spring grassroots internships in Ecuador, India, Jamaica, Kenya, Morocco, or Senegal, preceded by on-campus preparatory courses in the fall. The Student Project for Amity among Nations (SPAN) consists of summer overseas research on a topic of the student’s choosing, preceded by a year’s on-campus preparation and followed by project write-up in the fall; the four destinations change from year to year. The University also cosponsors two specialized options for CNR students: a tropical biology/conservation program in Costa Rica and a marine biology program in Denmark.

Integrated classroom study programs permit students to take regular university courses alongside host-country nationals. The University’s student exchanges and consortium memberships provide access to universities in many countries. Conservation and resource management curricula taught in English are available in Australia, Canada, Fiji, Finland, the Netherlands, the Philippines, and the United Kingdom. Students with sufficient language fluency may instead choose to study in Dutch (the Netherlands), Finnish (Finland), French (France), German (Germany), Italian (Italy), Korean (South Korea), Portuguese (Brazil), Spanish (Argentina, Colombia, Spain, Uruguay), Swedish (Finland, Sweden), or Thai (Thailand).

Other Study Abroad Opportunities—CNR students need not necessarily seek credit in their major. Study abroad is encouraged for language acquisition or cultural learning. The resulting credits can often be used as electives. The University and other institutions sponsor a broad range of intensive language and area studies programs. Contact ISTC for more information.

Credit and Financial Aid—Advance planning and CNR endorsement are essential to assure that credit from study abroad fits smoothly into the student’s degree program. Students who enroll in a University of Minnesota program will receive procedural information from the sponsoring office on campus. Those who select any other option should make an appointment with a Global Campus adviser, 106 Nicholson Hall (612/625-3379), as early as possible to discuss credit procedures and obtain a Foreign Study Checklist. Through the checklist, the CNR Office for Student Affairs, 135 Natural Resources Administration Building, will record agreements concerning credit. The checklist also helps maintain the student’s enrollment status and financial aid eligibility while abroad.

For nearly all study abroad programs, students can arrange to retain their University financial aid eligibility and/or defer past loans. Additional financial aid is available for some programs. Contact ISTC for more information.

Fisheries and Wildlife

The fisheries and wildlife curriculum provides students with a broad science background emphasizing biological and environmental sciences and other coursework needed for careers in fisheries, wildlife, conservation biology, and other natural resource and environmental fields. Graduates are prepared to research, plan, and implement the management, protection, and enhancement of fisheries and aquatic resources, wildlife resources, and biological diversity. Graduates find employment as fisheries and wildlife scientists and managers, naturalists, zoo biologists, environmental biologists, environmental educators, and other natural resource professionals.

The program also provides students with the fundamental science background needed to enter a wide variety of graduate programs in biological and natural resource sciences as well as professional programs in veterinary medicine (see page 22), environmental law, and environmental education. Undergraduate-level study satisfies only minimum requirements for professional employment, whereas graduate-level study enhances career opportunities. The master’s degree is required for many management, administrative, and research positions in biological and natural resource professions. The doctorate may be required for some research positions and college teaching.
Areas of Specialization
After completing a core curriculum of 115 to 130 credits that includes liberal education, basic science, mathematics, and an introduction to fisheries and wildlife, students select an area of specialization, usually by the end of the sophomore year. The three areas of specialization are fisheries, wildlife, and conservation biology. At the undergraduate level, these specializations allow students to focus on particular areas of personal interest but are not so specialized as to exclude employment across a broad range of natural resource careers.

Fisheries—This specialization is for students who wish to pursue careers in fisheries and aquatic resources science, management, and administration; fish hatchery management; and aquaculture, aquatic education, and aquatic environmental assessment. The curriculum meets the education criteria for the Certified Fisheries Scientist designation established by the American Fisheries Society, the major professional organization for fisheries scientists and managers in North America.

Wildlife—This specialization is for students who wish to pursue careers in wildlife science, management, and administration; zoo biology; and terrestrial ecology, environmental assessment, and education. With proper selection of electives, students can meet the education criteria for the Certified Wildlife Biologist designation established by The Wildlife Society, the major professional organization for wildlife scientists and managers in North America.

Conservation Biology—This specialization is for students interested in careers dealing with a broad range of conservation issues in both aquatic and terrestrial habitats. Positions typically focus on protection of endangered species and management for biodiversity. Careers as environmental educators or naturalists are also options. Course options allow students to meet their individual needs and interests.

Each specialization requires that students take a number of courses fundamental to the specialty area and select from a wide variety of courses in supporting areas. Students must also satisfy University-wide liberal education requirements in the diversified core curriculum, the designated themes of liberal education, and writing skills. To a large extent, these requirements are built into the curriculum or can be met by careful selection of electives. Although no computer course is required, students are expected to be computer literate and competent using word processing, spreadsheet, and e-mail software. NRES 1020—Information Technology in Natural Resources (2 credits) is recommended for students without computer skills.

Although the three specializations qualify students for admission to most graduate programs in the biological sciences, an honors program (see page 23) is available and specifically designed for highly qualified students who know at an early stage that they intend to pursue graduate education.

Required Core Curriculum
Note: Some of the required core curriculum courses also fulfill diversified core curriculum and designated theme requirements. Refer to the fisheries and wildlife curriculum sheet and quarterly Class Schedule when selecting coursework.

Communication Skills
Rhet 1101—Writing to Inform and Persuade (4)
or
Comp 1011—Writing Practice (5)
Rhet 3562—Writing in Your Profession (4)
or
Comp 3015—Writing About Science (4)
Rhet 1222—Public Speaking (4)
or
Sph 1101—Fundamentals of Speech Communication (4)

Mathematical Thinking
Math 1251, 1252—One-Variable Differential and Integral Calculus I-II (4,4)
Math 1261—Calculus III (4)
or
Math 1131—Finite Mathematics (5)
Stat 3011, 3012—Statistical Analysis (4,4)

Physical and Biological Sciences
Biol 1106—General Zoology (5)
Chem 1051, 1052—Chemical Principles I-II (4,4)
BioC 1401—Elementary Biochemistry (4)
GCB 3022—Genetics (4)

Select one of the following groups:
Biol 1009—General Biology (5)
and
Biol 1103—General Botany (5)
or
Biol 1201—Evolutionary and Ecological Perspectives (5)
and
Biol 1202—Molecular and Cellular Perspectives (5)
and
Biol 1203—Organismal Adaptation and Diversity (5)

Select one of the following groups:
Phys 1041, 1042—Introduction to Physics (5,5)
and
Geo 1001—The Dynamic Earth: Introduction to Geology (5)
or
Geo 1019—Our Changing Planet (4)
or
Geo 1601—Oceanography (4)
or
Ast 1021H—Introduction to Astronomy (4)
or
Geog 1425—Introduction to Meteorology (4)
or
Phys 1104, 1105, 1106—General Physics (5,5,5)
and
Phys 1107, 1108, 1109—General Physics Laboratory (1,1,1)
**Areas of specialization**

**Group 1—Communication, Leadership, Policy**  
NRES 3002—Communications, Leadership, Policy Skills  
or  
NRES 5240—Natural Resources Policy and Administration (3)

**Group 2—Animals and Plants**  
EEB 5136 Ichthyology (4)

Select two of the following:

- PBio 5231—Introduction to the Algae (5)
- PBio 1009—Minnesota Plant Life (4)
- PBio—Introductory Plant Systematics (4)
- Ent 5360—Aquatic Entomology (3)
- Ent 1005—Economic Entomology (4)
- or  
  Ent 5020—Insect Taxonomy (4)

**Group 3—Community and Ecosystem Ecology**

Select one of the following:

- EEB 5052—Theoretical Population Ecology (4)
- EEB 5607—Ecology of Animal Plankton (5)
- EEB 5608—Aquatic Entomology (4)
- EEB 5652—Community and Ecosystem Processes (5)
- EEB 5653—Community and Ecosystem Processes (5)

**Group 4—Fisheries, Wildlife, and Conservation Biology**

FW 3106—Important Plants in Fisheries and Wildlife Habitats (Itasca) (2)

FW 5600—Fisheries and Wildlife Field Techniques (Itasca) (4)

FW 5601—Fisheries Population Analysis (4)

FW 5604—Fisheries Ecology and Management (3)

**Group 5—Miscellaneous Required Courses**

EEB 5601—Limnology (4)

or  
EEB 5659—Fish Physiology (4)

or  
Biol 3111—Animal Biology (4)

or  
AnSci 3301—Systemic Physiology (6)

or  
EEB 5156—Comparative Animal Physiology (3)

Select one of the following:

- Chem 3100—Quantitative Analysis Laboratory (3)
  and  
  Chem 3101—Quantitative Analysis Lab (2)

- Chem 3301—Organic Chemistry I (4)
  and  
  Chem 3305—Organic Chemistry Lab I (2)

**Electives**—Select any course from the list below, from any of the three areas of specialization, or as approved by your adviser to total 192 credits for graduation with the B.S. degree.

**History and Social Sciences**—Minimum of three courses totaling at least 12 credits, including one course with historical perspective.

- One economics course (4)
- One history course (4)
- One social sciences course (4)

**Arts and Humanities**—Minimum of three totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

**Additional Fisheries, Wildlife, and Conservation Biology Core Courses**

- Biol 3008—Ecology and Evolution (4)
- FW 1001—Orientation in Fisheries and Wildlife (1)
- FW 3052—Introduction to Fisheries and Wildlife Conservation (3)
- FW 5701, 5702—Senior Project (1.2)
  or  
  FW 5801H, 5201H—Honors Research (3.3)
  and  
  FW 5200H—Honors Seminar (1)
- NRES 3010—Ethics and Values in Resource Management (3)

**Wildlife**

**Group 1—Communication, Leadership, Policy**

NRES 3020—Leadership and Management Skills Development (3)

or  
NRES 5240—Natural Resources Policy and Administration (3)

**Group 2—Animals and Plants**

FW 5129—Mammalogy (5)

EEB 5134—Introduction to Ornithology (5)

**Group 3—Community and Ecosystem Ecology**

Select one of the following:

- EEB 5052—Theoretical Population Ecology (4)
- EEB 5601—Limnology (4)
- EEB 5608—Ecosystem Form and Function (4)
- EEB 5652—Community and Ecosystem Processes (5)
- FR 5142—Tropical Forest Ecology (4)

**Group 4—Fisheries, Wildlife, and Conservation Biology**

EEB 5051—Analysis of Populations (4)

FW 3106—Important Plants in Fisheries and Wildlife Habitats (Itasca) (2)

FW 5600—Fisheries and Wildlife Field Techniques (Itasca) (4)

FW 5603—Wildlife Habitats and Management (3)

**Group 5—Miscellaneous Required Courses**

Select one of the following:

- Biol 3111—Animal Biology (4)
- AnSci 3301—Systemic Physiology (6)
- EEB 5156—Comparative Animal Physiology (3)

Select one of the following:

- LA 5202—Landscape Ecology (3)
- EEB 5014—Ecology of Vegetation (5)
- EEB 5016—Ecological Plant Geography (5)
- EEB 5122—Plant/Animal Interactions (4)

Select two of the following:

- FW 5570—Avian Conservation (4)
- FW 5620—Geographic Information Systems for Fisheries, Wildlife, and Biological Conservation (4)
  or  
  FR 5130—Geographic Information in Natural Resources Analysis (3)
- FR 5100—Silviculture (4)
  or  
  NRES 3020/5020—Plant Resource Management and the Environment (4)
- FR 5114—Forest Hydrology and Watershed Management (4)
- FR 5231—Range Management (3)
- FR 5232—Management of Recreational Lands (4)
- FR 5262—Remote Sensing of Natural Resources (4)
- NRES 3575/5575—Wetlands Conservation (3)
- EEB 3111—Introduction to Animal Behavior (4)
- EEB 5044—Evolution (4)
- EEB 5034—Population and Quantitative Genetics (4)

AgEt 5410—Hydrology and Water Quality (5)

or  
FR 5114—Forest Hydrology and Watershed Management (4)

EEB 5621—Limnology Laboratory (2)

FW 5455—Aquaculture (3)

FW 5461—The Behavior of Fishes (3)

NRES 3001—Colloquium in NRES: Exotic Animals and Plants (2)

NRES 3060/5060—Water Quality in Natural Resource Management (3)

NRES 3800—Natural Resources Interpretation and Communication (3)

NRES 5001—Colloquium in NRES: Aquatic Restoration (1)

NRES 5242—Management of Natural Resources Conflict (3)
Ent 1005—Economic Entomology (4)
Ent 5040—Insect Ecology (4)
Hort 5015—Restoration and Reclamation Ecology (4)
Stat 5301—Designing Experiments (5)

Electives—Select any course from the list below, from any of the three areas of specialization, or as approved by your adviser to total 192 credits for graduation with the B.S. degree.
NRES 3001—Colloquium in NRES: Exotic Animals and Plants (2)
NRES 3060/5060—Water Quality in Natural Resource Management (3)
NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resources I (4)
NRES 5218—Assessment and Modeling of Forests (3)
NRES 5242—Management of Natural Resources Conflict (3)

 Conservation Biology
Group 1—Communications, Leadership, Policy
NRES 3202—Leadership and Management Skills Development (3)
NRES 5240—Natural Resources Policy and Administration (3)
NRES 5242—Management of Natural Resources Conflict (3)

Group 2—Animals and Plants
Select three of the following, including one plant and one animal course:
FW 5129—Mammalogy (5)
EEB 5134—Introduction to Ornithology (5)
EEB 5136—Ichthyology (4)
Ent 1005—Economic Entomology (4)
or
Ent 5020—Insect Taxonomy (5)
FR 1100—Dendrology (4)
PBio 3201—Introductory Plant Systematics (4)

Group 3—Community and Ecosystem Ecology
Select one of the following:
EEB 5016—Ecology of Vegetation (5)
EEB 5017—Ecological Plant Geography (5)
EEB 5601—Limnology (4)
EEB 5608—Ecosystem Form and Function (4)
EEB 5652—Community and Ecosystem Processes (4)
FR 5142—Tropical Forest Ecology (4)

Group 4—Fisheries, Wildlife, and Conservation Biology
FW 3054—Biological Conservation: An Ecosystem Approach (3)
NRES 3100—Conservation of Biodiversity (4)
Itasca Summer Session—Any field course (5)
or
FW 5600—Fisheries and Wildlife Field Techniques (Itasca) (4) and FW 3106—Important Plants in Fisheries and Wildlife Habitats (Itasca) (2)

Select one of the following:
FW 5601—Fisheries Population Analysis (4)
EEB 5051—Analysis of Populations (4)
FW 5603—Wildlife Habitats and Management (3)
FW 5604—Fisheries Ecology and Management (3)

Group 5—Miscellaneous Required Courses
LA 5202—Landscape Ecology (3)

Select one of the following:
FW 5620—Geographic Information Systems for Fisheries, Wildlife, and Biological Conservation (4)
or
FR 5130—Geographic Information Systems in Natural Resources Analysis (3)
NRES 3575/5575—Wetlands Conservation (3)
Hort 5015—Restoration and Reclamation Ecology (4)

Electives—Select any course from the list below, from any of the three areas of specialization, or as approved by your adviser to total 192 credits for graduation with the B.S. degree.
NRES 3001—Colloquium in NRES: Exotic Animals and Plants (2)
NRES 5001—Colloquium in NRES: Aquatic Restoration (1)
NRES 3060/5060—Water Quality in Natural Resource Management (3)
NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resources I (4)

Total graduation requirements—192 credits. Required core curriculum (115-130 credits), area of specialization courses (42-53 credits), and electives (9-35 credits).

Pre-Veterinary Medicine—Students may fulfill the minimum requirements for admission to the University’s College of Veterinary Medicine and other colleges of veterinary medicine by completing a bachelor’s degree in fisheries and wildlife within any of the three areas of specialization. Although the minimum requirements for admission to colleges of veterinary medicine may be completed in three years, admission is highly competitive. Completing a bachelor’s degree in fisheries and wildlife provides students with additional academic skills and other career opportunities. Students must include the courses listed below in selecting their electives.
Chem 3301—Organic Chemistry I (4)
Chem 3305—Organic Chemistry Lab I (2)
Chem 3302—Organic Chemistry II (4)
VPB 3103—General Microbiology (5)

Fisheries and Wildlife Minor
This minor enables students in programs such as biology, communications, education, forestry, natural resources and environmental studies, and others to develop an understanding of the principles and practices of fisheries, wildlife, and conservation biology. An overview of fish and wildlife biology and natural history and general principles applied to managing animal populations and habitats is provided. Students interested in the minor should contact the CNR Office for Student Affairs.

Background Courses
Biol 1103—General Botany (5)
Biol 1106—General Zoology (5)
Biol 3008—Ecology and Evolution (4)
or an ecology course
FW 1001—Orientation in Fisheries, Wildlife, and Conservation Biology (1)
or a natural resources orientation course
Core Courses
FW 3052—Introduction to Fisheries and Wildlife Conservation (3)
FW 5603—Wildlife Habitats and Management (3)
FW 5604—Fisheries Ecology and Management (3)

Select one of the following:
FW 5129—Mammalogy (5)
EEB 5134—Introduction to Ornithology (5)
EEB 5136—Ichthyology (4)

Select one of the following:
FW 3054—Biological Conservation: An Ecosystem Approach (3)
FW 5461—The Behavior of Fishes (3)
FW 5459—Fish Physiology (4)
FW 5570—Avian Conservation (4)
FW 5601—Fisheries Population Analysis (4)
NRES 3575/5575—Wetlands Conservation (3)

Honors Program
The Department of Fisheries and Wildlife offers an honors program to recognize and promote outstanding academic achievement. The heart of the program is completion of a research project, supervised by a faculty mentor. Students also participate in an honors seminar designed to expose them to a broad range of current topics in natural resource science. The honors experience culminates in a senior thesis, an oral presentation of the research project, and recognition at the college graduation ceremony.

Research Project and Honors Seminar—The objectives of the research project are for students to gain experience conducting research and acquire new information about the topic under investigation. A goal is to promote high quality research and students are encouraged to submit their results for publication in a professional journal, if warranted.

Honors program students participate in one honors seminar. This seminar may be held in conjunction with graduate student seminars so that honors students interact with graduate students as well as each other, or the seminar may be organized and arranged to cover special topics of interest to the honors students.

Admission Procedures—Students who plan to apply for admission to the honors program should take the honors biology sequence of Biol 1201-1202-1203 beginning in the fall of the freshman year. If another biology sequence has been taken, the student must demonstrate the equivalency between the substitute courses and the Biol 1201-1202-1203 series. At the end of the sophomore year (after completion of 90 credits), students should complete an honors program application, available in 200 Hodson Hall.

Qualifications—A minimum GPA of 3.20 is required for admission. After admission, students must make continual progress toward achieving a GPA of 3.40, the minimum necessary to graduate with honors.

Graduation with Honors—Participation in the honors program is required for graduation with the traditional honors designations cum laude, magna cum laude, and summa cum laude. Candidates for graduation with honors must complete the following.

1. At least 60 credits in upper division courses (3xxx and 5xxx) at the University of Minnesota, Twin Cities campus.
2. Two quarters (six credits) of directed research (FW 5801H, 5802H) with the results reported in an acceptable honors thesis and as an oral seminar. Students may use research they conducted while participating in the Undergraduate Research Opportunities Program (UROP) if approved by their faculty mentor.
3. One quarter (one credit) of honors seminar (FW 5200H).
4. Graduate Record Examination (General Test and Biology Subject Test) results to be filed with the Department of Fisheries and Wildlife.
5. The last 90 credits of A-F registration with the minimum GPAs specified below. If a portion of those credits have been transferred from another institution, the proportion of residence credits with grades of A must at least equal the proportion of transfer credits with grades of A.
6. Transcripts of students graduating with honors will show one of the following:
   Cum laude .......................... 3.40 GPA
   Magna cum laude ..................... 3.60 GPA
   Summa cum laude .................... 3.80 GPA
Forest Products

This curriculum is for students interested in careers in developing, producing, marketing, and using the many products that flow from forests—paper, wood-based panels, lumber, and furniture as well as chemicals from wood. Coursework emphasizes chemical, physical, and mechanical properties of wood and the newest technologies for converting raw material into product. For more information, contact Joseph G. Massey, Department of Forest Products head (612/624-7459). More information about the department—its programs, faculty, and students—can be found on the Department of Forest Products World Wide Web Home page at http://forestry.umn.edu/FP/ForP.html.

Marketing

This forest products specialization is for students interested in the marketing, sales, and distribution of forest products. Technical emphasis is on the physical-mechanical nature of wood-based building materials, including lumber, plywood, fiberboard, particleboard, and newer composite products. In addition, coursework focuses on marketing principles and analysis, management science, computer applications, and economics. Career opportunities include purchasing and selling of all types of forest products at wholesale and retail levels, technical sales, product promotion, and specialized marketing research. For more information, contact Sheryl Bolstad, student adviser, (612) 624-4230, sbolstad@forestry.umn.edu.

Required Core Curriculum

Note: Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the forest products—marketing curriculum sheet and quarterly Class Schedule when selecting coursework.

Freshman and Sophomore Years—85 credits

Communication Skills
Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Writing to Inform and Persuade (4)
Rhet 1151—Writing in Your Major (4)
Rhet 1222—Public Speaking (4)

Mathematical Thinking
Math 1142—Short Calculus (5)
Stat 3011—Statistical Analysis (4)

Physical and Biological Sciences
Biol 1009—General Biology (5)
Chem 1001—General Principles of Chemistry (4)
Chem 1002—Elementary Organic Chemistry (4)
Phys 1041—Introductory Physics (5)
Phys 1042—Introductory Physics (5)

History and Social Sciences—Minimum of three courses totaling at least 12 credits, including one course with historical perspective.
ApEc 1101—Principles of Microeconomics (4)
ApEc 1102—Principles of Macroeconomics (4)
Jour 1001—Introduction to Mass Communication (4)
Psy 1001—Introduction to Psychology (5)

Arts and Humanities—Minimum of three courses totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

Additional required CNR freshman and sophomore courses
ForP 1001—Forest Products Orientation (1)
ForP 1301—Wood as a Raw Material (4)
ForP 1303—Wood Structure and Identification (2)
FR 1100—Dendrology (4)

Junior Year—46-48 required credits
Acct 1050—Introduction to Financial Reporting (5)
BIE 3060—Professional Sales Education (3)
CSci 3102—Introduction to PASCAL Programming (4)
or CSci 3113—Introduction to Programming in C (4)
or NRES 1020—Information Technology in Natural Resources (2)
ForP 3300—Wood Industry Tours (2)
ForP 3303—Forest Products Marketing (3)
ForP 3305—Grading Standards and Product Performance (2)
ForP 3312—Building Materials Estimating (2)
ForP 5300—Wood-Fluid Relationships (3)
ForP 5301—Mechanical Properties (3)
ForP 5303—Wood Deterioration (4)
ForP 5331—Undergraduate Seminar (2)
Mgmt 3001—Fundamentals of Management (4)
Mktg 3000—Principles of Marketing (4)
Mktg 3040—Buyer Behavior (3)
Acct 3001—Introduction to Management Accounting (4)

Senior Year—51-53 required credits
BLaw 3058—Introduction to Law, the Law of Contracts and Sales Contracts (4)
BFin 3000—Finance Fundamentals (4)
ForP 5304—Wood Drying and Preservation Processes (4)
ForP 5307—Wood Base Panel Technology (4)
ForP 5308—Wood Machining (3)
ForP 5355—Mechanics and Structural Design With Wood Products (4)
ForP 5356—Advanced Forest Products Marketing (3)
NRES 5240—Natural Resource Policy and Administration (3)
or FR 3250/5250—Role of Renewable Natural Resources in Developing Countries (2)
Jour 5251—Psychology of Advertising (4)
Mktg 3030—Sales Management (4)
Mktg 3080—Marketing Strategy (4)
Rhet 3562—Writing in Your Profession (4)

Directed Electives—at least two courses
Acct 5160—Financial Statement Analysis (4)
ForP 5412—A Systems Approach to Residential Construction (3)
Jour 5721—Mass Media and U.S. Society (4)
LM 3000—Introduction to Logistics (4)
LM 5020—Advanced Logistics Management (4)
Mgmt 3002—Psychology in Management (4)
Mktg 3050—Marketing Communications (4)
Mktg 3065—Retail Management (4)

**Total Graduation Requirements**—192 credits. Required core curriculum (182-186 credits); remaining diversified core curriculum, designated themes requirements. Refer to coursework. The forest products—production management curriculum sheet and quarterly Class Schedule when selecting coursework.

**Required Core Curriculum**

**Note:** Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the forest products—production management curriculum sheet and quarterly Class Schedule when selecting coursework.

**Freshman and Sophomore Years—88 credits**

**Communication Skills**
Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Research Methods (1)
Rhet 1151—Writing in Your Major (4)
Rhet 1222—Public Speaking (4)

**Mathematical Thinking**
Math 1251—One-Variable Differential and Integral Calculus I (4)
Math 1252—One-Variable Differential and Integral Calculus II (4)
Stat 3091—Probability and Statistics (4)

**Physical and Biological Sciences**
BioC 1401—Elementary Biological Chemistry I (4)
Biol 1009—General Biology (5)
Chem 1051—General Principles of Chemistry I (4)
Chem 1052—General Principles of Chemistry II (4)
Phys 1041—Introductory Physics (5)
Phys 1042—Introductory Physics (5)

**History and Social Sciences**—Minimum of three courses totaling at least 12 credits, including one course with historical perspective.

ApEc 1101—Principles of Microeconomics (4)
ApEc 1102—Principles of Macroeconomics (4)
Psy 1001—Introduction to Psychology (5)

**Arts and Humanities**—Minimum of three courses totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

**Suggested courses:**
Rhet 1301—Modern Thought and the Enlightenment (4)
Rhet 1302—Modern Thought and the Industrial Revolution (4)
Rhet 1303—Modern Thought and the Impact of Evolution (4)
Rhet 1310—Humanities: The Land in American Experience (4)

**Additional required CNR freshman and sophomore courses**
ForP 1001—Forest Products Orientation (1)
ForP 1301—Wood as a Raw Material (4)
ForP 1303—Wood Structure and Identification (2)
FR 1100—Dendrology (4)

**Junior Year—40-42 required credits**

CSci 3102—Introduction to PASCAL Programming (4)
or CSci 3113—Introduction to Programming in C (4)
or NRES 1020—Information Technology in Natural Resources (2)
ForP 3300—Wood Industry Tours (2)
ForP 3303—Forest Products Marketing (3)
ForP 3305—Grading Standards and Product Performance (2)
ForP 5300—Wood-Fluid Relationships (3)
ForP 5301—Mechanical Properties of Wood (3)
ForP 5303—Wood Deterioration (3)
ForP 5331—Undergraduate Seminar (2)
ForP 5355—Mechanics and Structural Design With Wood Products (4)
IEOR 3000—Introduction to Industrial Engineering Analysis (4)
IEOR 5030—Quality Control and Reliability (4)
IEOR 5040—Introduction to Operations Research (4)
IR 3002—Personnel and Industrial Relations (4)

**Senior Year—51-53 required credits**
ForP 5304—Wood Drying and Preservation Processes (4)
ForP 5305—Pulp and Paper Technology (2)
ForP 5306—Analysis of Production Systems (3)
ForP 5307—Wood-Base Panel Technology (4)
ForP 5308—Wood Machining (3)
NRES 5240—Natural Resource Policy and Administration (3)
or FR 3250/5250—Role of Renewable Natural Resources in Developing Countries (2)
IEOR 5010—Introduction to Work Analysis (4)
IEOR 5020—Engineering Cost Accounting (4)
IEOR 5311—Management for Engineers (4)
IEOR 5361—Inventory and Production Control (4)
IR 3007—Collective Bargaining and Modern Labor Relations (4)
Rhet 3562—Writing in Your Profession (4)

**Suggested Electives**
Acct 1050—Introduction to Financial Reporting (5)
NRES 3202—Leadership and Management Skills Development (2)
ForP 5356—Advanced Forest Products Marketing (3)
ForP 5412—A Systems Approach to Residential Construction (3)
IEOR 5180—Applied Industrial Engineering (3-5)
IEOR 5221—Facilities Planning (4)
IEOR 5351—Analysis of Production Processes (4)
LASk 1001—Becoming a Master Student (4)
LM 3000—Introduction to Logistics Management (4)
Mktg 3000—Principles of Marketing (4)
Mktg 3040—Buyer Behavior (4)
Mktg 3090—Marketing Topics: Industrial Marketing (4)
Rhet 3254—Advanced Public Speaking (4)
BACCALAUREATE PROGRAMS

Rhett 3266—Communication, Discussion in Small Group Decision Making (4)

Total Graduation Requirements—192 credits. Required core curriculum (170-173 credits); remaining diversified core curriculum, designated themes of liberal education, and electives (19-22 credits).

Paper Science and Engineering

This specialization provides in-depth training in mathematics, physics, chemistry, engineering, and wood and fiber science and technology. It also includes specialized pulp and paper and related engineering courses on the technology of the pulping and papermaking processes. Graduates find careers in process engineering, manufacturing operations, technical services, marketing, plant management, and research and development. For more information, contact Sheryl Bolstad, student adviser, (612) 624-4230, sbbolstad@forestry.umn.edu.

Required Core Curriculum

Note: Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the forest products—paper science and engineering curriculum sheet and quarterly Class Schedule when selecting coursework.

Freshman and Sophomore Years—92 credits

Communication Skills
Rhett 1101—Writing to Inform and Persuade (4)
Rhett 1104—Library Research Methods (1)
Rhett 1151—Writing in Your Major (4)
Rhett 1222—Public Speaking (4)

Mathematical Thinking
Math 1251—One-Variable Differential and Integral Calculus I (4)
Math 1252—One-Variable Differential and Integral Calculus II (4)
Math 1261—Algebra and Geometry of Euclidean Space (4)
Math 3261—Differential Equations with Linear Algebra (4)

Physical and Biological Sciences
Chem 1051—Chemical Principles I (4)
Chem 1052—Chemical Principles II (4)
Chem 3301—Elementary Organic Chemistry I (4)
Chem 3302—Elementary Organic Chemistry II (4)
Chem 3305—Elementary Organic Chemistry Laboratory I (2)
Chem 3306—Elementary Organic Chemistry Laboratory II (2)
Phys 1251—General Physics I (4)
Phys 1252—General Physics II (4)
Phys 1253—General Physics III (4)

History and Social Sciences—Minimum of three courses totaling at least 12 credits, including one course with historic perspective.
ApEc 1102—Principles of Macroeconomics (4)

Arts and Humanities—Minimum of three courses totaling at least 12 credits, including courses in two of the following:

Additional required CNR freshman and sophomore courses
CSci 3201—Introduction to PASCAL Programming (4)
or CSci 3113—Introduction to Programming in C (4)
ForP 1001—Forest Products Orientation (1)
ForP 5331—Undergraduate Seminar (2)

Junior Year—50 required credits
CE 3400—Fluid Mechanics (4)
ForP 1301—Wood as a Raw Material (4)
ForP 1303—Wood Structure and Identification (2)
ForP 3300—Wood Industry Tours (2)
ForP 3301—Industrial Internship (2)
ForP 5302—Wood Chemistry I (3)
ForP 5305—Pulp and Paper Technology (2)
ForP 5306—Analysis of Production Systems (3)
ForP 5310—Pulp and Paper Process Laboratory (3)
ForP 5311—Pulp and Paper Process Engineering Calculations I (4)
ForP 5312—Pulp and Paper Process Engineering Calculations II (4)
ForP 5315—Paper Engineering Laboratory (2)
ForP 5353—Wood Chemistry II (3)
ForP 5361—Adhesion and Adhesives (3)
ME 3301—Thermodynamics (4)
Stat 5021—Statistical Analysis (5)

Senior Year—35-36 required credits
Chem 5520—Elementary Physical Chemistry (3)
ForP 5313—Pulp and Paper Process Operations (4)
ForP 5316—Coated Product Development (2)
ForP 5318—Pulp and Paper Process Dynamics and Control (3)
ForP 5320—Biological and Environmental Science of Pulp and Paper (3)
ForP 5339—Surface and Colloid Chemistry of Papermaking (3)
ME 5342—Heat Transfer (4)
NRES 5240—Natural Resource Policy and Administration (3)
or FR 3250/5250—Role of Renewable Natural Resources in Developing Countries (2)
Rhet 3562—Writing in Your Profession (4)

Suggested Electives
CE 5500—Analysis and Design of Water Supply Systems (4)
CE 5501—Analysis and Design of Wastewater Systems (4)
Chem 5521—Elementary Physical Chemistry (3)
ChEn 5001—Computational Methods in Chemical Engineering and Material Science (4)
ChEn 5101—Principles of Chemical Engineering I (4)
ChEn 5102—Principles of Chemical Engineering II (4)
ForP 5300—Wood-Fluid Relations (3)
ForP 5301—Mechanical Properties (3)
IEOR 5020—Engineering Cost Accounting, Analysis, and Control (4)
ME 3201—Mechanical Engineering Systems Analysis (4)
ME 3303—Applied Thermodynamics (4)
ME 3701—Basic Measurements Laboratory I (2)
ME 3702—Basic Measurements Laboratory II (2)
ME 5283—Industrial Instrumentation and Automatic Control (4)
Stat 5301—Designing Experiments (5)

Total Graduation Requirements—192 credits. Required core curriculum (177-178 credits); remaining diversified core curriculum, designated themes of liberal education, and electives (14-15 credits).
Wood Science

This specialization is for students who want a broad education in forest products coupled with strong training in biology, chemistry, math, and physics. Completion of this specialization is excellent preparation for technical jobs in the wood products industry or for graduate school.

Required Core Curriculum

Note: Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the forest products—wood science curriculum sheet and quarterly Class Schedule when selecting coursework.

Freshman and Sophomore Years—102 Credits

Communication Skills
Rhet 1101—Writing to Inform and Persuade (4)
Rhet 1104—Library Research Methods (1)
Rhet 1151—Writing in Your Major (4)

Mathematical Thinking
Math 1251—One-Variable Differential and Integral Calculus I (4)
Math 1252—One-Variable Differential and Integral Calculus II (4)
Math 1261—Algebra and Geometry of Euclidean Space (4)
Math 3251—Multivariable Differential Calculus (4)

Physical and Biological Sciences
Biol 1009—General Biology (5)
Biol 1103—General Botany (5)
Chem 1051—Chemical Principles I (4)
Chem 1052—Chemical Principles II (4)
Chem 3301—Elementary Organic Chemistry I (4)
Chem 3302—Elementary Organic Chemistry II (4)
Chem 3305—Elementary Organic Chemistry Laboratory I (2)
Chem 3306—Elementary Organic Chemistry Laboratory II (2)
Physics 1251—General Physics I (4)
Physics 1252—General Physics II (4)
Physics 1253—General Physics III (4)

History and Social Sciences—Minimum of three courses totaling at least 12 credits, including one course with historic perspective.
ApEc 1101—Principles of Microeconomics (4)
ApEc 1102—Principles of Macroeconomics (4)

Arts and Humanities—Minimum of three courses totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

Additional required CNR freshman and sophomore courses
ForP 1001—Forest Products Orientation (1)
ForP 1301—Wood as a Raw Material (4)
ForP 1303—Wood Structure and Identification (2)
FR 1100—Dendrology (4)

Junior Year—33 required credits
Chem 3100—Quantitative Analysis Lecture (3)
Chem 3101—Quantitative Analysis Laboratory (2)
Chem 5520—Elementary Physical Chemistry (3)
ForP 3300—Wood Industry Tours (2)
ForP 5300—Wood-Fluid Relationships (3)
ForP 5301—Mechanical Properties (3)
ForP 5302—Wood Chemistry I (3)
ForP 5303—Wood Deterioration (4)
ForP 5331—Undergraduate Seminar (2)
Rhet 1222—Public Speaking (4)
Stat 3011—Statistical Analysis (4)

Senior Year—32 required credits
CSci 3102—Introduction to PASCAL Programming (4)
CSci 3113—Introduction to Programming in C (4)
AgET 3030—Introduction to Problem Solving With Computers (4)
ForP 5304—Wood Drying and Preservation Processes (4)
ForP 5305—Pulp and Paper Technology (4)
ForP 5306—Analysis of Production Systems (3)
ForP 5307—Wood-Base Panel Technology (4)
ForP 5353—Wood Chemistry II (3)
ForP 5355—Mechanics and Structural Design With Wood Products (4)
ForP 5361—Adhesion and Adhesives (3)
NRES 5240—Natural Resource Policy and Administration (3)
FR 3250/5250—Role of Renewable Natural Resources in Developing Countries (2)
Rhet 3562—Writing in Your Profession (4)

Total Graduation Requirements—192 credits. Required core curriculum (167 credits); remaining diversified core curriculum, designated themes of liberal education, and electives (25 credits).

Forest Resources

The forest resources curriculum prepares students to plan, implement, and research the management, protection, and sustainable use of forest and related resources, including timber, water, wildlife, recreation, and aesthetics. Forest resources students may select between two tracks, forest management and forest science. These tracks are similar in that both qualify students to be forest managers. However, students taking the forest management track receive more thorough training in principles and techniques of resource management, while those taking the forest science track receive more scientific or specialized training in particular aspects of forest resources.

Forest Management Track—This track is for students who wish to become directly involved in forest land management or find employment in specialized areas such as resource planning, forest protection, or policy development. Graduates may also pursue graduate study to become researchers and teachers or seek advanced positions in administering and managing forest and related natural resources.

Forest Science Track—This track is for students who wish to learn the fundamentals of forest resource management while gaining some depth
in a self-selected basic or applied science related to forest resources. Graduates might pursue careers as forest managers but more likely are considering graduate school followed by careers in research, teaching, and technical support for managers and administrators. Examples of areas of specialization include, quantitative methods, economics and policy, forest ecology, silviculture, watershed management/water resources, and resource protection.

Students following the forest management track must attend both the Itasca and Cloquet field sessions. Students following the forest science track must attend either the Itasca or Cloquet field session.

**Forest Management and Forest Science Required Core Curriculum**

*Note:* Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the forest resources curriculum sheet and quarterly Class Schedule when selecting coursework.

**Communication Skills**

Comp 1011—Writing Practice I (5)  
*or* Rhet 1101—Writing to Inform and Persuade (4)  
Rhet 1122—Public Speaking (4)  
*or* Spch 1101—Fundamentals of Speech  
Communication: Oral Communication (4)

*Select one of the following:*  
Comp 1027—Intermediate Expository Writing (4)  
Comp 3014—Writing in the Social Sciences (4)  
Comp 3015—Writing About Science (4)  
Comp 3027—Advanced Expository Writing (4)  
Rhet 3511—Writing in Your Major (4)  
Rhet 3562—Writing in Your Profession (4)

**Mathematical Thinking**

Math 1142—Short Calculus (5)  
*or* Math 1251, 1252—One Variable Differential and Integral Calculus I-II (4,4)  
Stat 3011—Statistical Analysis (4)  
*or* Stat 5021—Statistical Analysis (5)

**Physical and Biological Sciences**

Bio 1009—General Biology (5)  
*or* similar basic biology course (5)  
Biol 1103—Botany (5)  
Chem 1001—Chemical Principles (4)  
*and* Chem 1002—Elementary Organic Chemistry (4)  
*or* Chem 1051, 1052—General Principles I-II (4,4)  
Phys 1001—The Physical World (4)  
*and* Phys 1005—Physics Laboratory (1)  
Phys 1041—Introduction to Physics (5)  
Soil 1020—The Soil Resource (4)  
*or* Soil 3125—Basic Soil Science (4)  

1. Math 1251, 1252 recommended for forest science students.  
2. Chem 1251, 1252 recommended for forest science students interested in biophysical sciences.  
3. Offered through UC/CEE only.

**History and Social Sciences**—Minimum of three courses totaling at least 12 credits, including one course with historical perspective.  
ApEc 1101—Principles of Microeconomics (4)  
*or* Econ 1101—Principles of Microeconomics (4)  
ApEc 1102—Principles of Macroeconomics (4)  
*or* Econ 1102—Principles of Macroeconomics (4)

**Arts and Humanities**—Minimum of three courses totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

**Forest Management Track Required Professional Courses**

**Introductory and General**

FR 1001—Forest Resources Orientation (1)  
ForP 1301—Wood as a Raw Material (4)  
NRES 1020—Information Technology in Natural Resources (2)

**Resource Assessment**

FR 3201—Forest Measurement Techniques (Itasca) (1)  
FR 5262—Remote Sensing of Natural Resources (4)  
NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resources (4)  
FR 5202—Remote Sensing Field Applications (Cloquet) (2)  
FR 5218—Assessment and Modeling of Forests (3)  
FR 5222—Forest Resources Inventory (Cloquet) (2)

**Management of Vegetation, Wildlife, Soil, and Water**

FR 1100—Dendrology (4)  
FR 3100—Minnesota Plants (Itasca) (2)  
FR 3101—Northern Forest Ecosystems (Itasca) (3)  
FR 3103—Climatology and Meteorology for Natural Resource Managers (2)  
FR 3104—Forest Ecology (4)  
FR 5100—Silviculture (4)  
FR 5101—Field Silviculture (Cloquet) (4)  
FR 5102—Forest Wildlife Habitat Management (Cloquet) (1)  
FR 5114—Forest Hydrology and Watershed Management (4)  
FR 5115—Forest Hydrology: Field Applications (Cloquet) (2)  
FR 5126—Soil Site Relations (Cloquet) (2)  
FR 5248—Harvesting and Engineering (Cloquet) (3)  
FW 3052—Introduction to Fisheries and Wildlife Conservation (3)

*Select two of the following:*  
Ent 5250—Forest and Shade Tree Entomology (4)  
Pip 5212—Diseases of Forest and Shade Trees (4)  
FR 5215—Forest Fire Ecology and Management (2)

**Economics, Management, Policy, and Planning**

FR 5232—Management of Recreational Lands (4)  
FR 5236—Forest Recreation Planning (Cloquet) (1)  
NRES 5240—Natural Resources Policy and Administration (4)  
NRES 5260—Economics and Natural Resources Management (3)  
FR 5270—Forest Management and Planning (3)  
NRES 3202—Leadership and Management Skills Development (3)  
*or* NRES 5242—Management of Natural Resources Conflict (3)  
*or* IR 5001—Systems of Conflict and Dispute Resolution (4)  
*or* Rhet 3260—Communication Discussion in Small Group Decision Making (4)

**Forest Management Track Field Sessions**

**Itasca Session**—6 required credits (3 courses). Students should complete this 3½-week summer term offering between their freshman and sophomore or sophomore and junior years.
Cloquet Session—17 required credits (8 courses). Students should complete this 8-week session in the fall of their senior year.

Courses for both field sessions are listed under required professional courses and are identified as either Itasca or Cloquet.

Forest Management Professional Elective Courses—
Twenty credits, approved by adviser, are required. A maximum of eight credits of alternative professional courses may be used to satisfy this requirement.

Group 1—Managing Plants, Animals, Soils, and Water
FR 5120—Tree Biology (3)
FR 5142—Tropical Forests (3-4)
FR 5152—Forest Genetics (3)
FR 5153—Advanced Forest Hydrology (4)
FR 5231—Range Management (3)
FW 5603—Wildlife Habitats and Management (3)
FW 5604—Fisheries Ecology and Management (3)
Geo 1001—Introduction to Geology (4)
Geo 1021—Introduction to Geology Laboratory (1)
NRES 3060/5060—Water Quality in Natural Resource Management (3)
Soil 5710—Forest Soils (3)
The following courses may apply if they were not used to fulfill the core requirement:
Ent 5250—Forest and Shade Tree Entomology (4)
FR 5215—Forest Fire Ecology and Management (2)
NRES 3103—Climatology and Meteorology for Natural Resources Managers (2)
PIPs 5212—Diseases of Forest and Shade Trees (4)

Group 2—Resource Policy, Management, and Planning
FR 1201—Conservation of Natural Resources (3)
FR 3250/5250—Role of Renewable Natural Resources in Developing Countries (2)
FR 5264—Quantitative Techniques in Forest Management (3)
NRES 5200—Ethics and Values in Resource Management (3)
NRES 3202—Leadership and Management Skills Development (3)
NRES 5101—Integrated Natural Resources Planning (5)
NRES 5242—Management of Natural Resources Conflict (3)

Group 3—Assessment and Information Systems
FR 3300—Surveying (2)
FR 5130—Geographic Information Systems in Natural Resource Analysis (3)
FR 5228—Advanced Topics in Resource Assessment and Modeling (4)
FR 5412—Advanced Remote Sensing (4)

Forest Management Track total graduation requirements—
192 credits. Required core curriculum (72-77 credits); required professional courses (85-88 credits); professional electives (20 credits), and remaining diversified core curriculum, designated themes of liberal education, and electives (7-15 credits).

Forest Science Track Required Professional Courses

Introductory and General
FR 1001—Forest Resources Orientation (1)
NRES 1020—Information Technology in Natural Resources (2)

Resource Assessment
FR 5262—Remote Sensing of Natural Resources (4)
NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resources I (4)
FR 5218—Assessment and Modeling of Forests (3)

Management of Vegetation, Wildlife, Soil, and Water
FR 1100—Dendrology (4)
FR 3103—Climatology and Meteorology for Natural Resource Managers (2)
FR 3104—Forest Ecology (4)
FR 3100—Silviculture (4)
FR 5114—Forest Hydrology and Watershed Management (4)
or NRES 3060/5060—Water Quality in Natural Resource Management (3)
FW 3052—Introduction to Fisheries and Wildlife Conservation (3)
Enter 5250—Forest and Shade Tree Entomology (4)
or PIPs 5212—Diseases of Forest and Shade Trees (4)

Economics, Management, Policy, and Planning
FR 5232—Management of Recreational Lands (4)
NRES 5240—Natural Resources Policy and Administration (4)
NRES 5260—Economics and Natural Resources Management (3)
FR 5270—Forest Management and Planning (3)

Forest Science Track Field Sessions—Forest science students must take either the Itasca or Cloquet field session.

Itasca Session—6 required credits. Students should complete this 3½-week session between their freshman and sophomore or sophomore and junior years.
FR 3100—Minnesota Plants (2)
FR 3101—Northern Forest Ecosystems (3)
FR 3201—Forest Management Techniques (1)

Cloquet Session—17 required credits. Students should complete this 8-week session in the fall of their senior year.
FR 5101—Field Silviculture (4)
FR 5102—Forest Wildlife Habitat Management (1)
FR 5115—Forest Hydrology: Field Applications (2)
FR 5126—Silviculture: Soil-Site Relationships (2)
FR 5202—Remote Sensing: Field Applications (2)
FR 5222—Forest Resources Inventory (2)
FR 5236—Forest Recreation Planning (1)
FR 5248—Harvesting and Engineering (3)

Forest Science Track Science Core—27 credits required. These courses are in addition to the diversified core curriculum and other requirements and should be approved by faculty advisers. Some of the courses listed under professional elective courses may also qualify as science core courses.

Forest Science Professional Elective Courses—Eleven credits, approved by adviser, are required for students taking the Itasca field session.

Group 1—Managing Plants, Animals, Soils, and Water
FR 5120—Tree Biology (3)
FR 5142—Tropical Forests (3-4)
FR 5152—Forest Genetics (3)
FR 5153—Advanced Forest Hydrology (4)
FR 5231—Range Management (3)
FW 5603—Tropical Forests (3-4)
NRES 3060/5060—Water Quality in Natural Resource Management (3)
Soil 5710—Forest Soils (3)
The following courses may apply if they were not used to fulfill the core requirement:

- Ent 5250—Forest and Shade Tree Entomology (4)
- FR 5215—Forest Fire Ecology and Management (2)
- FR 3103—Meteorology and Climatology for Natural Resources Managers (2)
- PIPa 5212—Diseases of Forest and Shade Trees (4)

**Group 2—Resource Policy, Management, and Planning**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>FR 3250/5250</td>
<td>Role of Renewable Natural Resources in Developing Countries (2)</td>
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<tr>
<td>FR 5264</td>
<td>Quantitative Techniques in Forest Management (3)</td>
</tr>
<tr>
<td>NRES 1201</td>
<td>Conservation of Natural Resources (3)</td>
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<tr>
<td>NRES 3010</td>
<td>Ethics and Values in Resource Management (3)</td>
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<tr>
<td>NRES 3202</td>
<td>Leadership and Management Skills Development (3)</td>
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<td>NRES 5101</td>
<td>Integrated Natural Resources Planning (5)</td>
</tr>
<tr>
<td>NRES 5242</td>
<td>Management of Natural Resources Conflict (3)</td>
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**Group 3—Assessment and Information Systems**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>FR 3300</td>
<td>Surveying (2)</td>
</tr>
<tr>
<td>FR 5130</td>
<td>Geographic Information Systems in Natural Resource Analysis (3)</td>
</tr>
<tr>
<td>FR 5228</td>
<td>Advanced Topics in Resource Assessment and Modeling (4)</td>
</tr>
<tr>
<td>FR 5412</td>
<td>Advanced Remote Sensing (4)</td>
</tr>
</tbody>
</table>

**Group 4—Field Session Courses**

The Itasca field session may be used to satisfy Group 4 if it was not taken to fulfill the field session requirement. The Itasca session consists of three courses taken as a package while the Cloquet session courses may be taken individually if a student has already attended the Itasca field session.

**Forest Science Track total graduation requirements**—192 credits. Required core curriculum (72-77 credits); required professional courses (69-70 credits for students attending the Cloquet field session, 58-59 credits plus 11 credits of professional electives for students attending the Itasca field session); science core (27 credits); and remaining diversified core curriculum, designated themes of liberal education, and electives (18-24 credits).

**Forest Harvesting**—This option in the forest management or forest science track is for students interested in timber harvesting and its impact on other resource management considerations. The coursework is interdisciplinary and requires careful preparation for spending the senior year at the University of Idaho earning 14 semester credits (21 quarter credits). Students are trained for careers in logging engineering firms, forest products companies, and government agencies. Typical work includes planning and designing timber sales, supervising logging crews, designing and laying out roads, and managing wood procurement.

Students follow the forest management or forest science track the first three years, taking courses to meet University of Idaho prerequisites. Suggested courses are shown below. For more information, contact Dr. Charles R. Blinn, 314 Green Hall (612/624-3788).

### Junior Year

**CE 3100**—Introduction to Surveying and Mapping (4)*

*or* **FR 3300**—Elements of Surveying (Cloquet) (2)

**FR 3103**—Meteorology and Climatology for Natural Resource Managers (2)

**FR 3104**—Forest Ecology (4)

**FR 5218**—Assessment and Modeling of Forests (3)

**NRES 5260**—Economics and Natural Resources Management (3)

**FR 5262**—Remote Sensing (4)

**FW 3052**—Introduction to Fisheries and Wildlife Conservation (3)

**FR 5100**—Silviculture (4)

**NRES 5210**—Survey, Measurement, and Modeling Methods for Natural Resources I (4)

**NRES 5240**—Natural Resource Policy and Administration (3)

**Rhet 3562**—Writing in Your Profession (4)

**FR 5214**—Forest Hydrology (4)

**FR 5231**—Range Management (3)

*Students need override from the Department of Civil Engineering to register.*

### Senior Year

**Fall Quarter (Cloquet Session)**—17 credits

**Spring Semester (Idaho)**—6 or 9 semester credits

**Fall Semester (Idaho)**—5 or 8 semester credits

**Recommended Electives (Idaho)**

- **Bus 332**—Quantitative Methods in Business (3 sem/4.5 qtr cr; offered fall/spring)
- **CE 316**—Advanced Route Surveying (3 sem/4.5 qtr cr; offered spring)
- **CE 482**—Project Management Techniques (1-4 sem/1.5-6 qtr cr; offered spring)
- **For 476**—Forestry Project Evaluation (3 sem/4.5 qtr cr; offered fall)
- **For 477**—Integrated Forest Management Models (3 sem/4.5 qtr cr; offered spring)
- **For 575**—Advanced Forest Management (2 sem/3 qtr cr; offered alt yrs)
- **For Pr 431**—Production and Cost Control in Timber Harvesting (3 sem/4.5 qtr cr; offered alt yrs)
- **For Pr 433**—Forest Tractor Systems Analysis (3 sem/4.5 qtr cr)
- **For Pr 434**—Cable Systems Analysis (3 sem/4.5 qtr cr; taught as directed study alt yrs)*

*Students need override from the Department of Civil Engineering to register.*

### Urban Forestry

The urban forestry curriculum prepares students to plan and manage vegetation and associated natural resources in and near urban and rural communities. This typically includes consideration of forest, water, wildlife, and recreational and aesthetic values. The curriculum...
prepares students for direct involvement in resource management or for specialized supporting roles in areas such as urban planning and environmental education. Biological and managerial sciences are emphasized.

Urban forests include areas along streets and in parks, transportation right-of-ways, private lands, greenbelts, and open spaces. Urban foresters help communities plan and design their urban forests, supervise tree selection and planting, design insect and disease protection programs, and provide related services.

City governments are the principle employers, as well as state and federal forestry agencies, forest and arboricultural consulting firms, nurseries, and utility companies. Graduates may also be qualified for traditional forestry positions, including those in the federal government.

All urban forestry students take the same required core curriculum. In addition, students working with their adviser select professional electives to increase competence either in the technical or social managerial aspects of urban forestry. Those going into consulting or private business emphasize the technical aspects. Those interested in managing the urban landscape will emphasize the managerial and sociopolitical aspects.

**Required Core Curriculum**

*Note:* Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the urban forestry curriculum sheet and quarterly *Class Schedule* when selecting coursework.

**Communication Skills**

Comp 1011—Writing Practice (5)

or  Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1122—Public Speaking (4)

or  Spch 1101—Fundamentals of Speech-Communications: Oral Communication (4)

**Select two of the following:**

Comp 1027—Intermediate Expository Writing (4)

Comp 3014—Writing in the Social Sciences (4)

Comp 3015—Writing About Science (4)

Comp 3027—Advanced Expository Writing (4)

Rhet 3151—Writing in Your Major (4)

Rhet 3562—Writing in Your Profession (4)

**Select one of the following:**

Rhet 3266—Communication, Discussion in Small Group Decision Making (4)

Spch 3411—Small Group Communication Processes (4)

**Mathematical Thinking**

Math 1142—Short Calculus (5)

or  Math 1251, 1252—One-Variable Differential and Integral Calculus I-II (4, 4)

Stat 3011—Statistical Analysis (4)

or  Stat 5021—Statistical Analysis (4)

**Physical and Biological Sciences**

Biol 1009—General Biology (5)

or  similar basic biology course (5)

Biol 1103—Botany (5)

Chem 1001—General Principles of Chemistry (4)

and  Chem 1002—Elementary Organic Chemistry (4)

Phys 1001—The Physical World (4)

and  Phys 1005—Physics Laboratory (1)

or  Physics 1041—Introductory Physics (5)

Soil 1020—The Soil Resource (5)

or  Soil 3125—Basic Soil Science (4)

**History and Social Sciences**—Minimum of three courses totaling at least 12 credits, including one course with historical perspective.

ApEc 1101—Principles of Microeconomics (4)

or  Econ 1101—Principles of Microeconomics (4)

ApEc 1102—Principles of Macroeconomics (4)

or  Econ 1102—Principles of Macroeconomics (4)

Pol 1011—American Government and Politics (5)

**Arts and Humanities**—Minimum of three courses totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

* Offered through UC/CEE only.

**Required Professional Courses**

**Introductory and General**

FR 1001—Forest Resources Orientation (1)

NRES 1020—Information Technology in Natural Resources (2)

**Resource Assessment**

FR 3201—Forest Measurement Techniques (Itasca) (1)

NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resources I (4)

FR 5262—Remote Sensing of Natural Resources (4)

FR 5130—Geographic Information Systems in Natural Resource Analysis (3)

**Management of Vegetation, Wildlife, Soil, and Water**

FR 1100—Dendrology (4)

or  Hort 1021—Woody Plant Materials (5)

FR 3100—Minnesota Plants (Itasca) (2)

FR 3101—Northern Forest Ecosystems (Itasca) (3)

FR 3104—Forest Ecology (4)

FR 3500—Aboriculture (3)

FR 5100—Silviculture (4)

FR 5114—Forest Hydrology and Watershed Management (4)

or  NRES 3060/5060—Water Quality in Natural Resources Management (3)

FR 5120—Tree Biology (3)

FR 5500—Urban Forest Management (4)

Ent 5250—Forest Entomology (4)

PIPa 5212—Forest and Shade Tree Pathology (4)

**Economics, Management, and Policy**

FR 5232—Management of Recreational Lands (4)

NRES 5240—Natural Resources Policy and Administration (3)

NRES 5260—Economics and Natural Resources Management (3)

UrbS 3104—Introduction to Urban Studies (4)
Required Professional Elective Courses—Twenty credits, approved by adviser, are required. A maximum of eight credits of alternative professional courses may be used to satisfy this requirement.

Group 1—Technical
ForP 1301—Wood as a Raw Material (4)
FW 3052—Introduction to Fisheries and Wildlife Conservation (3)
FW 5603—Wildlife Habitats and Management (3)
Hort 1036—Plant Propagation (5)
Hort 3001—Growth Regulation of Horticulture Plants (5)
Hort 3002—Horticultural Cropping Systems (5)
Hort 3030—Landscape Design of Residential and Small Commercial Sites (4)
Hort 5046—Nursery Management I (4)* and Hort 5047—Nursery Scheduling and Enterprise Development (2) and Hort 5048—Nursery Management II (4)
Soil 3416—Plant Nutrients in the Environment (4)
Stat 3012—Statistics (4)
* No grade will be assigned for these three courses (Hort 5046, 5047, 5048) unless all three are completed.

Group 2—Managerial and Sociopolitical
ApEc 5630—Regional Development Systems (3)
Anth 5117—Natural Resources Anthropology (4)
FR 5233—Principles of Outdoor Recreation Planning (3)
Geo 1402—Geography and Environmental Systems (5)
LA 1401—The Designed Environment (4)
NRES 1201—Conservation of Natural Resources (3)
NRES 3001—Colloquium in Natural Resources and Environmental Studies (1-2)
NRES 3010—Ethics and Values in Resource Management (3)
NRES 3202—Leadership and Management Skills Development (3) or NRES 5242—Management of Natural Resources Conflict (3)
Soc 1001—Introduction to Sociology (4)
Soc 3601—Urban Community (4)
Spch 3451—Intercultural Communication: Theory and Practice (4)

Total graduation requirements—192 credits. Required core curriculum (81-86 credits); required professional courses (69-70 credits); required professional electives (20 credits); and remaining diversified core curriculum, designated themes of liberal education, and electives (16-22 credits).

Recreation Resource Management

The recreation resource management curriculum prepares students for comprehensive planning and management of land and water for recreation, with emphasis on natural and managed nonurban areas; administration of natural resources-oriented recreation programs in public and private sectors; and graduate study. Understanding social science aspects of natural resources use and developing skills in communications and planning are emphasized.

Graduates may become directly involved in recreation resource management or play specialized supporting roles in areas such as planning and public relations. Still others find employment in related fields such as environmental education and interpretation. Students pursuing graduate study may develop careers in teaching and/or research or seek advanced positions in recreation resource management and administration.

Required Core Curriculum

Note: Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the recreation resource management curriculum sheet and quarterly Class Schedule when selecting coursework.

Communication Skills
Comp 1011—Writing Practice (5) or Rhet 1101—Writing to Inform and Persuade (4)
Select two of the following:
Comp 1027—Intermediate Expository Writing (4)
Comp 3014—Writing in the Social Sciences (4)
Comp 3015—Writing About Science (4)
Comp 3027—Advanced Expository Writing (4)
Rhet 3151—Writing in Your Major (4)
Rhet 3562—Writing in Your Profession (4)
Select one of the following:
Rhet 1122—Public Speaking (4)
Spch 1101—Fundamentals of Speech Communication: Oral Communication (4)
Select one of the following:
Rhet 3266—Communication, Discussion in Small Group Decision Making (4)
Rhet 3254—Advanced Public Speaking (4)
Spch 3411—Small Group Communication Processes (4)

Mathematical Thinking
Math 1142—Short Calculus (5)
Stat 3011—Statistical Analysis (4) and Stat 3012—Statistical Analysis (4) or Stat 5021—Statistical Analysis (5)

Physical and Biological Sciences
Biol 1009—General Biology (5) or similar basic biology course (5)
Biol 1103—Botany (5)
Chem 1001—General Principles of Chemistry (4)
Chem 1002—Elementary Organic Chemistry (4)
Geo 1001—Introduction to Geology (4)
Geo 2011—Introduction to Geology Laboratory (1)
Soil 1020—The Soil Resource (4)* or Soil 3125—Basic Soil Science (4)
* Offered through UC/CEE only.

History and Social Sciences—Minimum of three courses totaling at least 12 credits, including one course with historical perspective.
ApEc 1101—Principles of Microeconomics (4) or Econ 1101—Principles of Microeconomics (4)
ApEc 1102—Principles of Macroeconomics (4) or Econ 1102—Principles of Macroeconomics (4)
Select one of the following three groups:

Psy 1001—Introduction to Psychology (4)
and Psy 3201—Introduction to Social Psychology (5)
or Soc 1001—Introduction to Sociology (4)
and Soc 3401—Principles of Social Organization (4)
or Soc 1001—Introduction to Sociology (4)
and Soc 3411—Understanding Formal Organizations (4)

Arts and Humanities—Minimum of three courses totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.
LA 1401—The Designed Environment (4)

Additional Recreation Resource Management Core Courses
Anth 5117—Natural Resources Anthropology (4)

Required Professional Courses
Introductory and General
FR 1001—Forest Resources Orientation (1)
or NRES 1001—Natural Resources Orientation (1)
NRES 1201—Conservation of Natural Resources (3)
or NRES 1040—Natural Resources as Raw Materials (3)
NRES 1020—Information Technology in Natural Resources (2)
NRES 3001—Colloquium in Natural Resources and Environmental Studies (1)

Resource Assessment
NRES 5210 Survey, Measurement, and Modeling Methods for Natural Resources (4)
FR 5130—Geographic Information Systems in Natural Resources (3)

Management of Vegetation, Wildlife, Soil, and Water
FR 1100—Dendrology (4)
FR 3104—Forest Ecology (4)
or Biol 3008—Ecology and Evolution (4)
FR 5114—Forest Hydrology and Watershed Management (4)
or NRES 3060/5060—Water Quality in Natural Resource Management (3)
NRES 3020/5020—Plant Resource Management and the Environment (4)
or FR 5100—Silviculture (4)
FW 3052—Introduction to Fisheries and Wildlife Conservation (3)

Management, Policy, and Planning
FR 5232—Management of Recreational Lands (4)
FR 5257—Recreation Land Policy (3)
FR 5259—Analysis of Outdoor Recreation Behavior (3)
NRES 3010—Ethics and Values in Resource Management (3)
NRES 5100—Interdisciplinary Problem Solving (5)
NRES 5245—Fundamentals of Landscape Planning for Recreation (3)
NRES 5800—Natural Resources Interpretation and Communication (3)
Rec 3530—Recreation and Park Areas and Facilities (4)
or Rec 3550—Park and Recreation Administration (4)
Rec 5750—Legal Issues in Leisure Services (4)
or NRES 5242—Management of Natural Resources Conflict (3)

Required Professional Elective Courses
Select one course from each of the following:

Group 1—Social and Managerial Sciences
ApÉc 5620—Regional Economic Analysis (3)
Geog 5393—Look of the Land (4)
NRES 3202—Leadership and Management Skills Development (3)
NRES 5101—Integrated Natural Resource Planning (5)
NRES 5240—Natural Resource Policy and Administration (3)
NRES 5242—Management of Natural Resources Conflict (3)
NRES 5260—Economics and Natural Resources Management (5)
Psy 5202—Attitudes and Social Behavior (4)
Soc 5305—Environmental Sociology (3)

Group 2—Recreation, Programming, and Management Services
Rec 5190—Commercial Recreation (3)
Rec 5250—Financing Leisure Services (3)
Rec 5310—Programming in Outdoor Recreation (4)
Rec 5350—Wilderness Outdoor Recreation (4)

Group 3—Management of Vegetation, Soil, and Water
EEB 5016—Ecological Plant Geography (5)
EEB 5608—Ecosystems: Form and Function (4)
NRES 3200—Field Ecology (Itasca) (4)
or FR 3101—Northern Forest Ecosystems (3)
and FR 3100—Minnesota Forest Plants (Itasca) (2)
and FR 3201—Forest Measurement Techniques (Itasca) (1)
LA 5202—Landscape Ecology (3)

Total graduation requirements—192 credits. Required core curriculum (89-94 credits); required professional courses (63-65 credits); required professional electives (9-15 credits); and remaining diversified core curriculum, designated themes of liberal education, and electives (18-31 credits).

Forest Resources Minor

This minor helps students in natural resources or related areas to develop a solid understanding of forest resource dynamics and management and the importance of forest resources in our society. The minor incorporates a fundamental science background plus coursework dealing with the multiple uses and manipulation of forest resources and their assessment and policy implications. Open to students who have completed the required background courses or the equivalent, the minor is awarded once the minor core and optional courses are completed.

Minor Core—15 credits
FR 1100—Dendrology (4)
NRES 1201—Conservation of Natural Resources (3)
FR 3104—Forest Ecology (4)
or Biol 3008—Ecology and Evolution (4)
FR 5100—Silviculture (4)
This requirement can also be met by the following courses offered at Itasca: FR 3100—Minnesota Plants (2), FR 3101—Northern Forest Ecosystems (3), FR 3201—Forest Measurements Techniques (1).

Optional Courses—10 credits, with at least one course from each of the following categories:
Management and Policy
ForP 1301—Wood as a Raw Material (4)
FR 3201—Forest Measurements Techniques (1)
FR 3250/5250—Role of Renewable Natural Resources in Developing Countries (2)
FR 5130—Geographic Information Systems in Natural Resources Analysis (3)
FR 5262—Remote Sensing (4)  
FR 5218—Assessment and Modeling of Forests (3)  
FR 5202—Remote Sensing: Field Applications (2) (Cloquet)  
FR 5222—Forest Resources Inventory (2) (Cloquet)  
FR 5214—Forest Hydrology (4)  
FR 5231—Range Management (3)  
FR 5232—Management of Recreational Lands (4)  
FR 5236—Forest Recreation Planning (1) (Cloquet)  
FR 5248—Harvesting and Engineering (3) (Cloquet)  
FR 5264—Quantitative Techniques in Forest Management (3)  
FR 5270—Forest Management and Planning (3)  
FR 5500—Urban Forest Management (4)  
NRES 5240—Natural Resource Policy and Administration (3)  

Biology  
Ent 5250—Forest Entomology (4)  
FR 3500—Aboriculture (3)  
FR 3100—Minnesota Plants (Itasca) (1)  
FR 3101—Northern Forest Ecosystems (Itasca) (3)  
FR 3103—Meteorology and Climatology for Natural Resource Managers (2)  
FR 5101—Field Silviculture (4) (Cloquet)  
FR 5114—Forest Hydrology and Watershed Management (4)  
FR 5115—Forest Hydrology, Field Applications (Cloquet) (2)  
FR 5120—Tree Biology (3)  
FR 5126—Silviculture: Soil-Site Relationships (Cloquet) (2)  
FR 5142—Tropical Forest Ecology (3)  
FR 5152—Forest Genetics (3)  
FR 5153—Advanced Forest Hydrology (4)  
FR 5215—Forest Fire Ecology and Management (2)  
NRES 3060/5060—Water Quality in Natural Resource Management (3)  
PpA 5212—Diseases of Forest and Shade Trees (4)

Natural Resources and Environmental Studies

The natural resources and environmental studies curriculum is for students interested in an interdisciplinary major focusing on the use and management of natural resources and the study of the environment.

Students have considerable flexibility in designing their study program. Programs can be designed to achieve one or more of the following objectives:

- Gain an understanding of the interaction between natural resources and modern society. Learn about the significant social and environmental roles that natural resources can play nationally and internationally.
- Prepare for careers in public and private organizations that are responsible for planning the use and management of natural resources and protection of the environment.
- Learn about subjects that will prepare you for positions in fields such as environmental assessment, resource inventory, natural resource planning, environmental protection, sustainable development, policy analysis, waste management, and natural resource management.
- Develop appropriate background for graduate study.

All students take the core curriculum of required courses (including two colloquia) listed below. In addition, a minimum of 24 credits in an area of concentration is required. Areas of concentration are listed below. Courses should be selected in collaboration with the student’s adviser. Course selection is critical because it helps define career direction and opportunities.

**Required Core Curriculum**

*Note:* Some of the required core curriculum courses also fulfill diversified core curriculum and designated themes requirements. Refer to the natural resources and environmental studies curriculum sheet and quarterly *Class Schedule* when selecting coursework.

**Freshman and Sophomore Years—91-93 credits**

**Communication Skills**

Rhet 1101—Writing to Inform and Persuade (4)  
Rhet 1104—Library Research Methods (1)  
Rhet 1151—Writing in Your Major (4)  
Rhet 1222—Public Speaking (4)  

**Mathematical Thinking**

Math 1142—Short Calculus (5)  
\( \text{or} \) Math 1251, 1252—One-Variable Differential and Integral Calculus (4,4)  
Stat 3011—Statistical Analysis (4)  

**Physical and Biological Sciences**

Biol 1009—General Biology (5)  
Biol 1103—Botany (5)  
\( \text{or} \) Biol 1106—General Zoology (5)  
Chem 1051, 1052—Chemical Principles I-II (4,4)  
\( \text{or} \) Chem 1001—General Principles of Chemistry (4)  
\( \text{and} \) Chem 1002—Elementary Organic Chemistry (4)  
Geo 1001—Introduction to Geology (4)  
\( \text{and} \) Geo 1021—Introduction to Geology Lab: Geology of Minnesota (1)  
Phys 1041—Introductory Physics (5)  
\( \text{or} \) Phys 1001, 1005—The Physical World (4,1)  

**History and Social Sciences**—Minimum of three courses totaling at least 12 credits, including one course with historical perspective.

ApEc 1101—Principles of Microeconomics (4)  
\( \text{or} \) Econ 1101—Principles of Microeconomics (4)  
ApEc 1102—Principles of Macroeconomics (4)  
\( \text{or} \) Econ 1102—Principles of Macroeconomics (4)  

**Arts and Humanities**—Minimum of three totaling at least 12 credits, including courses in two of the following: literature, philosophical perspective, and visual or performing arts.
**Additional required CNR freshman and sophomore courses**

NRES 1001—Orientation to Natural Resources and Environmental Studies (1)
NRES 1020—Information Technology in Natural Resources (2)
NRES 1040—Natural Resources as Raw Materials (3)
NRES 1201—Conservation of Natural Resources (3)
NRES 3001—Colloquium in Natural Resources and Environmental Studies (1)
NRES 3010—Ethics and Values in Resource Management (3)
Pol 1001—Political Science (5)

* Two (1 credit each) colloquia are required.

**Junior and Senior Year—68-74 credits, including concentration:**

- FR 3104—Forest Ecology (4)
  - or Biol 3008—Ecology and Evolution (4)
- FR 5103—Meteorology and Climatology for Natural Resource Managers (2)
  - or FR 5114—Forest Hydrology and Watershed Management (4)
- NRES 3060/5060—Water Quality in Natural Resource Management (3)
- FW 3054—Biological Conservation: An Ecosystem Approach (3)
- NRES 3020/5020—Plant Resource Management and the Environment (4)
  - or FR 5100—Silviculture (4)
- NRES 5100—Problem Solving in Natural Resources and Environmental Studies (4)
- NRES 5210—Survey, Measurement, and Modeling Methods for Natural Resources I (4)
- NRES 5240—Natural Resource Policy and Management (3)
- NRES 5260—Economics and Natural Resources Management (3)
- Rhet 3562—Writing in Your Profession (4)
  - or Soil 1200—The Soil Resource (4)
  - or Soil 3125—Basic Soil Science (4)
- Soil 3220—Soil Conservation and Land Management (4)
  - or Soil Physical Properties and the Environment (4)
  - or Soil 5510—Field Study of Soil for Environmental Assessment (4)

* Offered through UC/CEE only.

**Total graduation requirements—180 credits. Required core curriculum (135-143); area of concentration (24 credits minimum); and remaining diversified core curriculum, designated themes of liberal education and electives (13-21).**

**Areas of Concentration—24 credits minimum**

**Environmental Issues and Planning**—Focus on major issues in natural resources and the environment at local, national, and worldwide levels. Emphasis on understanding, analysis, planning, and decision making required to address these issues. For more information, contact Dr. Dorothy H. Anderson, 301F Green Hall, (612) 624-2721, danderso@forestry.umn.edu; Dr. Melvin J. Baughman, 330G Green Hall, (612) 624-0734, mbbaughma@forestry.umn.edu; Dr. Francesca J. Cuthbert, 320 Hodson Hall, (612) 624-1756, cuthb001@maroon.tc.umn.edu; Dr. Paul V. Ellefson, 330B Green Hall, (612) 624-3735, pellefso@forestry.umn.edu; Dr. Howard M. Hoganson, North Central Experiment Station, Grand Rapids, MN 55744 (218) 327-4490; Dr. Peter A. Jordan, 201C Green Hall, (612) 624-9281, pjordan@forestry.umn.edu; Dr. Anne Kapucinsciki, 130 Hodson Hall, (612) 624-2720, akapuci@forestry.umn.edu; Dr. David W. Lime, 301G Green Hall, (612) 624-2250, dlime@forestry.umn.edu; or Dr. Dietmar W. Rose, 301H Green Hall, (612) 624-9711, drose@forestry.umn.edu.

**ApEc 5650—Economics of Natural Resource Policy (4)**
**FR 3104—Forest Ecology (4)**
**or EEB 3001—Introduction to Ecology (4)**
**Econ 5611—Resource and Environmental Economics (4)**
**FR 5232—Management of Recreation Lands (4)**
**FR 5130/5131—Geographic Information Systems and Laboratory (3)**
**FR 5257—Recreation Land Policy (3)**
**FW 5460—Pollution Impacts on Aquatic Systems (2)**
**FW 5603—Wildlife Habitats and Management (3)**
**FW 5604—Fisheries Ecology and Management (3)**
**Geog 3361—Land Use and The Federal Government (4)**
**Geog 3362—Land Use and State Government (4)**
**Geog 5361—The Geography of Land Ownership (4)**
**Geog 5444—Water Resources, Individuals and Institutions (4)**
**Geog 5601—Introduction to Land Use Planning (4)**
**NRES 5101—Integrated Natural Resource Planning (5)**
**NRES 5242—Management of Natural Resources Conflict (3)**
**NRES 5245—Fundamentals of Landscape Planning for Recreation (3)**
**Pol 3872—International Organizations and the Environment (4)**
**Pol 5523—Politics of the Regulatory Process (4)**

**Environmental Learning**—Focus on skills and knowledge for working in a variety of information and education fields associated with natural resources and the environment. Emphasis on environmental issues at local, regional, and global levels; the human dimensions of environmental education; and “best practices” for diverse audiences and teaching and learning in nonformal settings. For more information, contact Dr. Dorothy H. Anderson, 301 Green Hall, (612) 624-2721, danderso@forestry.umn.edu; Dr. Melvin J. Baughman, 330G Green Hall, (612) 624-0734, mbbaughma@forestry.umn.edu; Dr. Stephan P. Carlson, 340 Coffey Hall, (612) 626-1259, carls009@maroon.tc.umn.edu; Dr. James A. Cooper, 110 Hodson Hall, (612) 624-4228, jcooper@forestry.umn.edu; Dr. James R. Kitts,
### BACCALAUREATE PROGRAMS

220 Hodson Hall, (612) 624-3000, jkitts@forestry.umn.edu; or Dr. Steven B. Laursen, 235 NRAB, (612) 624-9298, slaursen@forestry.umn.edu.

**AgEc 3040**—Appropriate Technology in International Development (3)

**Agro 5200**—World Food Problems (3)

**AnPl 3010**—Environment and World Food Production (4)

**Anth 3116**—Ecological Anthropology (3)

**CI 5537**—Principles of Environmental Education (3)

**EPsy 5115**—Psychology of Adult Learning (3)

**FR 5257**—Recreation Land Policy (3)

**FR 5259**—Analysis of Outdoor Recreation Behavior (3)

**FR 5403**—Fundamentals of Natural Resource Education (1-3)

**HSci 3812**—Introduction to History of Science: Scientific Revolution (4)

**NRES 3070**—From Local to Global Ecology (3)

**NRES 5242**—Management of Natural Resource Conflict (3)

**NRES 5245**—Fundamentals of Land Use Planning for Recreation (3)

**NRES 5500**—Natural Resources Interpretation and Communication (3)

**Pipa 3004**—Air Pollution, People, and Plants (3)

**Pol 3872**—International Organizations and the Environment (4)

**Rec 5300**—Adventure Education (3)

**Rec 5310**—Programming in Outdoor Education (4)

**Rhet 5395**—In Search of Nature (3)

### Resource Assessment—Focus on development of skills for assessing the magnitude and quality of various natural and environmental resources with techniques such as remote sensing, quantitative analysis, and geographic information systems. For more information, contact Dr. Marvin E. Bauer, 220B Green Hall (612) 624-3000, mbauer@forestry.umn.edu; Dr. Paul V. Bolstad, 301B Green Hall, (612) 624-3000, pbolstad@forestry.umn.edu; Dr. Andrew M. Mohn, 105 Green Hall, (612) 624-7281, cmohn@forestry.umn.edu; Dr. Hans G. Gregersen, 301D Green Hall, (612) 624-6298, hggregers@forestry.umn.edu; Dr. Carl A. Mohn, 105 Green Hall, (612) 624-7281, cmohn@forestry.umn.edu; Dr. James A. Perry, 312 Green Hall, (612) 624-9796, jtperry@forestry.umn.edu; Dr. Dietmar W. Rose, 301H Green Hall, (612) 624-9711, drose@forestry.umn.edu; or Dr. Edward I. Sucoff, 103 Green Hall, (612) 624-7249, esucoff@forestry.umn.edu.

**ApEc 3040**—Economic Development of American Agriculture (4)

**ApEc 3610**—Resource Development and Environmental Economics (4)

**Econ 5611**—Economics of Resource and Environmental Economics (4)

**FR 3104**—Forest Ecology (4)

**FR 3105**—Introduction to Ecology (4)

**FR 3300**—Elements of Surveying (2)

**FR 5130**—Geographic Information Systems in Natural Resource Analysis (3)

**FR 5218**—Assessment and Modeling of Forests (3)

**FR 5228**—Advanced Topics in Resource Assessment and Modeling (4)

**FR 5231**—Range Management (3)

**FR 5232**—Management of Recreational Lands (4)

**FR 5245**—Fundamentals of Landscape Planning for Recreation (3)

**FR 5262**—Remote Sensing of Natural Resources (4)

**FR 5412**—Advanced Remote Sensing (4)

**FR 5500**—Urban Forest Management (4)

**FW 5460**—Pollution Effects on Aquatic Systems (2)

**FW 5603**—Wildlife Habitats and Management (3)

**FW 5604**—Fisheries Ecology and Management (3)

**FW 5620**—Geographic Information Systems for Fisheries, Wildlife, and Biological Conservation (4)

**Geog 5562**—Introduction to Geographic Information Systems (4)

**Hort 5015**—Restoration and Reclamation Ecology (4)

**NRES 3060/5060**—Water Quality in Natural Resource Management (3)

**NRES 5101**—Integrated Natural Resource Planning (5)

**NRES 5220**—Survey, Measurement, and Modeling Methods for Natural Resources II (4)

**NRES 5242**—Management of Natural Resources Conflict (3)

**NRES 5245**—Fundamentals of Landscape Planning for Recreation (3)

**Soil 5020**—Environmental Impact Assessment (4)

**Soil 5510**—Field Study of Soils: Morphology (1)

**Soil 5511**—Field Study of Soils: Mapping (1)

**Soil 5515**—Soil Development Classification and Geography (4)

**Soil 5550**—Peatlands Formation, Classification, and Utilization (3)

**Stat 5302**—Applied Regression Analysis (5)

### Resources and Environmental Protection—Focus on understanding major environmental protection issues and their solutions. Typical concerns include solid waste management, global climate change, and protection of plant and animal resources. For more information, contact Dr. Ira R. Adelman, 200 Hodson Hall, (612) 624-3600, iadelman@forestry.umn.edu; Dr. Glenn R. Furnier, 101E Green Hall, (612) 624-3720, gfurnier@forestry.umn.edu; Dr. Hans M. Gregersen, 301D Green Hall, (612) 624-6298, hggregers@forestry.umn.edu; Dr. Anne Kapuscinski, 130 Hodson Hall, (612) 624-2720, akapusci@forestry.umn.edu; Dr. James R. Kitts, 216 Hodson Hall, (612) 624-3298, jkitts@forestry.umn.edu; Dr. Carl A. Mohn, 105 Green Hall, (612) 624-7281, cmohn@forestry.umn.edu; Dr. James A. Perry, 312 Green Hall, (612) 624-9796, jtperry@forestry.umn.edu; Dr. Dietmar W. Rose, 301H Green Hall, (612) 624-9711, drose@forestry.umn.edu; or Dr. Edward I. Sucoff, 103 Green Hall, (612) 624-7249, esucoff@forestry.umn.edu.

**ApEc 5600**—Land Economics (3)

**Econ 5611**—Research and Environmental Economics (4)

**FR 3104**—Forest Ecology (4)

**FR 3105**—Introduction to Ecology (4)

**FR 5130**—Geographic Information Systems in Natural Resource Analysis (3)

**FR 5262**—Remote Sensing of Natural Resources (4)

**FW 5460**—Pollution Impacts on Aquatic Systems (2)

**FW 5570**—Avian Conservation (1-2)

**FW 5603**—Wildlife Habitats and Management (3)

**FW 5604**—Fisheries Ecology and Management (3)

**FW 5605**—Fisheries Ecology and Management (3)
FW 5620—Geographic Information Systems for Fisheries, Wildlife, and Biological Conservation (4)
Geo 5108—Advanced Environmental Geology (4)
Hort 5015—Restoration and Reclamation Ecology (4)
NRES 3060/5060—Water Quality in Natural Resource Management (3)
Pol 3872—International Organizations and the Environment (4)
Pol 5523—Politics of the Regulatory Process (4)
PubH 5181—Air Pollution (3)
PubH 5253—Introduction to Hazardous Waste Management (3)*
Soil 3416—Soil Fertility (5)

* Offered through UC/CEE only

Soil Resources—Focus on management, interpretation, and inventory of soil resources. Emphasis on preventing soil erosion and reducing land degradation and adverse impacts of erosion on water and air quality. For more information, contact Dr. Edward I. Sucoff, 103 Green Hall, (612) 624-7249, esucoff@forestry.umn.edu.

FR 5262—Remote Sensing in Natural Resources (4)
FR 5114—Forest Hydrology and Watershed Management (4) or NRES 3060/5060—Water Quality in Natural Resource Management (3)
FR 5130—Geographic Information Systems in Natural Resources Analysis (3)
FR 5231—Range Management (3)
Soil 3416—Plant Nutrients in the Environment (4)
Soil 3417—Plant Nutrients in the Environment Laboratory (1)
Soil 5210—Environmental Biophysics (3)
Soil 5232—Soil Physics: Transport Processes in the Soil (4)
Soil 5510—Field Study of Soils: Morphology (1)
Soil 5511—Field Study of Soils: Mapping (1)
Soil 5515—Soil Development, Classification, and Geography (1)
Soil 5555—Wetland Soils (4)
Soil 5560—Interpretation of Land Resources (3)
Soil 5610—Soil Biology (4)
Soil 5710—Forest Soils (3)
Any 3xxx course in biochemistry or organic chemistry or any adviser-approved courses that will develop interests and professional competence in soils.

Waste Management—Focus on the requirements needed to manage the waste stream. Understanding processes involved in managing wastes; implementing procedures for municipal solid waste composting, incineration, and recycling; and implications of landfilling solid waste. For more information, contact Dr. Edward I. Sucoff, 103 Green Hall, (612) 624-7249, esucoff@forestry.umn.edu.

CE 5510—Solid and Hazardous Waste Management (4)
Econ 5611—Resource and Environmental Economics (4)
FW 5460—Pollution Effects on Aquatic Systems (3)
Pol 5523—Politics of the Regulatory Process (4)
Soil 5600—Principles of Waste Management (4)
Soil 5610—Soil Biology (4)

The following courses are highly recommended and offered in the new solid waste management certificate program available through UC/CEE only. Not all courses are available every year. For more information consult the solid waste management certificate program adviser (612/625-2500) and the UC/CEE bulletin.

New Core Courses
Regulatory and Legal Framework of Solid Waste Management (2)
Applied Economics of Solid Waste Management (2)
Solid Waste Policy and Administration (2)

Existing Courses
CE 5098—Risk and Uncertainty in Environmental Decision Making (4)
CE 5580—Environmental Law for Engineers (4)
ID 5525—Garbage, Government, and the Globe (4)
ID 5526—Garbage, Government, and the Globe (4)
PA 5221—Law and Urban Affairs (3)
PA 5230—Strategic Planning and Management (3)
Pol 5610—Environmental Ethics, Politics, and Public Policy (4)
PubH 5150—Topics: Environmental Health Law I (3)
PubH 5150—Topics: Environmental Health Law II (3)
PubH 5255—Hazardous Materials Management (3)
PubH 5253—Introduction to Hazardous Waste Management (3)

Water Resources—Focus on the management of water resources to achieve desired water quantity and quality. Special emphasis on water movement, storage, and hydrologic and climatologic cycles. (Students should take Math 1251 and 1252 in place of Math 1142.) For more information, contact Dr. Kenneth N. Brooks, 301 Green Hall, (612) 624-2774, kbrooks@forestry.umn.edu; or Dr. James A. Perry, 312 Green Hall, (612) 624-9796, jpperry@forestry.umn.edu.

BAE 5540—Watershed Engineering (4)
BAE 5550—Water Management Engineering (4)
AgET 5410—Hydrology and Water Quality (5)
CE 3400—Fluid Mechanics (4)
CE 5401—Water Resources Engineering (4)
CE 5505—Water Quality Engineering (4)
CE 5510—Solid and Hazardous Waste Management (4)
CE 5515—Water and Wastewater Microbiology (4)
FR 3104—Forest Ecology (4) or EEB 3001—Introduction to Ecology (4)
FR 3103—Meteorology and Climatology for Natural Resource Managers (2)
FR 5114—Forest Hydrology and Watershed Management (4)
FR 5115—Forest Hydrology: Field Applications (2)
FR 5153—Advanced Forest Hydrology (4)
FW 5460—Pollution Impacts on Aquatic Systems (2)
Geo 5601—Linnology (4)
Geo 5641—General and Physical Hydrology (4)
Geog 5444—Geography of Water Resources, Individuals, and Institutions (4)
Hort 5015—Restoration and Reclamation Ecology (4)
NRES 3060/5060—Water Quality in Natural Resource Management (3)
Soil 5240—Microclimatology (4)