



College of
**FOOD, AGRICULTURAL AND
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College of FOOD, AGRICULTURAL AND NATURAL RESOURCE SCIENCES

General Information

The College of Food, Agricultural and Natural Resource Sciences (CFANS) offers 14 undergraduate majors, three pre-majors and 22 minors on a picturesque, close-knit campus where students meet some of the best professors in the world and outstanding students from all over.

CFANS is focused on helping students experience the joy of discovering solutions through science: CFANS calls it Solution-Driven Science™. Its students and faculty are working to discover new agricultural practices that increase yields and improve the environment, more nutritious and flavorful foods, and ways to conserve natural resources and biodiversity in the face of global climate and environmental change. CFANS is also making discoveries and preparing students for the emerging bioeconomy and biofuels industry. These are all important areas to explore, and CFANS is making progress.

The college encourages students to visit. The St. Paul campus offers the convenience of a small college, the rewards of learning at a top research university, and the fun of living in a vibrant and exciting urban area.

CFANS student learning communities help students get to know their major, fellow students, and professors. Distinguished faculty members share their knowledge, enthusiasm, and experience with students every day, teaching undergraduate courses and acting as academic advisers. The St. Paul campus features a wireless learning environment, and when students need extra help, a strong academic support system is in place to make sure they succeed. CFANS is an active participant in the University's study abroad initiative to send 50 percent of undergraduate students abroad during their four years at the University. In addition, the St. Paul Campus Career Center works closely with students to help them land exciting summer internships and, most importantly, great jobs in fields related to their studies after graduation.

Whether students are interested in animals, bioresources and bioenergy, business, education and leadership, the environment and plant sciences, or foods and health, CFANS is the perfect place for academic and personal growth!

Admission

For information regarding freshman admission, visit the Office of Admissions website at admissions.tc.umn.edu or call 612-625-2008 or 800-752-1000.

Transfer admission—For information regarding transfer admission, including transfer admission by students who have previously attended a University of Minnesota campus, visit the CFANS transfer admission website at: fans.umn.edu/UndergraduateStudents/FutureTransferStudents/index.htm.

Non-degree admission—Non-degree admission is primarily for students who are pursuing coursework in CFANS departments but who are not seeking a degree, or for students who are preparing to apply to a graduate program offered by CFANS departments but who still have prerequisites to satisfy. Admission may be processed at any time before the first day of class. The non-degree-seeking student category is also open to staff members in CFANS departments who are taking courses through the Regents Scholarship Program and to CFANS graduates returning for coursework.

Students who enter CFANS as non-degree-seeking students with the intention of transferring later to the Graduate School should be aware of restrictions on the number of non-degree-seeking credits that may be transferred to a graduate program. See the [Graduate School Catalog](#).

Degrees/Majors

The College of Food, Agricultural and Natural Resource Sciences offers 14 majors; the major curricula all lead to the bachelor of science degree.

Agricultural and Food Business Management

- Business management
- Financial management
- Individualized
- Marketing, sales, and food industry management

Agricultural Education

- Agricultural education teacher licensure
- Agricultural leadership and communication

Agricultural Industries and Marketing

- Crops and soils industries
- Food industries
- Individualized

Animal Science

- Animal industry
- Animal production
- Science/biotechnology/pre-veterinary medicine

Applied Economics

- Food retailing
- Individualized professional
- Management and finance
- Marketing
- Regional and public economics
- Resources and the environment
- Trade and development

Applied Plant Science

- Agroecology
- Plant improvement
- Plant utilization

Bioproducts Marketing and Management

- Marketing and management
- Residential building science and technology

Horticulture**Environmental Sciences, Policy and Management**

Conservation and resource management
 Corporate environmental management
 Environmental education and communication
 Environmental science
 Policy, planning, law and society

Fisheries and Wildlife

Conservation biology
 Fisheries
 Wildlife
 Pre-veterinary medicine

Food Science**Forest Resources**

Forest management and planning
 Forest conservation and ecosystem management
 Urban and community forestry

Nutrition

Didactics program in dietetics
 Nutritional science

Recreation Resource Management

Recreation resource management
 Resource based tourism

Because the first year of coursework is somewhat similar among many of these programs, students may transfer between majors at the end of their freshman or sophomore year with little or no credit loss.

Most CFANS majors offer an orientation class for all incoming students. This class provides interaction with faculty and alumni in their chosen professional field, and exposure to career, learning abroad, and student life opportunities.

Preprofessional Opportunities

Students may prepare for the following upper division/professional programs in CFANS:

Pre-bioproducts and biosystems engineering

(B.S. granted by the College of Science and Engineering, formerly the Institute of Technology)

Pre-medicine and pre-dentistry**Pre-veterinary medicine****Minors**

The College of Food, Agricultural and Natural Resource Sciences offers the following minors:

Agronomy**Animal science****Applied economics****Bio-based products engineering****Climatology****Corporate environmental management****Entomology****Environmental sciences, policy and management****Fisheries and wildlife****Food science****Food systems and the environment****Forest resources****Horticulture****Integrated pest management in cropping systems****International agriculture****Nutrition****Recreation resource management****Soil science****Sustainable agriculture****Sustainability studies****Urban and community forestry****Water science**

CFANS students may also apply for a minor in any University department or program. Upon graduation, the minor is listed on the transcript with degree and major. For assistance in planning a minor, contact the Student Services Office. Detailed minor requirements are described in the CFANS Degree Programs and Minors section of this catalog.

Graduate Degrees—The master of science (M.S.) and the doctor of philosophy (Ph.D.) in 16 areas of study are offered through the Graduate School in cooperation with the College of Food, Agricultural and Natural Resource Sciences. For more information, consult the [Graduate School Catalog](#) or CFANS website at cfans.umn.edu.

Policies

Grading—All required courses in the major must be taken A-F with grades of C- or better; students who receive a grade below C- in a major course must repeat the course.

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 must report the incident to the Office for Student Conduct and Academic Integrity. For more information about the honor system, contact the Student Services Office.

Directed Study—With instructor approval, students may take custom-designed courses through independent study. Contact the Student Services Office for more information.

Policy Waivers—Occasionally it may be to the educational advantage of both the student and the department to consider an alternative or substitution in an academic policy or curricular requirement, provided the basic spirit of the policy or requirement is maintained. A student may petition for a departure from normal procedure. Students must receive approval from the major coordinator for any major course exceptions and an academic adviser's recommendation before the petition is routed to the Student Scholastic Standing Committee for consideration of general policy exceptions.

Special Examinations for Credit—Students who believe their knowledge of a subject is equal to that which is required to complete a particular course may request to take an examination for credit. If the department and college approve, arrangements can be made with an appropriate instructor to take an examination. A fee is assessed for each examination. Credit by

special examination is not granted for language or mathematics courses taken in high school. (See Credit by Examination in the Policies, Processes, and Systems section of this catalog.)

Suspension—to appeal a suspension (see Probation in the Policies, Processes, and Systems section of this catalog), a student must obtain a Petition for Reinstatement from the Student Services Office. The petition must be completed and turned in to the Student Scholastic Standing Committee, along with any supporting documents. The final decision rests with the Student Scholastic Standing Committee, which informs the student of its decision in writing.

Graduation Requirements

To receive the B.S. degree, CFANS students must meet the following requirements.

- Complete the prescribed curriculum as listed in the student's degree program.
- Achieve a cumulative GPA of at least 2.00, with grades of C- or better in each course in the major. Major course work is defined as all required courses listed in each major program including specialization courses, track courses, concentration courses, professional courses, and writing courses. The only courses not included in this policy are free electives and courses taken beyond those in the major coursework to satisfy liberal education requirements.
- Satisfy liberal education requirements.
- Satisfy residence and other general University requirements.
- Officially apply for graduation.
- Meet all financial obligations to the University.

Advising

Advising services for both current and prospective students are provided by professional academic advisers and by departmental faculty.

Each CFANS student, with adviser assistance, is responsible for learning curricular and graduation requirements and developing a course program and timetable to meet them. All freshmen students are assigned a professional academic adviser for their first year and then assigned a faculty adviser within their major area of study at the beginning of their sophomore year. All transfer students are assigned immediately to a faculty adviser in their major area of study.

Honors

The University Honors Program (UHP) offers rigorous and interdisciplinary curricula along with other honors experiences designed for highly qualified and motivated students. Honors courses, available only to honors students, offer small class size, close interaction with world-class faculty, and an engaging learning atmosphere. The University Honors Program serves honors students in all colleges. See the University Honors Program section at the front of this catalog for more information, or visit the University Honors Program website at honors.umn.edu.

Students admitted to honors before fall 2008 will continue to follow the honors requirements outlined at the time they entered their college honors program. All students admitted to honors as of fall 2008 forward follow the requirements of the University Honors Program. Students admitted to a college honors program

before fall 2008 and who change colleges, must apply to UHP if they want to participate in Honors. If admitted, they will be held to the new UHP requirements. See the University Honors Program section of this catalog for further instructions on how to apply.

Special Learning Opportunities

Many majors in CFANS offer field trips, summer field sessions, hands-on experiential learning, and other opportunities. Speak with your adviser or major coordinator for more information.

The CFANS Research Apprenticeship Program is a two-year opportunity designed to provide incoming freshmen with an early chance to develop their interests in formal research. The program includes faculty mentorship, research funding, and action-oriented programming that encompasses the research experience from beginning to end. The apprenticeship experience seeks to stimulate students' minds, broaden their perspectives, expand their intellectual and social networking, and strengthen connections within the University and global community.

The University of Minnesota's **Undergraduate Research Opportunities Program (UROP)** offers financial awards to undergraduates for research, scholarly, or creative projects undertaken in partnership with a faculty member. Applications are accepted in the fall and early spring each year. For more information or an application packet, students should contact the CFANS Student Services Office, 190 Coffey Hall (612-624-6768).

CFANS juniors and seniors may participate in **internships** designed for students who wish to reinforce their academic experience by working in an area related to their course of study. Students work full time either fall or spring semester or during the summer. Students earn 1–3 credits for satisfactory completion of an internship. Students may enroll in two different internships, for a total of 6 credits. Salaries are paid by the cooperating businesses, industries, producers, and agencies participating in the program. For more information, students should consult their adviser or the St. Paul Campus Career Center in 198 McNeal Hall (612-624-2710).

Student Learning Communities in CFANS provide the glue that holds together an undergraduate's college experience. Students create positive academic and social relationships with faculty and other new students as they make the transition to college and become aware of the many resources available on campus and at the University. Each CFANS major has a learning community that intentionally links or clusters two or more courses and enrolls a common group of students with similar academic interests.

The Dean's Engaged Leaders Program is an exciting, two-year opportunity for incoming first-year students who are committed to developing their potential to enhance our civic spaces through leadership, a commitment to diversity, and stewardship of the urban, rural, and natural environment. The program provides a unique opportunity for interested students to explore questions related to developing necessary and relevant leadership skills in academic, social, and public service contexts. The program emphasizes hands-on learning, real-world applications, and relationship building with faculty and community leaders. For more information, students should contact the CFANS Student Services Office, 190 Coffey Hall (612-624-6768).

Environment House is open to first-year students in Bailey Residence Hall who are interested in sustainability and the health and well-being of our natural world. Environment House helps students get to know one another, professors, the University, and the broader Twin Cities' environment through weekend retreats, field trips, speakers and special programs.

Pre-Veterinary Medicine House, also located in Bailey Hall, offers an array of social and professional programs to help students learn more about animal-related careers and educational opportunities. Programs include study groups and tutoring, opportunities to participate in animal-related service activities, and off-campus visits to sites of interest.

The St. Paul **Engaged Leaders House** is a special community in Bailey Residence Hall for incoming freshmen admitted to the Dean's Engaged Leaders Program in CFANS. The house provides an opportunity for students to experience a diverse community that lives, studies, and shares extracurricular experiences together. Note: Students interested in the Engaged Leaders Program are strongly encouraged to select the St. Paul Engaged Leaders House as their top housing preference since it serves as the hub for many activities.

International Programs

The College of Food, Agricultural and Natural Resource Sciences offers several types of study abroad experiences that can enhance degree work, including field study, enrollment in international institutions, and integrated classroom study. International Programs in Food, Agricultural and Natural Resource Sciences (IPFANS) coordinates international opportunities in CFANS (135 Skok Hall; 612-624-3221; international.cfans.umn.edu).

International Learning Grants are available through CFANS to defray costs of overseas study and travel; a written proposal and application are required. Preference is given to proposals for study in non-English-speaking countries. Students must initiate and plan the project with the aid of a faculty adviser. For more information, see the website at www.cfans.umn.edu/UndergraduateStudents/CurrentStudents/LearningAbroad or contact the CFANS Student Services Office, 190 Coffey Hall (612-624-6768).

The University of Minnesota offers opportunities through 360 universities in over 70 countries around the world. The Learning Abroad Center, 230 Heller Hall on the West Bank has more information for all of these opportunities. In addition, guidance is available from your adviser, IPFANS staff, or on the Learning Abroad Center's website at umabroad.umn.edu. Students must attend or complete the online First Step meeting (umabroad.umn.edu/programs/getStarted.html) to investigate how to proceed with planning and selecting a program that fits their individual educational program.

Students fluent in their host country's language can participate in classroom study programs that permit students to take regular university courses alongside students from the host country. The University's student exchanges and consortium memberships provide access to universities in many countries. Conservation and resource management, agricultural, business and policy, plant, and animal science curricula are available throughout the world.

CFANS students need not always seek credit in their major. Study abroad is encouraged for language acquisition or cultural learning. The resulting credits can often be used as electives

or to fulfill second language or liberal education requirements. The University and other institutions sponsor a broad range of intensive language and area studies programs.

MAST Experience Abroad—This program provides qualified individuals the opportunity to broaden their agricultural/horticultural skills and knowledge as well as develop or improve international language skills. Practical training programs of 3 to 12 months are available to individuals between the ages of 18 and 30. Participants gain a cross-cultural experience by living and working with a host family in Australia, Austria, Brazil, Denmark, Finland, France, Germany, Italy, the Netherlands, New Zealand, Sweden, Switzerland, or the United Kingdom. Departure dates are in January, April, June, and September. For more information, students should contact the MAST International office, 135 Skok Hall (612-624-3740).

Scholarships

Through generous donations from alumni, friends, and corporate sponsors, the College of Food, Agricultural and Natural Resource Sciences provides significant scholarship support to its undergraduate students. Separate funding opportunities (achievement, diversity, learning abroad, research, professional development, internship) exist for new freshmen, transfer, and current students. Some department scholarships are also available.

Career Information

The St. Paul Campus Career Center, 198 McNeal Hall, offers assistance and advice to students seeking summer jobs and internships, as well as permanent employment after graduation. Job search assistance for all students is provided by career services staff and by department faculty. A series of workshops are provided by the center on topics such as résumé writing, interviewing, initiating internship and job searches, and summer/seasonal intern hiring updates. See stpaulcareers.umn.edu for more information.

Student Organizations

CFANS Student Board—The Student Board promotes student involvement in issues related to the quality and content of education both in and out of the classroom. The board creates channels of communication between the students, faculty, and administration of CFANS. Students may file for election to the board or may serve as a representative of one of the clubs or organizations affiliated with the college. More information is available in the Student Services Office in 190 Coffey Hall.

St. Paul Ambassadors—The St. Paul Ambassadors is a voluntary, honorary organization consisting of CFANS undergraduate students who assist in promoting the college to prospective students and their parents, alumni, potential donors, and the community. Ambassadors gain experience in public relations and recruitment, and develop communications skills through public speaking engagements and small group discussions with prospective students. More information is available in the Student Services Office in 190 Coffey Hall.

St. Paul Board of Colleges—The St. Paul Board of Colleges directs and coordinates student activities and encourages student leadership throughout the St. Paul campus. Its membership is drawn from the following colleges: Biological Sciences;

Food, Agricultural and Natural Resource Sciences; Continuing Education; Design; Education and Human Development; and Veterinary Medicine. The board cooperates with the Minnesota Student Association, the Twin Cities Student Unions Board of Governors and the respective Student Boards.

The Twin Cities Student Unions Board of Governors—The Twin Cities Student Unions Board of Governors is an advisory board for the St. Paul Student Center and Coffman Memorial Union. Composed of students elected to represent various academic and student organizations on the Minneapolis and St. Paul campuses, the board formulates policies for operation of the student unions and establishes its budget. For more information, call 612-624-4738.

Student Representation on College and University Committees—All CFANS committees and most all-University committees have student representatives.

Governance—Students are encouraged to participate in governance activities at the department, college, or campus level. Within each department, several committees (including curriculum committees) have student representatives. Students serve on CFANS committees and on the Student Board, which advises the dean on student issues and concerns. Students may also participate in the St. Paul Board of Colleges, which directs student activities and acts as a liaison between the student body and administration, and on the Twin Cities Unions Board of Governors, which establishes programs, operation policies, and budgets for the St. Paul Student Center and Coffman Union. Finally, CFANS student senators are elected to serve on the executive committee of the Minnesota Student Association and the University Senate.

Clubs—Student clubs and honor societies in the College of Food, Agricultural and Natural Resource Sciences include:

- Agricultural Education Club
- Alpha Epsilon Delta (pre-med and pre-vet)
- Alpha Tau Alpha
- Alpha Zeta Fraternity (an honor and service fraternity)
- American Association of Bovine and Swine
- American Society of Agricultural Engineers, Student Branch
- Applied Economics Student Association
- Block and Bridle
- Collegiate Agri-Women
- Cornercopia Student Organic Farm
- Environmental Studies Club
- Equestrian Club
- Fisheries and Wildlife Club (with an affiliated student chapter of The Wildlife Society)
- Food Science and Nutrition Club
- Forestry Club
- Forest Products Society/Student Chapter
- Frenatae—the Entomology Student Association
- Gopher Crops and Soils
- Gopher Dairy Club
- Gopher Poultry Science Club
- Horticulture Club
- National Agri-Marketing Association (NAMA)
- National Society for Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS)
- Pre-Vet Med Club
- Production Animal Medicine Club (Pre-PAM)
- Recreation Resource Management Club
- Residential Building Science and Technology Club
- Student Chapter of the Institute of Packaging Professionals (IOPP)
- Student Chapter of the Paper Industry Management Association (PIMA)
- Student Chapter of the Society of American Foresters
- Student Chapter of the Technical Association of the Pulp and Paper Industry (TAPPI)
- Student Organization of Nutrition and Dietetics (SOND)
- Students in Honors
- Turf Club (Golf Course Superintendent Association, U of M Student Chapter)
- University of Minnesota Bass Fishing Team
- Water Resources Students in Action
- Xi Sigma Pi Honor Society

Directory

Administration

Office of the Dean

Dean: Allen S. Levine
277 Coffey Hall, 612-624-1234

Associate Dean for Academic Programs and Faculty Affairs: Jay Bell
190 Coffey Hall, 612-625-6703

Associate Dean for Extension: Greg Cuomo
277 Coffey Hall, 612-625-7098

Senior Associate Dean for Research and Graduate Affairs: Abel Ponce de León
277 Coffey Hall, 612-624-2299

Chief of Staff: Lori Engstrom
277 Coffey Hall, 612-626-5985

Director of Alumni Relations: Mary Buschette
190E Coffey Hall, 612-624-1745

Director of Diversity Programs: Karl Lorenz
190 Coffey Hall, 612-624-9299

International Programs

Director of International Programs: John Vreyens
135 Skok Hall, 612-624-1774

Student Services

Director of Student Services: Bill Ganzlin
190 Coffey Hall, 612-624-3047

Admissions/Prospective Student Services
General Information, 612-624-6768

Departments

Agricultural, Food and Environmental Education
Major Coordinator: Bradley Greiman
320M Vocational and Technical Education Building,
612-624-5644

Agronomy and Plant Genetics
Head: Nancy Ehlke
411 Borlaug Hall, 612-625-1791

Animal Science
Head: James Linn
205 Haecker Hall, 612-624-1205

Applied Economics
Head: Brian Buhr
231 Classroom Office Building, 612-625-0231

Bioproducts and Biosystems Engineering
Head: Shri Ramaswamy
207 Kaufert Lab and 213 Biosystems and Agricultural
Engineering Building, 612-624-8797

Entomology
Interim Head: David Ragsdale
219 Hodson Hall, 612-624-3278

Fisheries, Wildlife, and Conservation Biology
Head: Francesca Cuthbert
204 Hodson Hall, 612-624-1756

Food Science and Nutrition
Head: Gary Reineccius
225 Food Science and Nutrition, 612-624-3224

Forest Resources
Head: Alan Ek
115 Green Hall, 612-624-3400

Horticultural Science
Head: Emily Hoover
305 Alderman Hall, 612-624-7711

Plant Pathology
Head: Carol Ishimaru
495 Borlaug Hall, 612-625-9736

Soil, Water, and Climate
Head: Carl Rosen
439 Borlaug Hall, 612-625-8114

Outreach

Bell Museum of Natural History
Director: Susan Weller
10 Church Street S.E. (Mpls.), 612-624-7217

Cloquet Forestry Center
Director of Operations: Ronald Severs
Cloquet, Minn., 218-726-6400

Minnesota Landscape Arboretum
Director: Ed Schneider
Chanhassen, Minn., 952-443-1400

North Central Research and Outreach Center
Head: Daniel L. Erkkila
Grand Rapids, Minn., 218-327-4361

Northwest Research and Outreach Center
Head: Larry Smith
Crookston, Minn., 218-281-8602

Southern Research and Outreach Center
Head: Forrest Izuno
Waseca, Minn., 507-837-5615

Southwest Research and Outreach Center
Head: Pauline Nickel
Lamberton, Minn., 507-752-5068

UMore Park
Director of Operations: Forrest Izuno
Rosemount, Minn., 651-423-2455

West Central Research and Outreach Center
Director of Operations: Lee Johnston
Morris, Minn., 320-589-1711

NOTE: All offices are located on the St. Paul campus unless otherwise noted.

College of FOOD, AGRICULTURAL AND NATURAL RESOURCE SCIENCES

Degree Programs and Minors

Agricultural and Food Business Management B.S.

Applied Economics

- Required credits to graduate with this degree: 120.
- Required credits within the major: 64.

The agricultural and food business management major is offered jointly by CFANS and the Carlson School of Management. The curriculum emphasizes concepts and methods from economics and business management and their use in identifying, analyzing, and solving management problems related to food, agriculture, natural resources, and economic development. The program provides a balance between applied economics and business management studies, with a limited amount of applied science. Students may elect a variety of courses in their junior and senior years to accommodate special interests and career goals.

Graduates of the curriculum are prepared for a wide range of employment opportunities in the food system and other agribusinesses. Examples of employment areas include finance and banking, management, input, commodity and food marketing, sales, administration, public and industrial relations, production management, economic and statistical analysis, managerial accounting, management information systems, and transportation.

Students completing the program may also pursue graduate studies in preparation for research, teaching, or continuing education positions in academic institutions, government agencies, or industry.

Admission Requirements

Students must complete 60 credits before admission to the program.

Freshmen and transfer students are usually admitted to pre-major status before admission to this major.

A GPA above 2.00 is preferred for the following:

- 2.80 for students already admitted to the degree-granting college.
- 2.80 for students transferring from another University of Minnesota college.
- 2.80 for students transferring from outside the University.

Students are admitted to the major after satisfactory completion of a pre-agricultural and food business management program. Admission standards are developed in conjunction with the Carlson School of Management. Application deadlines are April 15 for fall semester and October 15 for spring semester.

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Required Courses for Admission

Students must complete the following management “tool” courses taken A-F before entering the program and earn a GPA of at least 2.50 in these courses.

- ACCT 2050—Introduction to Financial Reporting (4 cr)
- APEC 1101—Principles of Microeconomics (3 cr)
 - or ECON 1101—Principles of Microeconomics, SOCS (4 cr)
- APEC 1102—Principles of Macroeconomics, IP, SSCI (3 cr)
 - or ECON 1102—Principles of Macroeconomics, IP, SSCI (4 cr)
- OMS 2550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)
 - or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)
- MATH 1142—Short Calculus (4 cr)
 - or MATH 1271—Calculus I (4 cr)

Program Requirements

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

Students may not major in both agricultural and food business management and applied economics.

Communication Courses

- WRIT 3152W—Writing on Issues of Science and Technology, WI (4 cr)
 - or WRIT 3562W—Technical and Professional Writing, WI (4 cr)
- COMM 1101—Introduction to Public Speaking (3 cr)
- MGMT 3033W—Business Communication, WI (3 cr)
 - or COMM 3441—Introduction to Organizational Communication (3 cr)
 - or WRIT 3257—Scientific and Technical Presentations (3 cr)

Professional Courses

- APEC 1001—Orientation to Applied Economics (1 cr)
 - or CFAN 3201—Strategic Career Planning (1 cr)
- APEC 3001—Applied Microeconomics: Consumers, Producers, and Markets (4 cr)
- APEC 3002—Applied Microeconomics: Managerial Economics (4 cr)
- APEC 3006—Applied Macroeconomics: Government and the Economy (3 cr)
- APEC 3007—Applied Macroeconomics: Policy, Trade, and Development, GP (3 cr)
- APEC 3501—Agribusiness Finance (3 cr)
- APEC 4821W—Business Economics and Strategy, WI (3 cr)
- ACCT 3001—Introduction to Management Accounting (3 cr)
- MGMT 3001—Fundamentals of Management (3 cr)
- MKTG 3001—Principles of Marketing (3 cr)
- OMS 3001—Introduction to Operations Management (3 cr)

Ethics and Responsible Management Courses

Student must take one course (3 credits) that fosters one or more of the following objectives: responsible judgment about the management of natural resources and the environment; responsible judgment regarding ethical and policy issues related to agriculture; application of global perspectives to agricultural, food, and environmental issues and decisions; application of a historical perspective to the role of science and technology.

- CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
 - or AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
 - or AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 - or ANSC 1011—Animals and Society, CIV (3 cr)
 - or BBE 5212—Safety and Environmental Health Issues in Plant and Animal Production and Processing, H (3 cr)
 - or BIOL 4501—Social Uses of Biology (3 cr)
 - or EE 1701W—Energy, Environment, and Society, WI (3 cr)
 - or EEB 3001—Ecology and Society, ENV (3 cr)
 - or ESPM 1011—Issues in the Environment, ENV (3 cr)

or ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
 or ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)
 or FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)
 or GEO 3005—Earth Resources (3 cr)
 or GEOG 3401—Geography of Environmental Systems and Global Change, ENV (4 cr)
 or HSCI 3331—Technology and American Culture (3 cr)
 or HSCI 3332—Science and American Culture, HIS, DSJ (3 cr)
 or PBIO 1212—Plants and Society (3 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Financial Management Sub-plan

Students must take a minimum of two courses (6–8 credits) in APEC or ECON and a minimum of two courses (6–8 credits) from CSOM.

Required Courses for the Sub-plan

Take 4 or more course(s) from the following:

Take 2 or more course(s) from the following:

APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4481—Futures and Options Markets (3 cr)
 APEC 4501—Financial Modeling (3 cr)
 APEC 5341—Public Finance (3 cr)
 APEC 5751—Global Trade and Policy, IP (3 cr)
 ECON 3701—Money and Banking (3 cr)
 ECON 4432W—International Finance, WI (3 cr)
 ECON 4751—Financial Economics (3 cr)

Take 2 or more course(s) from the following:

ACCT 5101—Intermediate Accounting I (4 cr)
 ACCT 5125—Auditing Principles and Procedures (4 cr)
 ACCT 5160—Financial Statement Analysis (2 cr)
 BLAW 3058—The Law of Contracts and Agency (4 cr)
 FINA 4121—Financial Markets and Interest Rates (2 cr)
 FINA 4122—Banking Institutions (2 cr)
 FINA 4221—Principles of Corporate Finance (2 cr)
 FINA 4321—Portfolio Management and Performance Evaluation (2 cr)
 INS 4100—Corporate Risk Management (2 cr)

Business Management Sub-plan

Students must take a minimum of two courses (6–8 credits) in APEC or ECON and a minimum of two courses (6–8 credits) from CSOM.

Required Courses for the Sub-plan

Take 4 or more course(s) from the following:

Take 2 or more course(s) from the following:

APEC 3451—Food and Agricultural Sales (3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4481—Futures and Options Markets (3 cr)
 APEC 4501—Financial Modeling (3 cr)
 APEC 5711—U.S. Agricultural and Environmental Policy (3 cr)
 APEC 5811—Cooperative Organization (3 cr)

Take 2 or more course(s) from the following:

ACCT 3201—Intermediate Management Accounting (2 cr)
 ACCT 5100—Corporate Financial Reporting (4 cr)
 BLAW 3058—The Law of Contracts and Agency (4 cr)
 FINA 4221—Principles of Corporate Finance (2 cr)
 HRIR 3021—Human Resource Management and Industrial Relations (3 cr)
 HRIR 3032—Training and Development (2 cr)
 HRIR 3042—The Individual and Organizational Performance (2 cr)

MGMT 3010—Introduction to Entrepreneurship (4 cr)
 MGMT 4002—Managerial Psychology (4 cr)
 MGMT 4008—Entrepreneurial Management (4 cr)

Marketing, Sales, and Food Industry Management Sub-plan

Students must take a minimum of two courses (6–8 cr) in APEC or ECON and a minimum of two courses (6–8 cr) from CSOM or DHA 2215, 3242 only.

Required Courses for the Sub-plan

Take 4 or more course(s) from the following:

Take 2 or more course(s) from the following:

APEC 3411—Commodity Marketing (3 cr)
 APEC 3451—Food and Agricultural Sales (3 cr)
 APEC 3821—Retail Center Management (3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4103—World Food Problems, GP (3 cr)
 APEC 4451W—Food Marketing Economics, CIV, WI (3 cr)
 APEC 4461—Horticultural Marketing (3 cr)
 APEC 4481—Futures and Options Markets (3 cr)
 APEC 4501—Financial Modeling (3 cr)
 APEC 5711—U.S. Agricultural and Environmental Policy (3 cr)
 APEC 5751—Global Trade and Policy, IP (3 cr)
 APEC 5811—Cooperative Organization (3 cr)

Take 2 or more course(s) from the following:

RM 2215—Multichannel Retailing (3 cr)
 RM 3242—Retail Buying (3 cr)
 MKTG 3010—Marketing Research (4 cr)
 MKTG 3040—Buyer Behavior (4 cr)
 MKTG 4030—Sales Management (4 cr)
 MKTG 4050—Integrated Marketing Communications (4 cr)
 MKTG 4060—Marketing Channels (4 cr)
 MKTG 4080W—Marketing Strategy, WI (4 cr)
 OMS 3056—Supply Chain Planning and Control (4 cr)

Individualized Sub-plan

Students preparing for career opportunities that emphasize skills such as accounting, communications, law, or information systems may use this alternative to design an area of emphasis. A program of study under the emphasis must be approved by the adviser and the major coordinator. At least 6 of the 12 credits must be completed after receiving approval.

Required Courses for the Sub-plan

Select 12 credits from individual electives

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Agricultural Education B.S.

CFANS/CEHD

- Required credits to graduate with this degree: 120.
- Required credits within the major: 71 to 98.
- This program requires summer terms.

The undergraduate agricultural education program is a collaborative partnership between the College of Food, Agricultural and Natural Resource Sciences (CFANS) and the College of Education and Human Development (CEHD). Graduates of the program are prepared for formal and nonformal teaching positions as well as organizational and business career opportunities that emphasize leadership and communication skills.

Two specializations are available. The agricultural education teacher licensure specialization prepares students to meet Minnesota Board of Teaching requirements. Students who complete the agricultural leadership and communications specialization seek career paths in organizations and businesses within food, agriculture, and natural resources.

Admission Requirements

A GPA above 2.00 is preferred for the following:

- 2.50 for students already admitted to the degree-granting college.
- 2.50 for students transferring from another University of Minnesota college.
- 2.50 for students transferring from outside the University.

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Physical and Biological Sciences

CHEM 1015—Introductory Chemistry: Lecture (3 cr)
 CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
 AGRO 1101—Biology of Plant Food Systems, BIOL (4 cr)
 or BIOL 1009—General Biology, BIOL (4 cr)

Mathematics

MATH 1031—College Algebra and Probability, MATH (3 cr)

Major Courses

AFEE 1001—Introduction to Agricultural Education and Extension (1 cr)
 AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
 AFEE 2051—Current Technical Competencies (3 cr)
 AFEE 2096—Professional Practicum in Agricultural Education: Early Experience (1–3 cr)
 AFEE 5111W—Agricultural Education: Methods of Teaching, WI (4 cr)
 CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

Agricultural Leadership and Communication Sub-plan

This specialization prepares students for careers in organizations and businesses within food, agriculture, and natural resources. Employment opportunities range from training and development, commodity, agribusiness, sales and marketing, extension, nonformal teaching and learning, public relations, university-related, nonprofit, and communications. It provides students with the opportunity to take a broad spectrum of courses within food, agriculture, and natural resources. Professional courses are focused around leadership, communication, and organizational principles. Students develop leadership and communication skills that employers have determined are critical to a successful career.

Internships provide students with relevant experience and networking opportunities. Students use electives to declare a minor or certificate to supplement coursework in the agricultural education major; some require limited additional coursework.

Required Courses for the Sub-plan

Animal Science

ANSC 1101—Introductory Animal Science (4 cr)

Applied Economics and Agribusiness

APEC 1101—Principles of Microeconomics (3 cr)
 APEC 1251—Principles of Accounting (3 cr)
 or APEC 3411—Commodity Marketing (3 cr)
 or APEC 3xxx
 APEC 3451—Food and Agricultural Sales (3 cr)
 or BIE 3061—Professional Sales Management (3 cr)

Natural Resources

Take 3 or more credit(s) from the following:

EEB 1xxx
 ESPM 1xxx
 FR 1xxx
 FW 1xxx

Plant Science

CFAN 3001—Pests and Crop Protection (3 cr)
 or HORT 1001—Plant Propagation, BIOL (4 cr)

Soil Science

SOIL 1125—The Soil Resource (4 cr)
 or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

Agricultural Education

AFEE 3096—Experiential Learning: Production and Business (1–8 cr)
 AFEE 5361—World Development Problems (3 cr)

Leadership

AFEE 2221—People Skills for Leadership (3 cr)
 AFEE 4221—Rural Leadership Development (3 cr)

Communication

COMM 1101—Introduction to Public Speaking (3 cr)
 AFEE 3221—Presentations and Meeting Management for Agricultural Industry (3 cr)

Human Resource Development

HRD 3001—Introduction to Human Resource Development (3 cr)
 HRD 3xxx

Agricultural Education Teacher Licensure Sub-plan

This specialization prepares students to meet Minnesota Board of Teaching requirements in agricultural education for grades 5–12 and for teacher coordinator of work-based learning. It includes a broad study of courses in food, agriculture, and natural resources. Professional courses are focused on standards of effective teaching and content pedagogy. Students gain relevant knowledge through integrated field experience. In addition to teaching in the formal classroom, graduates are prepared for a wide range of employment opportunities in training, nonformal teaching and learning, sales, management and public relations in the food, agriculture, and natural resource industry.

Students may graduate from this program with a minimum 2.00 overall GPA, but a minimum 2.50 overall GPA is required for recommendation for Minnesota teaching licensure.

Required Courses for the Sub-plan

Social Sciences

PSTL 1281—Principles of Psychology, SOCS (4 cr)
 or PSY 1001—Introduction to Psychology, SSCI (4 cr)

Communication

WRIT 3562W—Technical and Professional Writing, WI (4 cr)

Animal Science

ANSC 1101—Introductory Animal Science (4 cr)
Take 1 or more course(s) from the following:
 ANSC 1403—Companion Animal Nutrition and Care (3 cr)
 ANSC 1511—Food Animal Products for Consumers (3 cr)
 ANSC 2012—Livestock and Carcass Evaluation (3 cr)
 ANSC 2401—Animal Nutrition (3 cr)
 ANSC 3221—Animal Breeding (4 cr)

Applied Economics and Agribusiness

APEC 1101—Principles of Microeconomics (3 cr)
Take 1 or more course(s) from the following:
 APEC 1251—Principles of Accounting (3 cr)
 APEC 3411—Commodity Marketing (3 cr)
 APEC 3451—Food and Agricultural Sales (3 cr)
 BIE 3061—Professional Sales Management (3 cr)
 or APEC 3811—Principles of Farm Management (3 cr)
 or APEC 3821—Retail Center Management (3 cr)

Food Science

FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)

Natural Resources

Take 3 or more credit(s) from the following:
 EEB 3001—Ecology and Society, ENV (3 cr)
 ESPM 1011—Issues in the Environment, ENV (3 cr)
 FR 1xxx
 FW 1002—Wildlife: Ecology, Values, and Human Impact (3 cr)
 FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)

Plant Science

CFAN 3001—Pests and Crop Protection (3 cr)

Take 3 or more credit(s) from the following:

AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
 AGRO 4401—Plant Genetics and Breeding (4 cr)
 HORT 1001—Plant Propagation, BIOL (4 cr)
 HORT 1003—Master Gardener Core Course: Horticulture for Home and Garden (3 cr)
 HORT 1013—Floral Design (3 cr)
 HORT 3002W—Greenhouse Management, WI (3 cr)

Soil Science

SOIL 1125—The Soil Resource (4 cr)
 or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

Technology

AFEE 3112—Technical Drawing and Production Technologies (3 cr)

Education

CI 5452—Reading in the Content Areas for Initial Licensure Candidates (1 cr)
 EDHD 5001—Learning, Cognition, and Assessment (3 cr)
 EDHD 5003—Developmental and Individual Differences in Educational Contexts (2 cr)
 EDHD 5004—Teaching Students With Special Needs in Inclusive Settings (2 cr)
 EDHD 5005—School and Society (2 cr)
 EDHD 5007—Technology for Teaching and Learning (1.5 cr)
 EDHD 5009—Human Relations: Applied Skills for School and Society (1 cr)
 PUBH 3003—Fundamentals of Alcohol and Drug Abuse (2 cr)
 or PUBH 3005—Fundamentals of Alcohol and Drug Abuse for Teacher Education (1 cr)

Agricultural Education

AFEE 5112—Agricultural Education Program Organization and Curriculum for Youth (3 cr)
 AFEE 5114—Agricultural Education Teaching Seminar (1 cr)
 AFEE 5116—Coordination of SAE Programs: Work-based Learning (2 cr)
 AFEE 5118—Strategies for Managing and Advising the FFA Organization (2 cr)
 WHRE 5697—Teaching Internship: School and Classroom Settings (2 cr)
 WHRE 5698—Teaching Internship (3–8 cr)
 AFEE 3221—Presentations and Meeting Management for Agricultural Industry (3 cr)
 or COMM 1101—Introduction to Public Speaking (3 cr)

Agricultural Industries and Marketing B.S.

College of Food, Agricultural and Natural Resource Sciences

- Required credits to graduate with this degree: 120.
- Required credits within the major: 108.

This major prepares students for careers in agricultural industries. Industries related to modern agriculture include manufacturers and distributors of farm production inputs (such as equipment, structures, health products, seeds, fertilizers, and crop protection products); assemblers, processors, manufacturers, and distributors of products originating from farms (products such as meat, milk, eggs, wool, grains, fruits, vegetables, nursery crops, flowers, and turf); and finance and insurance industries providing agricultural credit. Agribusinesses such as these, as well as state, federal, and marketing agencies, need individuals who have a broad education in the scientific (and technical) aspects of agriculture, effective work and communication skills, and quantitative and qualitative skills to solve business problems.

The scientific knowledge and technical skills necessary to become an effective agribusiness professional are provided through requirements in the basic and agricultural sciences and are strengthened by selection of one of three areas of emphasis: crops and soils industries, food industries, or an individualized emphasis.

With 21 free standing elective credits, all AIM majors are encouraged to pursue a CFANS or other minor. Only 6 credits in the AIM major may also be counted towards a minor. For students interested in preparing for the Certified Crop Advisor (CCA) exam or the certified professional agronomist (CPAg) programs, a minor in agronomy is highly recommended.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

Students must complete at least 14 credits in their sub-plan emphasis plus an internship or a student project.

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

Quantitative Foundations

MATH 1031—College Algebra and Probability, MATH (3 cr)
or MATH 1131—Finite Mathematics (3 cr)
or MATH 1142—Short Calculus (4 cr)
ANSC 3011—Statistics for Animal Science (3 cr)
or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)
or ESPM 3012—Statistical Methods for Environmental Scientists and Managers, MATH (4 cr)

Communication

COMM 1101—Introduction to Public Speaking (3 cr)
WRIT 3257—Scientific and Technical Presentations (3 cr)
WRIT 3562W—Technical and Professional Writing, WI (4 cr)
COMM 3411—Introduction to Small Group Communication (3 cr)
WRIT 4258—Information-Gathering Techniques in Scientific and Technical Communication (3 cr)
or COMM 3422—Interviewing and Communication (3 cr)
or COMM 3441—Introduction to Organizational Communication (3 cr)

Business Management

APEC 1101—Principles of Microeconomics (3 cr)
APEC 1102—Principles of Macroeconomics, IP, SSCI (3 cr)
APEC 1251—Principles of Accounting (3 cr)
MKTG 3001—Principles of Marketing (3 cr)
APEC 3411—Commodity Marketing (3 cr)
or APEC 4451W—Food Marketing Economics, CIV, WI (3 cr)
APEC 3451—Food and Agricultural Sales (3 cr)
or MKTG 4030—Sales Management (4 cr)
APEC 3811—Principles of Farm Management (3 cr)
or APEC 3821—Retail Center Management (3 cr)
or PSTL 1513—Small Business Fundamentals With E-Business Applications (3 cr)
or MGMT 3001—Fundamentals of Management (3 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Crops and Soils Industries Sub-plan

Students must complete at least 14 credits in their area of emphasis and an internship or a student project.

Required Courses for the Sub-plan

Science Foundations

CHEM 1015—Introductory Chemistry: Lecture (3 cr)
CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
AGRO 1101—Biology of Plant Food Systems, BIOL (4 cr)
or BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
or BIOL 1009—General Biology, BIOL (4 cr)
BIOC 1001—Elementary Biochemistry (3 cr)
or BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)

Agriculture

AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
AGRO 1660—First-Year Colloquium/Experience in Agroecosystems Analysis (2 cr)
AGRO 4660—Senior Capstone (2 cr)
AGRO 4096—Professional Experience Program: Internship (1–3 cr)
or AIM 4011—Student Project/Field Investigation (3 cr)
or AGRO 4093—Directed Studies for Advanced Students (1–4 cr)

Crops and Soils Industries

CFAN 3001—Pests and Crop Protection (3 cr)
SOIL 3416—Plant Nutrients in the Environment (3 cr)
AGRO 4005—Applied Crop Physiology and Development (4 cr)
or take the following course pair
BIOL 3002—Plant Biology: Function (2 cr)
and BIOL 3005W—Plant Function Laboratory, WI (2 cr)
AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
or AGRO 4103—World Food Problems, GP (3 cr)
or AGRO 4401—Plant Genetics and Breeding (4 cr)
or AGRO 4505—Biology, Ecology, and Management of Invasive Plants (3 cr)
or AGRO 4603—Field Crop Scouting and Problem Diagnosis (3 cr)
or AGRO 4605—Management Strategies for Crop Production (3 cr)
or ESPM 3221—Soil Conservation and Land-Use Management (3 cr)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Individualized Sub-plan

At least 14 credits must be selected in consultation with an adviser and with approval of the AIM major committee. The courses comprising the individualized emphasis must have a definite theme. A collection of unrelated courses is unacceptable.

Required Courses for the Sub-plan

Science Foundations

CHEM 1015—Introductory Chemistry: Lecture (3 cr)
 CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
 SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
 AGRO 1101—Biology of Plant Food Systems, BIOL (4 cr)
or BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
or BIOL 1009—General Biology, BIOL (4 cr)
 BIOC 1001—Elementary Biochemistry (3 cr)
or BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)

Agriculture

AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
 AGRO 4660—Senior Capstone (2 cr)
 AGRO 4096—Professional Experience Program: Internship (1–3 cr)
or AIM 4011—Student Project/Field Investigation (3 cr)
or AGRO 4093—Directed Studies for Advanced Students (1–4 cr)

Orientation

APEC 1001—Orientation to Applied Economics (1 cr)
or AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
or AGRO 1660—First-Year Colloquium/Experience in Agroecosystems Analysis (2 cr)
or FSCN 1001—Orientation to Nutrition (1 cr)

Individualized Emphasis Electives

14 credits from individual electives

Food Industries Sub-plan

Students must complete at least 14 credits in the area of emphasis and an internship or a student project.

Required Courses for the Sub-plan

Science Foundations

CHEM 1021—Chemical Principles I (4 cr)
 CHEM 1022—Chemical Principles II (4 cr)
 AGRO 1101—Biology of Plant Food Systems, BIOL (4 cr)
or BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
or BIOL 1009—General Biology, BIOL (4 cr)

Agriculture

FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)
 FSCN 1112—Principles of Nutrition (3 cr)
 FSCN 2021—Introductory Microbiology (4 cr)
or VBS 2032—General Microbiology With Laboratory (4 cr)
 AIM 4011—Student Project/Field Investigation (3 cr)
or FSCN 4096—Professional Experience Program: Internship (1–4 cr)
or AGRO 4093—Directed Studies for Advanced Students (1–4 cr)

Orientation

FSCN 1001—Orientation to Nutrition (1 cr)
or AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)

Food Industries

FSCN 3102—Introduction to Food Science (3 cr)
 FSCN 3731—Food Service Operations Management Laboratory (2 cr)
 FSCN 3732—Food Service Operations Management (3 cr)
 FSCN 4131—Food Quality (3 cr)
 ANSC 1511—Food Animal Products for Consumers (3 cr)
or FSCN 3612—Life Cycle Nutrition (3 cr)
or FSCN 3615—Sociocultural Aspects of Food, Nutrition, and Health (3 cr)
or FSCN 4614—Community Nutrition, CD (3 cr)
or MKTG 3010—Marketing Research (4 cr)

Agronomy Minor

Agronomy and Plant Genetics

This is a free-standing minor.

- Required credits in this minor: 17.

This minor provides strong science-based courses emphasizing crop management in the context of sustainable ecosystems. It is well suited for students majoring in agriculture, food and environmental education; animal science; business and economics; environmental science, or for students seeking knowledge and principles of crop production. The minor allows students to complete coursework providing the minimal background needed to prepare for the Certified Crop Advisor (CCA) exams. Students must complete a minimum of 17 credits.

Minor Requirements

Required Courses

CFAN 3001—Pests and Crop Protection (3 cr)
 AGRO 4005—Applied Crop Physiology and Development (4 cr)
 AGRO 4660—Senior Capstone (2 cr)
 SOIL 3416—Plant Nutrients in the Environment (3 cr)

Electives

Take 5 or more credit(s) from the following:

AGRO 2104—Grain and Seed Technology (2 cr)
 AGRO 2501—Plant Identification for Urban and Rural Landscapes (2 cr)
 AGRO 4093—Directed Studies for Advanced Students (1–4 cr)
 AGRO 4401—Plant Genetics and Breeding (4 cr)
 AGRO 4505—Biology, Ecology, and Management of Invasive Plants (3 cr)
 AGRO 4605—Management Strategies for Crop Production (3 cr)
 AGRO 4603—Field Crop Scouting and Problem Diagnosis (3 cr)

Animal Science B.S.

Animal Science

- Required credits to graduate with this degree: 120.
- Required credits within the major: 93 to 103.
- This program requires summer terms.

The animal science major prepares students for veterinary school, work as managers and technical advisers for animal production systems, various careers in animal industries or biotechnology, or graduate study in animal related specializations. Areas of emphasis include industry, production, or science/pre-vet. In addition, depending on the area of emphasis, students may select from the following areas of study: biotechnology, dairy, beef, sheep, swine, equine, companion animal, or poultry.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Foundation Courses

One semester of calculus is required for biotechnology option in the science/pre-veterinary sub-plan.

APEC 1101—Principles of Microeconomics (3 cr)
 BIOL 1009—General Biology, BIOL (4 cr)
 COMM 1101—Introduction to Public Speaking (3 cr)
 WRIT 3562W—Technical and Professional Writing, WI (4 cr)

MATH 1031—College Algebra and Probability, MATH (3 cr)
or MATH 1142—Short Calculus (4 cr)
or MATH 1271—Calculus I (4 cr)

Professional Courses

ANSC 1001—Orientation to Animal Science (1 cr)
ANSC 1101—Introductory Animal Science (4 cr)
ANSC 3011—Statistics for Animal Science (3 cr)
ANSC 2401—Animal Nutrition (3 cr)
ANSC 3221—Animal Breeding (4 cr)
ANSC 3301—Human and Animal Physiology (3 cr)
ANSC 3302—Human and Animal Physiology Laboratory (1 cr)

Students must take a minimum of 3 credits of internship or a minimum of 6 credits of senior thesis.

ANSC 4096—Professional Experience Program: Internship (1–3 cr)
or CFAN 4009W—Undergraduate Senior Thesis: Science in Agriculture, WI (1–6 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Animal Industry Sub-plan

Required Courses for the Sub-plan

Animal Industry

APEC 1102—Principles of Macroeconomics, IP, SSCI (3 cr)
APEC 1251—Principles of Accounting (3 cr)
CHEM 1011—Introductory Chemistry: Lecture and Laboratory (4 cr)
BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
WRIT 3152W—Writing on Issues of Science and Technology, WI (4 cr)
or WRIT 3257—Scientific and Technical Presentations (3 cr)
Take 4 or more course(s) from the following:
ANSC 3801—Livestock Merchandising (3 cr)
APEC 3001—Applied Microeconomics: Consumers, Producers, and Markets (4 cr)
APEC 3002—Applied Microeconomics: Managerial Economics (4 cr)
APEC 3411—Commodity Marketing (3 cr)
APEC 3451—Food and Agricultural Sales (3 cr)
APEC 3501—Agribusiness Finance (3 cr)
APEC 3811—Principles of Farm Management (3 cr)
APEC 3821—Retail Center Management (3 cr)
APEC 4451W—Food Marketing Economics, CIV, WI (3 cr)
APEC 4821W—Business Economics and Strategy, WI (3 cr)
BIE 3061—Professional Sales Management (3 cr)
JOUR 3201—Principles of Strategic Communication: Advertising (3 cr)

Animal Science Electives

Courses in this list cannot be used to fulfill requirements in other areas.

Take 12 or more credit(s) from the following:
CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
ANSC 1007—Horse in Your Backyard (2 cr)
ANSC 1011—Animals and Society, CIV (3 cr)
ANSC 1021—Avian Sampler (1 cr)
ANSC 1403—Companion Animal Nutrition and Care (3 cr)
ANSC 1511—Food Animal Products for Consumers (3 cr)
ANSC 2012—Livestock and Carcass Evaluation (3 cr)
ANSC 2013—Beginning Livestock Judging (2 cr)
ANSC 3007—Equine Nutrition (3 cr)
ANSC 3052—Equine Anatomy and Exercise Physiology (4 cr)
ANSC 3142—Advanced Livestock Judging (2 cr)

ANSC 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
ANSC 3305—Reproductive Biology in Health and Disease (4 cr)
ANSC 3501—Farm Animal Environment (3 cr)
ANSC 3509—Animal Biotechnology (3 cr)
ANSC 3511—Animal Growth and Development (3 cr)
ANSC 3609—Business Planning for Animal Enterprises (2 cr)
ANSC 4011—Dairy Cattle Breeding (3 cr)
ANSC 4401—Swine Nutrition (3 cr)
ANSC 4403—Ruminant Nutrition (3 cr)
ANSC 4404—Applied Dairy Nutrition (2 cr)
ANSC 4611—Advanced Pork Production Systems Management (2 cr)
ANSC 4613—Advanced Beef Production Systems Management (2 cr)
ANSC 4614—Advanced Dairy Production Systems Management (2 cr)
ENT 3281—Veterinary Entomology (3 cr)
FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)
SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
VCS 4600—Small Animal and Equine Behavior (3 cr)
VPM 3700—Equine Reproduction and Breeding Management (2 cr)
ANSC 1701—Historical Influence of the Horse on Society (3 cr)
ANSC 3801—Livestock Merchandising (3 cr)

Animal Management

ANSC 4601—Pork Production Systems Management (4 cr)
or ANSC 4602—Sheep Production Systems Management (4 cr)
or ANSC 4603—Beef Production Systems Management (4 cr)
or ANSC 4604—Dairy Production Systems Management (4 cr)
or ANSC 4605—Poultry Production Systems Management (4 cr)
or VCS 4606—Small Animal Management (3 cr)
or ANSC 2055—Horse Management (2 cr)
ANSC 3007—Equine Nutrition (3 cr)

Animal Production Sub-plan

In the animal production emphasis students may select from the following areas of study: dairy, beef, sheep, swine, equine, companion animal, or poultry.

Required Courses for the Sub-plan

Production

ANSC 1511—Food Animal Products for Consumers (3 cr)
ANSC 3609—Business Planning for Animal Enterprises (2 cr)
CHEM 1011—Introductory Chemistry: Lecture and Laboratory (4 cr)
BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)

Animal Science Electives

AGRO 1103 is required for dairy, beef, swine, sheep, and poultry options. Courses in this list cannot be used to fulfill requirements in other areas.

Take 22 or more credit(s) from the following:

AFE 2051—Current Technical Competencies (3 cr)
CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
ANSC 1007—Horse in Your Backyard (2 cr)
ANSC 1011—Animals and Society, CIV (3 cr)
ANSC 1021—Avian Sampler (1 cr)
ANSC 1403—Companion Animal Nutrition and Care (3 cr)
ANSC 1511—Food Animal Products for Consumers (3 cr)
ANSC 2012—Livestock and Carcass Evaluation (3 cr)
ANSC 2013—Beginning Livestock Judging (2 cr)
APEC 1251—Principles of Accounting (3 cr)
SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
VBS 2032—General Microbiology With Laboratory (4 cr)
ANSC 3007—Equine Nutrition (3 cr)
ANSC 3052—Equine Anatomy and Exercise Physiology (4 cr)
ANSC 3142—Advanced Livestock Judging (2 cr)
ANSC 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)

ANSC 3305—Reproductive Biology in Health and Disease (4 cr)
 ANSC 3501—Farm Animal Environment (3 cr)
 ANSC 3509—Animal Biotechnology (3 cr)
 ANSC 3511—Animal Growth and Development (3 cr)
 ANSC 4011—Dairy Cattle Breeding (3 cr)
 ANSC 4102—Equine Management (3 cr)
 ANSC 4401—Swine Nutrition (3 cr)
 ANSC 4403—Ruminant Nutrition (3 cr)
 ANSC 4404—Applied Dairy Nutrition (2 cr)
 ANSC 4601—Pork Production Systems Management (4 cr)
 ANSC 4602—Sheep Production Systems Management (4 cr)
 ANSC 4603—Beef Production Systems Management (4 cr)
 ANSC 4604—Dairy Production Systems Management (4 cr)
 ANSC 4605—Poultry Production Systems Management (4 cr)
 ANSC 3609—Business Planning for Animal Enterprises (2 cr)
 ANSC 4611—Advanced Pork Production Systems Management (2 cr)
 ANSC 4613—Advanced Beef Production Systems Management (2 cr)
 ANSC 4614—Advanced Dairy Production Systems Management (2 cr)
 APEC 3411—Commodity Marketing (3 cr)
 APEC 3451—Food and Agricultural Sales (3 cr)
 APEC 3811—Principles of Farm Management (3 cr)
 ENT 3281—Veterinary Entomology (3 cr)
 VCS 4600—Small Animal and Equine Behavior (3 cr)
 VCS 4606—Small Animal Management (3 cr)
 VPM 3700—Equine Reproduction and Breeding Management (2 cr)
 ANSC 1701—Historical Influence of the Horse on Society (3 cr)

Animal Production Focus

Students are required to complete one of the following course groups.

Dairy

ANSC 4011—Dairy Cattle Breeding (3 cr)
 ANSC 4403—Ruminant Nutrition (3 cr)
 ANSC 4604—Dairy Production Systems Management (4 cr)
 ANSC 4614—Advanced Dairy Production Systems Management (2 cr)

Beef

ANSC 2012—Livestock and Carcass Evaluation (3 cr)
 ANSC 4403—Ruminant Nutrition (3 cr)
 ANSC 4603—Beef Production Systems Management (4 cr)
 ANSC 4613—Advanced Beef Production Systems Management (2 cr)

Sheep

ANSC 2012—Livestock and Carcass Evaluation (3 cr)
 ANSC 4403—Ruminant Nutrition (3 cr)
 ANSC 4602—Sheep Production Systems Management (4 cr)

Swine

ANSC 2012—Livestock and Carcass Evaluation (3 cr)
 ANSC 4401—Swine Nutrition (3 cr)
 ANSC 4601—Pork Production Systems Management (4 cr)
 ANSC 4611—Advanced Pork Production Systems Management (2 cr)

Equine

Take 11 or more credit(s) from the following:
 ANSC 2055—Horse Management (2 cr)
 ANSC 3007—Equine Nutrition (3 cr)
 ANSC 3052—Equine Anatomy and Exercise Physiology (4 cr)
 VPM 3700—Equine Reproduction and Breeding Management (2 cr)

Companion Animal

ANSC 1403—Companion Animal Nutrition and Care (3 cr)
 VCS 4600—Small Animal and Equine Behavior (3 cr)
 VCS 4606—Small Animal Management (3 cr)
 3 credits to be determined in consultation with an adviser

Poultry

The three poultry courses must be taken from the Midwest Poultry Consortium (MPC) Summer Program at Madison, Wisconsin. Courses cannot count for requirements in this section and professional courses.

ANSC 4605—Poultry Production Systems Management (4 cr)
 Three MPC summer courses

Individualized Option

Students select 12 credits in consultation with an adviser and with the approval of the Animal Production Systems Committee.

Science/Pre-Veterinary sub-plan

Students in the science/pre-veterinary emphasis must select either the basic science or biotechnology option.

Required Courses for the Sub-plan

Core Courses

BIOL 4003 is required for the biotechnology option.

BIOC 3021—Biochemistry (3 cr)
 CHEM 1021—Chemical Principles I (4 cr)
 CHEM 1022—Chemical Principles II (4 cr)
 CHEM 2301—Organic Chemistry I (3 cr)
 CHEM 2311—Organic Lab (4 cr)
 VBS 2032—General Microbiology With Laboratory (4 cr)
 BIOL 4003—Genetics (3 cr)
 or GCD 3022—Genetics (3 cr)

Take one of the follow pairs of courses

PHYS 1101W—Introductory College Physics I, PHYS, WI (4 cr)
 and PHYS 1102W—Introductory College Physics II, PHYS, WI (4 cr)

or

PHYS 1201W—Introductory Physics for Biology and Pre-medicine I, PHYS, WI (5 cr)
 and PHYS 1202W—Introductory Physics for Biology and Pre-medicine II, PHYS, WI (5 cr)

Science/Pre-Veterinary Options

Students are required to complete one of the following course groups.

Basic Science Option

Any animal science course not used to fulfill another requirement may also be used as a basic science elective.

Take 12 or more credit(s) from the following:

CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
 ANSC 1011—Animals and Society, CIV (3 cr)
 ANSC 1403—Companion Animal Nutrition and Care (3 cr)
 ANSC 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)

ANSC 3305—Reproductive Biology in Health and Disease (4 cr)
 ANSC 3509—Animal Biotechnology (3 cr)
 ANSC 3511—Animal Growth and Development (3 cr)
 ANSC 4011—Dairy Cattle Breeding (3 cr)
 ANSC 4401—Swine Nutrition (3 cr)
 ANSC 4403—Ruminant Nutrition (3 cr)
 ENT 3281—Veterinary Entomology (3 cr)

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

ANSC 4601—Pork Production Systems Management (4 cr)
 or ANSC 4602—Sheep Production Systems Management (4 cr)
 or ANSC 4603—Beef Production Systems Management (4 cr)
 or ANSC 4604—Dairy Production Systems Management (4 cr)
 or ANSC 4605—Poultry Production Systems Management (4 cr)
 or VCS 4606—Small Animal Management (3 cr)
 or ANSC 2055—Horse Management (2 cr)
 ANSC 3007—Equine Nutrition (3 cr)

Biotechnology Option

CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
 ANSC 3509—Animal Biotechnology (3 cr)
 BIOL 4003—Genetics (3 cr)
 Select at least 2 credits of a laboratory.
Take 11 or more credit(s) from the following:
 ANSC 3511—Animal Growth and Development (3 cr)
 ANSC 3305—Reproductive Biology in Health and Disease (4 cr)
 BIOC 4025—Laboratory in Biochemistry (2 cr)
 BIOC 4125—Laboratory in Molecular Biology and Biotechnology (3 cr)
 BIOC 5001—Biochemistry, Molecular and Cellular Biology (5 cr)
 BIOL 4004—Cell Biology (3 cr)
 GCD 4015—Genetics Laboratory (2 cr)
 GCD 4025—Cell Biology Laboratory (3 cr)
 GCD 4034—Molecular Genetics (3 cr)
 GCD 4143—Human Genetics (3 cr)
 GCD 4151—Molecular Biology of Cancer (3 cr)
 GCD 4161—Developmental Biology (3 cr)
 GCD 5036—Molecular Cell Biology (3 cr)
 MICB 3301—Biology of Microorganisms (5 cr)
 MICB 4131—Immunology (3 cr)
 MICB 4141W—Biology, Genetics, and Pathogenesis of Viruses:
 Writing Intensive, WI (4 cr)
 MICB 4151—Molecular and Genetic Bases for Microbial Diseases (3 cr)
 MICB 4235—Advanced Laboratory: Virology, Immunology, and
 Microbial Genetics (3 cr)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Animal Science Minor

Animal Science

- Required credits in this minor: 20.

This minor is for students who want to include animal science coursework to enhance or supplement their major program. Students have flexibility in choosing courses to meet the requirements.

Minor Requirements

Students must complete at least 20 credits of courses with an animal science (ANSC) designator.

Minor Courses

At least 10 credits must be 3xxx or higher.

Take 20 or more credit(s) from the following:

Take no more than 10 credit(s) from the following:

ANSC 1xxx
 ANSC 2xxx

Take 10 or more credit(s) from the following:

ANSC 3xxx
 ANSC 4xxx
 ANSC 5xxx

Applied Economics B.S.

Applied Economics

- Required credits to graduate with this degree: 120.
- Required credits within the major: 52.

The applied economics major prepares students for careers in private industry, government agencies, agribusiness, or graduate work. Students may choose one of six professional application clusters: management and finance; marketing; food retailing; trade and development; resources and environment; or regional and public economics. Students may also, in consultation with their adviser, develop an individualized application cluster.

The curriculum emphasizes fundamental written and oral communication skills and a strong foundation in mathematics and economic principles and their applications. Areas of employment for graduates include management, finance, marketing and international trade, domestic and international development, environmental impact assessment, resource management and use, and government-related work in planning, taxation, and development. Entry-level jobs are often in merchandising and sales, credit analysis, management, and other customer contact areas.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

Every student's program is capped off with 12 credits of advanced-level coursework, called a professional application cluster.

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

Foundation Courses

Students considering graduate study in applied economics are encouraged to take MATH 1271 and MATH 1272

MATH 1142—Short Calculus (4 cr)
 or MATH 1271—Calculus I (4 cr)

Writing Performance

WRIT 3562W—Technical and Professional Writing, WI (4 cr)
 COMM 1313W—Analysis of Argument, WI (3 cr)
 or WRIT 3152W—Writing on Issues of Science and Technology, WI (4 cr)
 or WRIT 3221W—Communication Modes and Methods, WI (4 cr)

Speech Performance

COMM 1101—Introduction to Public Speaking (3 cr)
 COMM 3441—Introduction to Organizational Communication (3 cr)
 or WRIT 3257—Scientific and Technical Presentations (3 cr)
 COMM 3411—Introduction to Small Group Communication (3 cr)

Additional Social Science

Students majoring in applied economics must complete 3 credits in social sciences beyond the 6 credits required for liberal education. The 3 credits may not be in courses with the APEC or ECON designator.

Social science course

Professional Courses

APEC 1001—Orientation to Applied Economics (1 cr)
 or CFAN 3201—Strategic Career Planning (1 cr)

APEC 1101—Principles of Microeconomics (3 cr)
 APEC 1102—Principles of Macroeconomics, IP, SSCI (3 cr)
 APEC 3001—Applied Microeconomics: Consumers, Producers, and Markets (4 cr)
 APEC 3002—Applied Microeconomics: Managerial Economics (4 cr)
 APEC 3006—Applied Macroeconomics: Government and the Economy (3 cr)
 APEC 3007—Applied Macroeconomics: Policy, Trade, and Development, GP (3 cr)
 ACCT 2050—Introduction to Financial Reporting (4 cr)
 or APEC 1251—Principles of Accounting (3 cr)
 OMS 2550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)
 or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

Ethics and Responsible Management

Students must take one course (3 cr) from the list below that fosters one or more of the following objectives: responsible judgment about management of natural resources and environment; responsible judgment regarding ethical/policy issues related to agriculture; application of global perspectives to agricultural, food, and environmental issues/decisions; application of a historical perspective to the role of science/technology.

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

CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
 AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
 AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 ANSC 1011—Animals and Society, CIV (3 cr)
 BBE 5212—Safety and Environmental Health Issues in Plant and Animal Production and Processing, H (3 cr)
 BIOL 4501—Social Uses of Biology (3 cr)
 EE 1701W—Energy, Environment, and Society, WI (3 cr)
 EEB 3001—Ecology and Society, ENV (3 cr)
 ESPM 1011—Issues in the Environment, ENV (3 cr)
 ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
 ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)
 FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)
 GEO 3005—Earth Resources (3 cr)
 GEOG 3401—Geography of Environmental Systems and Global Change, ENV (4 cr)
 HSCI 3211—Biology and Culture in the 19th and 20th Centuries (3 cr)
 HSCI 3331—Technology and American Culture (3 cr)
 HSCI 3332—Science and American Culture, HIS, DSJ (3 cr)
 P BIO 1212—Plants and Society (3 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Resources and the Environment Sub-plan

Students must take at least two upper division APEC courses (including no more than one of the following: 3991, 4096, 5891, 5991) plus two additional courses from APEC, ECON, Carlson School of Management, or other courses listed below, for a total of at least 12 credits. While students are encouraged to complete credits in one of the following areas, students may select courses across the categories in consultation with their adviser.

Required Courses for the Sub-plan

Resources and Environment Electives

Take 12 or more credit(s) from the following:

Take 2 or more course(s) from the following:

APEC 3611—Environmental and Natural Resource Economics, ENV (3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)

APEC 5651—Economics of Natural Resource and Environmental Policy, ENVT (3 cr)
 APEC 5711—U.S. Agricultural and Environmental Policy (3 cr)
Take 2 or more course(s) from the following:
 ECON 3611—Environmental Economics (3 cr)
 ECON 4831—Cost-Benefit Analysis, WI (3 cr)
 ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
 ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)
 ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
 ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)
 GEOG 3331—Geography of the World Economy, SOCS, GP (3 cr)
 URBS 3751—Understanding the Urban Environment, ENV (3 cr)

Trade and Development Sub-plan

Students must take at least two upper division APEC courses (including no more than one of the following: 3991, 4096, 5891, 5991) plus two additional courses from APEC, ECON, Carlson School of Management, or other courses listed below, for a total of at least 12 credits. While students are encouraged to complete credits in one of the following areas, students may select courses across the categories in consultation with their adviser.

Required Courses for the Sub-plan

Trade and Development Electives

Take 12 or more credit(s) from the following:

Take 2 or more course(s) from the following:

APEC 3041W—Economic Development of U.S. Agriculture, WI (3 cr)
 APEC 3061—General Survey of Development in Africa (3 cr)
 APEC 3071—Agriculture and Economic Growth in Developing Countries (3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4103—World Food Problems, GP (3 cr)
 APEC 5711—U.S. Agricultural and Environmental Policy (3 cr)
 APEC 5751—Global Trade and Policy, IP (3 cr)
Take 2 or more course(s) from the following:
 ECON 4041—The Prospective World Economy (3 cr)
 ECON 4301—Economic Development, WI (3 cr)
 ECON 4307—Comparative Economic Systems (3 cr)
 ECON 4311—Economy of Latin America (3 cr)
 ECON 4313—The Russian Economy (3 cr)
 ECON 4315—The Japanese Economy (3 cr)
 ECON 4331W—Economic Development, WI (3 cr)
 ECON 4337—Comparative Economic Systems (3 cr)
 ECON 4421W—Economic Integration of the Americas, WI (3 cr)
 ECON 4432W—International Finance, WI (3 cr)

Food Retailing Sub-plan

Students take at least two upper division APEC courses (including no more than one of the following: 3991, 4096, 5891, 5991), plus two additional courses from APEC, ECON, Carlson School of Management, or other courses listed below for a total of 12 credits minimum. While students are encouraged to complete credits in one of the following areas, students may select courses across the categories in consultation with their adviser.

Required Courses for the Sub-plan

Food Retailing Core Courses

Take 12 or more credit(s) from the following:

Take 2 or more course(s) from the following:

APEC 3451—Food and Agricultural Sales (3 cr)
 APEC 3821—Retail Center Management (3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4451W—Food Marketing Economics, CIV, WI (3 cr)

APEC 4481—Futures and Options Markets (3 cr)
 APEC 4501—Financial Modeling (3 cr)
Take 2 or more course(s) from the following:
 RM 2215—Multichannel Retailing (3 cr)
 RM 3242—Retail Buying (3 cr)
 HRIR 3032—Training and Development (2 cr)
 HRIR 3042—The Individual and Organizational Performance (2 cr)
 MKTG 3040—Buyer Behavior (4 cr)
 MKTG 4060—Marketing Channels (4 cr)
 MKTG 4080W—Marketing Strategy, WI (4 cr)
 OMS 3001—Introduction to Operations Management (3 cr)
 OMS 3056—Supply Chain Planning and Control (4 cr)

Individualized Professional Sub-plan

Students develop a program in consultation with an adviser.

Students must take at least 12 credits.

Required Courses for the Sub-plan

Individualized Professional Application Courses

Courses listed here are suggestions. All courses must be chosen in consultation with an adviser.

Take 12 or more credit(s) from the following:

APEC 3xxx
 APEC 4xxx
 HRIR 3xxx
 HRIR 4xxx
 MGMT 3xxx
 MGMT 4xxx
 MKTG 3xxx
 MKTG 4xxx

Management and Finance Sub-plan

Students must take at least two upper division APEC courses (including no more than one of the following: 3991, 4096, 5891, 5991) plus two additional courses from APEC, ECON, Carlson School of Management, or other courses listed below, for a total of at least 12 credits. While students are encouraged to complete credits in one of the following areas, students may select courses across the categories in consultation with their adviser.

Required Courses for the Sub-plan

Management and Finance Core Courses

Take 12 or more credit(s) from the following:

Take 2 or more course(s) from the following:

APEC 3811—Principles of Farm Management (3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4481—Futures and Options Markets (3 cr)
 APEC 4501—Financial Modeling (3 cr)
 APEC 4821W—Business Economics and Strategy, WI (3 cr)
 APEC 5811—Cooperative Organization (3 cr)
 APEC 3501—Agribusiness Finance (3 cr)
 or FINA 3001—Finance Fundamentals (3 cr)

Take 2 or more course(s) from the following:

ACCT 3001—Introduction to Management Accounting (3 cr)
 ACCT 5100—Corporate Financial Reporting (4 cr)
 ACCT 5160—Financial Statement Analysis (2 cr)
 ECON 4751—Financial Economics (3 cr)
 FINA 4221—Principles of Corporate Finance (2 cr)
 HRIR 3021—Human Resource Management and Industrial Relations (3 cr)
 MGMT 3001—Fundamentals of Management (3 cr)
 ECON 3701—Money and Banking (3 cr)
 or ECON 4721—Money and Banking (3 cr)

Marketing Sub-plan

Students must take at least two upper division APEC courses (including no more than one of the following: 3991, 4096, 5891, 5991) plus two additional courses from APEC, ECON, Carlson School of Management, or other courses listed below, for a total of at least 12 credits. While students are encouraged to complete credits in one of the following areas, students may select courses across the categories in consultation with their adviser.

Required Courses for the Sub-plan

Marketing Core Courses

Take 12 or more credit(s) from the following:

Take 2 or more course(s) from the following:

APEC 3411—Commodity Marketing (3 cr)
 APEC 3451—Food and Agricultural Sales (3 cr)
 APEC 3821—Retail Center Management (3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4461—Horticultural Marketing (3 cr)
 APEC 4481—Futures and Options Markets (3 cr)
 APEC 4501—Financial Modeling (3 cr)
Take 2 or more course(s) from the following:
 RM 2215—Multichannel Retailing (3 cr)
 MKTG 3001—Principles of Marketing (3 cr)
 MKTG 3010—Marketing Research (4 cr)
 MKTG 3040—Buyer Behavior (4 cr)
 MKTG 4030—Sales Management (4 cr)
 MKTG 4050—Integrated Marketing Communications (4 cr)
 MKTG 4060—Marketing Channels (4 cr)

Regional and Public Economics Sub-plan

Students must take at least two upper division APEC courses (including no more than one of the following: 3991, 4096, 5891, 5991) plus two additional courses from APEC, ECON, Carlson School of Management, or other courses listed below, for a total of at least 12 credits. While students are encouraged to complete credits in one of the following areas, students may select courses across the categories in consultation with their adviser.

Required Courses for the Sub-plan

Regional and Public Economics Electives

Take 12 or more credit(s) from the following:

Take 2 or more course(s) from the following:

APEC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4311—Tourism Development: Principles, Processes, Policies (3 cr)
 APEC 5321—Regional Economic Analysis (3 cr)
 APEC 5341—Public Finance (3 cr)
Take 2 or more course(s) from the following:
 ECON 3041—Prospective World Economy (3 cr)
 ECON 3501—Labor Economics (3 cr)
 ECON 3601—Industrial Organization and Antitrust Policy (3 cr)
 ECON 3801—Elements of Public Economics (3 cr)
 ECON 4307—Comparative Economic Systems (3 cr)
 ECON 4337—Comparative Economic Systems (3 cr)
 ECON 4531—Labor Economics (3 cr)
 ECON 4623—Housing Markets and Public Policy (3 cr)
 ECON 4631—Industrial Organization and Antitrust Policy (3 cr)
 ECON 4831—Cost-Benefit Analysis, WI (3 cr)
 URBS 1001W—Introduction to Urban Studies: The Complexity of Metropolitan Life, WI (3 cr)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program

requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Applied Economics Minor

Applied Economics

- Required credits in this minor: 15.

This minor is for students who want to include a basic core of applied economics coursework to enhance or supplement their major program. Students have flexibility in choosing courses to meet these minor requirements. Students who wish to minor in applied economics should consult with the major coordinator for applied economics to obtain approval before completion of 9 credits in the minor. No more than 6 credits may be counted for both the major and the applied economics minor. Students must complete at least 15 credits for the minor.

Minor Requirements

Minor Courses

APEC 1101—Principles of Microeconomics, SSCI (3 cr)
 or ECON 1101—Principles of Microeconomics, IP, SSCI (4 cr)
 APEC 1102—Principles of Macroeconomics, IP, SSCI (3 cr)
 or ECON 1102—Principles of Macroeconomics, IP, SSCI (4 cr)

Take 9 or more credit(s) from the following:

APEC 3xxx
 APEC 4xxx
 APEC 5xxx

Applied Plant Science B.S.

Agronomy and Plant Genetics

- Required credits to graduate with this degree: 120.
- Required credits within the major: 73 to 82.
- This program requires summer terms.

The applied plant science major provides options for a broad course of study in plant sciences, as well as options to concentrate more specifically within an area of individual interest. It provides a solid science background and integrates knowledge of science, environment, production and industry in preparation for continuing study in graduate school or careers in improvement of the quality and benefits of plants and plant products; industry, government, and universities as research scientists; agencies and organizations concerned with natural resource management; advisory, inspection and certification services; bio-safety and food security; related fields of biology and agricultural education.

Students choose from three areas of emphasis: agroecology, plant improvement, and plant utilization.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Students develop a plan of study that fulfills the required science core (43–49 credits) and area electives (12–17 credits). Students enroll in a set of three common courses in their freshman year and a series of three integrative courses in each of the following three years. The last course in the series is the senior capstone course. After fulfilling CLE and major requirements, students should have between 15 and 22 credits available for electives.

Science Foundation Courses

BIOL 2022—General Botany (3 cr)
 CHEM 1021—Chemical Principles I (4 cr)
 PHYS 1101W—Introductory College Physics I, PHYS, WI (4 cr)
 BIOL 1009—General Biology, BIOL (4 cr)
 or BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
 AGRO 4005—Applied Crop Physiology and Development (4 cr)
 or BIOL 3002—Plant Biology: Function (2 cr)
 BIOL 3005W—Plant Function Laboratory, WI (2 cr)
 or HORT 3005W—Environmental Effects on Horticultural Crops, WI (4 cr)

Major Courses

AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
 AGRO 1660—First-Year Colloquium/Experience in Agroecosystems Analysis (2 cr)
 AGRO 4660—Senior Capstone (2 cr)
 AGRO 4096—Professional Experience Program: Internship (1–3 cr)
 or AGRO 4097—Undergraduate Research Thesis (1–6 cr)
 AGRO 3660—Plant Genetic Resources: Identification, Conservation, and Utilization (3 cr)
 Take 1 or more course(s) from the following:
 CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
 or CFAN 3001—Pests and Crop Protection (3 cr)
 or AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 or AGRO 4103—World Food Problems, GP (3 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Agroecology Sub-plan

Required Courses for the Sub-plan

Agroecology

SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
 BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
 or BIOC 3021—Biochemistry (3 cr)
 BIOL 3407—Ecology (3 cr)
 or BIOL 3408W—Ecology, WI (3 cr)
 or ESPM 3108—Ecology of Managed Systems, ENV (3 cr)
 BIOL 4003—Genetics (3 cr)
 or GCD 3022—Genetics (3 cr)
 MATH 1031—College Algebra and Probability, MATH (3 cr)
 or MATH 1142—Short Calculus (4 cr)
 or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

Electives

Take 17 or more credit(s) including 4 or more sub-requirement(s) from the following:

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

AGRO 2501—Plant Identification for Urban and Rural Landscapes (2 cr)

ENT 5021—Insect Taxonomy and Phylogeny (4 cr)

ENT 5371—Principles of Systematics (3 cr)

PBIO 4321—Minnesota Flora (3 cr)

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

AGRO 4505—Biology, Ecology, and Management of Invasive Plants (3 cr)

EEB 5122W—Plant Interactions with Animals and Microbes, WI (3 cr)

ENT 3005—Insect Biology, BIOL (4 cr)

ENT 5211—Insect Pest Management (3 cr)

ENT 5341—Biological Control of Insects and Weeds (3–4 cr)

PLPA 5204—Plant Disease Management (3 cr)

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

AGRO 3131—Student Organic Farm Planning, Growing, and Marketing (3 cr)

AGRO 4605—Management Strategies for Crop Production (3 cr)

HORT 3131—Student Organic Farm Planning, Growing, and Marketing (3 cr)

HORT 5052—Specialty Greenhouse Crop Production (3 cr)

SOIL 3416—Plant Nutrients in the Environment (3 cr)

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

AGRO 5321—Ecology of Agricultural Systems (3 cr)

ESPM 3221—Soil Conservation and Land-Use Management (3 cr)

ESPM 3612W—Soil and Environmental Biology, WI (3 cr)

HORT 5031—Organic Viticulture and Fruit Production (3 cr)

HORT 5032—Organic Vegetable Production (3 cr)

HORT 5071—Restoration and Reclamation Ecology (4 cr)

PLPA 2001—Introductory Plant Pathology (3 cr)

Plant Utilization Sub-plan

Required Courses for the Sub-plan

Plant Utilization

BIOC 3021—Biochemistry (3 cr)

CHEM 1022—Chemical Principles II (4 cr)

CHEM 2301—Organic Chemistry I (3 cr)

FSCN 3102—Introduction to Food Science (3 cr)

STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

MATH 1142—Short Calculus (4 cr)

or MATH 1271—Calculus I (4 cr)

Electives

Take 12 or more credit(s) from the following:

AGRO 4401—Plant Genetics and Breeding (4 cr)

BBE 4744—Engineering Principles for Biological Scientists (4 cr)

BIOL 3407—Ecology (3 cr)

EEB 3001—Ecology and Society, ENV (3 cr)

FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)

FSCN 1112—Principles of Nutrition (3 cr)

FSCN 4121—Food Microbiology (3 cr)

FSCN 4332—Food Processing Operations (3 cr)

FSCN 4612—Advanced Human Nutrition (4 cr)

FSCN 5441—Introduction to New Product Development (2 cr)

FSCN 5531—Grains: Introduction to Cereal Chemistry and Technology (2 cr)

HORT 5031—Organic Viticulture and Fruit Production (3 cr)

HORT 5032—Organic Vegetable Production (3 cr)

HORT 5052—Specialty Greenhouse Crop Production (3 cr)

BBE 4001—Chemistry of Plant Materials (4 cr)

or PBIO 4516W—Plant Cell Biology: Writing Intensive, WI (3 cr)

or PBIO 4601—Topics in Plant Biochemistry (3 cr)

or PBIO 5516—Plant Cell Biology (3 cr)

Plant Improvement Sub-plan

Required Courses for the Sub-plan

Plant Improvement

AGRO 4401—Plant Genetics and Breeding (4 cr)

BIOC 3021—Biochemistry (3 cr)

CHEM 1022—Chemical Principles II (4 cr)

CHEM 2301—Organic Chemistry I (3 cr)

BIOL 4003—Genetics (3 cr)

or GCD 3022—Genetics (3 cr)

STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

MATH 1031—College Algebra and Probability, MATH (3 cr)

or MATH 1142—Short Calculus (4 cr)

Electives

Take 12 or more credit(s) from the following:

BBE 3013—Engineering Principles of Molecular and Cellular Processes (3 cr)

BIOC 4025—Laboratory in Biochemistry (2 cr)

BIOC 4125—Laboratory in Molecular Biology and Biotechnology (3 cr)

EEB 3001—Ecology and Society, ENV (3 cr)

EEB 5122W—Plant Interactions with Animals and Microbes, WI (3 cr)

HORT 4071W—Applications of Biotechnology to Plant Improvement, WI (4 cr)

HORT 5031—Organic Viticulture and Fruit Production (3 cr)

HORT 5032—Organic Vegetable Production (3 cr)

HORT 5052—Specialty Greenhouse Crop Production (3 cr)

PBIO 5301—Plant Genomics (3 cr)

PBIO 5412—Plant Physiology (3 cr)

PBIO 5514—Plant Molecular Genetics and Development (3 cr)

PLPA 5103—Plant-Microbe Interactions (3 cr)

PLPA 5300—Current Topics in Molecular Plant Pathology (1 cr)

SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

PBIO 4516W—Plant Cell Biology: Writing Intensive, WI (3 cr)

or PBIO 5516—Plant Cell Biology (3 cr)

or PBIO 4601—Topics in Plant Biochemistry (3 cr)

or BBE 4001—Chemistry of Plant Materials (4 cr)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Bio-Based Products Engineering Minor

Bioproducts and Biosystems Engineering

This is a free-standing minor.

- Required credits in this minor: 14.

This program provides students with a strong background in the basic sciences and engineering and their application to manufacturing and end-use applications of materials, chemicals, and energy from renewable resources.

Minor Requirements

Minor Courses

Take 14 or more credit(s) from the following:

- BBE 4001—Chemistry of Plant Materials (4 cr)
- BBE 4301—Surface and Colloid Science in Bio-based Products Manufacturing (3 cr)
- BBE 4302—Organisms Impacting Bio-based Products (3 cr)
- BBE 4303—Introduction to Bio-based Materials Science (3 cr)
- BBE 4305—Pulp and Paper Technology (3 cr)
- BBE 4401—Bioproducts Engineering (3 cr)
- BBE 4404—Bio-based Composites Engineering (3 cr)
- BBE 4501—Process and Product Design I (2 cr)
- BBE 4502W—BBE Capstone Design, WI (4 cr)

Bioproducts Marketing and Management B.S.

Bioproducts and Biosystems Engineering

- Required credits to graduate with this degree: 120.
- Required credits within the major: 97 to 113.

Bio-based products are materials, chemicals, and energy derived from renewable, bio-resources, including forestry, agriculture, and other biomass. Many of the commercial products and forms of energy that we use today and come from depleting fossil fuels can be derived from renewable, bio-resources. The molecular building blocks and components of biomass can be harnessed to heat homes, run cars, light buildings, and provide industrial and consumer products. These products include fibers and fiber-based products, paper, board, engineered wood, structural panels, wood-based composites, renewable plastics, and bio-derived chemicals and fuels.

This major provides students with a strong foundation in the sustainable use of bio-resources while protecting the environment. The interdisciplinary bio-based products major combines coursework in science, engineering, technology, and business—all related to the manufacturing and end-use applications of materials, products, and energy from renewable resources.

Students choose one of the following two areas of specialization: bio-based products marketing and management or residential building science and technology. In addition, the department also offers a minor in bio-based products engineering that enables students in any of the basic sciences and engineering majors to gain a better understanding of and appreciation for sustainable use of the renewable resources.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Communication Skills

COMM 1101—Introduction to Public Speaking (3 cr)

Physical and Biological Sciences

BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
 or BIOL 1009—General Biology, BIOL (4 cr)
 PHYS 1101W—Introductory College Physics I, PHYS, WI (4 cr)
 or PHYS 1301W—Introductory Physics for Science and Engineering I, PHYS, WI (4 cr)

Economics

APEC 1101—Principles of Microeconomics (3 cr)
 or ECON 1101—Principles of Microeconomics, SOCS (4 cr)
 or ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)

Major Courses

BBE 1001—Bioproducts and Biosystems Engineering Orientation (1 cr)
 BBE 1002—Wood and Fiber Science (3 cr)
 BBE 3411—Introduction to Residential Construction (2 cr)
 BBE 3412—Introduction to Residential Building Materials Estimating (1 cr)
 BBE 4302—Organisms Impacting Bio-based Products (3 cr)
 BBE 4407—Bio-based Products Manufacturing and Applications I (3 cr)
 BBE 4412W—Bio-based Products Manufacturing and Applications II, WI (3 cr)
 BBE 4413—Systems Approach to Residential Construction (4 cr)
 BBE 4504W—Bio-based Products Development and Management, WI (3 cr)
 ESPM 2041—Natural Resources Consumption and Sustainability (3 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Residential Building Science and Technology Sub-plan

The residential building science and technology program is designed to investigate the important relationships between people, their homes, and the environment. From a solid scientific and engineering base, this interdisciplinary program builds critical thinking skills and helps students explore the opportunities that can enhance the performance of houses. The curriculum draws upon a wide range of resources across the University and includes physical science, social science, management, marketing, communications, material sciences, and engineering coursework.

The environment and international perspectives themes are satisfied automatically by completing required courses in the residential building science and technology specialization.

Required Courses for the Sub-plan

Mathematical Thinking

MATH 1271—Calculus I (4 cr)
 MATH 1272—Calculus II (4 cr)
 STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)
 or STAT 3021—Introduction to Probability and Statistics (3 cr)

Chemistry and Physics

CHEM 1021—Chemical Principles I (4 cr)
 PHYS 1102W—Introductory College Physics II, PHYS, WI (4 cr)
 or PHYS 1302W—Introductory Physics for Science and Engineering II,
 PHYS, WI (4 cr)

Residential Building Science and Technology

BBE 3001—Mechanics and Structural Design (4 cr)
 BBE 4414—Advanced Residential Building Science, WI (3 cr)
 BBE 4415—Advanced Residential Building Science Lab (1 cr)
 BBE 4416—Building Testing and Diagnostics (2 cr)
 CE 3402—Civil Engineering Materials (3 cr)
 CE 4101W—Project Management, WI (3 cr)
 HSG 2463—Housing and Community Development (3 cr)
 OMS 3001—Introduction to Operations Management (3 cr)
 ARCH 1701—The Designed Environment (3 cr)
 or DES 1101W—Introduction to Design Thinking, AH, WI (4 cr)
 or LA 1101W—Introduction to Design Thinking, WI (4 cr)

Electives

Course selections must be approved by faculty adviser.
 Take 12 or more credit(s) from the following:
 ACCT 2050—Introduction to Financial Reporting (4 cr)
 ARCH 1281—Design Fundamentals I (4 cr)
 ARCH 3711W—Environmental Design and the Sociocultural Context, C/
 PE, WI (3 cr)
 ARCH 4561—Architecture and Ecology (3 cr)
 BBE 2201—Renewable Energy and the Environment, TS (3 cr)
 BBE 3503—Marketing of Bio-based Products (4 cr)
 BBE 4355—Design of Wood Structures (3 cr)
 BBE 4733—Renewable Energy Technologies (3 cr)
 BLAW 3058—The Law of Contracts and Agency (4 cr)
 CE 3301—Soil Mechanics I (3 cr)
 CHEM 1022—Chemical Principles II (4 cr)
 CMGT 4011—Construction Documents and Contracts (3 cr)
 CMGT 4021—Construction Planning and Scheduling (3 cr)
 CMGT 4022—Construction Estimating (3 cr)
 CMGT 4031—Construction Safety and Loss Control (3 cr)
 HSG 2401—Introduction to Housing (3 cr)
 DHA 2402—Residential Technology (3 cr)
 HSG 4461—Housing Development and Management (3 cr)
 HSG 4465—Housing in a Global Perspective (3 cr)
 HSG 5463—Housing Policy (3 cr)
 SUST 3003—Sustainable People, Sustainable Planet, ENV (3 cr)
 ESPM 3480—Topics in Natural Resources (1–4 cr)
 ESPM 3603—Environmental Life Cycle Analysis (3 cr)
 ESPM 3604—Environmental Management Systems and Strategy (3 cr)
 ESPM 5019—Business, Natural Environment, and Global Economy (2 cr)
 HRIR 3021—Human Resource Management and Industrial Relations (3 cr)
 IE 5531—Engineering Optimization I (4 cr)
 LA 3501—Environmental Design and Its Biological and Physical Context,
 ENV (3 cr)
 MGMT 3001—Fundamentals of Management (3 cr)
 MKTG 3001—Principles of Marketing (3 cr)
 OMS 3059—Quality Management and Lean Six Sigma (4 cr)
 CMGT 2019—AutoCAD for Construction Managers (2 cr)
 or ARCH 3351—AutoCAD I (3 cr)

General Electives

Minimum of 8 credits.

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Marketing and Management Sub-plan

The bio-based products marketing and management specialization combines coursework in liberal arts, basic sciences, communications, and business. Students learn about the physical and social aspects of renewable bio-based products and resources, and the combination of marketing and sales courses with technical bio-based products engineering coursework prepares them for the growing bio-based products industries.

Required Courses for the Sub-plan

Mathematical Thinking

STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)
 MATH 1142—Short Calculus (4 cr)
 or MATH 1271—Calculus I (4 cr)

Physical and Biological Sciences

Take one of the following course groups.
 CHEM 1015—Introductory Chemistry: Lecture (3 cr)
 and CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
 and BIOC 2011—Biochemistry for the Agricultural and Health Sciences
 (3 cr)
 or CHEM 1021—Chemical Principles I (4 cr)
 and CHEM 1022—Chemical Principles II (4 cr)

Macroeconomics

APEC 1102—Principles of Macroeconomics, IP, SSCI (3 cr)
 or ECON 1102—Principles of Macroeconomics, IP, SSCI (4 cr)

Bio-Based Products Marketing and Management

ACCT 2050—Introduction to Financial Reporting (4 cr)
 BBE 3101—Introductory Statics and Structures for Construction
 Management (3 cr)
 BBE 3503—Marketing of Bio-based Products (4 cr)
 MGMT 3001—Fundamentals of Management (3 cr)
 MKTG 3001—Principles of Marketing (3 cr)
 PSY 1001—Introduction to Psychology, SSCI (4 cr)
 FINA 3001—Finance Fundamentals (3 cr)
 or APEC 3501—Agribusiness Finance (3 cr)

General Electives

Minimum of 12 credits.

Marketing and Management Focus

Students are required to complete one of the following course groups.

Marketing and Sales

Take 12 or more credit(s) from the following:
 APEC 3001—Applied Microeconomics: Consumers, Producers, and
 Markets (4 cr)
 APEC 3411—Commodity Marketing (3 cr)
 APEC 3451—Food and Agricultural Sales (3 cr)
 APEC 4481—Futures and Options Markets (3 cr)
 ESPM 3202W—Environmental Conflict Management, Leadership, and
 Planning, WI (3 cr)
 JOUR 4261—Advertising: Media Strategy (3 cr)
 JOUR 4272—Interactive Advertising (3 cr)

MKTG 3010—Marketing Research (4 cr)

MKTG 4030—Sales Management (4 cr)

Management

Take 12 or more credit(s) from the following:

ACCT 3001—Introduction to Management Accounting (3 cr)

APEC 3002—Applied Microeconomics: Managerial Economics (4 cr)

BBE 2201—Renewable Energy and the Environment, TS (3 cr)

BLAW 3058—The Law of Contracts and Agency (4 cr)

ESPM 3602—Regulations and Corporate Environmental Management (3 cr)

ESPM 3603—Environmental Life Cycle Analysis (3 cr)

ESPM 3604—Environmental Management Systems and Strategy (3 cr)

HRIR 3021—Human Resource Management and Industrial Relations (3 cr)

IDSC 3001—Information Systems for Business Processes and Management (3 cr)

IE 4521—Statistics, Quality, and Reliability (4 cr)

IE 5522—Quality Engineering and Reliability (4 cr)

OMS 3001—Introduction to Operations Management (3 cr)

OMS 3056—Supply Chain Planning and Control (4 cr)

Climatology Minor

Soil, Water and Climate

This is a free-standing minor.

- Required credits in this minor: 20.

The minor lets students broaden their expertise in weather and climate studies. Students who will be working for any industry or agency that depends on understanding weather and climate change will find the minor useful. Students take courses in meteorology, atmosphere, and biometeorology. Electives are in climate models, climate variations, climate change, and atmospheric boundary layer.

To complete the minor, students must complete at least 20 credits.

Minor Requirements

Required Courses

ESPM 1425—The Atmosphere, PHYS, ENV (4 cr)

ESPM 5131—Environmental Biophysics and Ecology (3 cr)

Electives

Take 13 or more credit(s) from the following:

EEB 5008—Forest Response to Quaternary Climate Change (2 cr)

EEB 5009—Quaternary Vegetation History and Climate (3 cr)

GEOG 3401—Geography of Environmental Systems and Global Change, ENV (4 cr)

GEOG 5426—Climatic Variations (3 cr)

GEOG 5423—Climate Models and Modeling (3 cr)

Corporate Environmental Management Minor

Bioproducts and Biosystems Engineering

This is a free-standing minor.

- Required credits in this minor: 18.

The corporate environmental management (CEM) minor is designed to provide students with an excellent opportunity to gain a broad exposure to the strategic, analytical, and managerial processes associated with the environmental impact of companies? and other organizations? products and processes. Completion of the CEM minor enhances students? preparation for graduate school and for entering a career in the growing

corporate functions of environmental management and regulatory compliance.

The CEM minor is available to students in good standing in all majors at the University of Minnesota, Twin Cities.

Admission Requirements

Preparatory Courses

APEC 1101—Principles of Microeconomics, SSCI (3 cr)

or ECON 1101—Principles of Microeconomics, IP, SSCI (4 cr)

or ESPM 3261—Economics and Natural Resources Management, ENVT, SSCI (4 cr)

BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4 cr)

or BIOL 1009—General Biology, BIOL SCI/L (4 cr)

MATH 1142—Short Calculus, MATH (4 cr)

or any first semester calculus

OMS 2550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)

or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

Minor Requirements

Required Courses

Minor Courses

ACCT 2050—Introduction to Financial Reporting (4 cr)

ESPM 3603—Environmental Life Cycle Analysis (3 cr)

ESPM 3604—Environmental Management Systems and Strategy (3 cr)

ESPM 5019—Business, Natural Environment, and Global Economy (2 cr)

Take 6 or more credit(s) from the following:

ESPM 3011W—Ethics in Natural Resources, C/PE, ENVT, WI (3 cr)

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, C/PE, WI (3 cr)

ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, C/PE, SSCI, WI (3 cr)

ESPM 3602—Regulations and Corporate Environmental Management (3 cr)

ESPM 3605—Recycling: Extending Raw Materials (3 cr)

ESPM 3606—Pollution Prevention: Principles, Technologies, and Practices (3 cr)

ESPM 4061W—Water Quality and Natural Resources, ENVT, WI (3 cr)

ESPM 4607—Industrial Biotechnology and the Environment (3 cr)

ESPM 4608—Bioremediation (2 cr)

PLPA 3002—Air Pollution, People, and Plants: The Science and the Ethics, C/PE, ENVT (3 cr)

Entomology Minor

Entomology

This is a free-standing minor.

- Required credits in this minor: 12.

This minor provides a strong background in entomological principles and theory suitable for students interested in a variety of professions or advanced degree programs. Examples include programs in entomology, veterinary science, or public health; teaching biology in secondary educational institutions; or enhancing marketable skills for a variety of professional careers, such as forest health specialist, crop consultant, grounds manager, pest management specialist, agronomist, greenhouse or nursery technician, natural resource manager, or water quality specialist. Specific courses are selected based on students' educational objectives, in consultation with a minor adviser.

Minor Requirements

Required Courses

CFAN 3001—Pests and Crop Protection (3 cr)

or ENT 3005—Insect Biology, BIOL (4 cr)

or ENT 4015—Ornamentals and Turf Entomology (3 cr)
or ENT 4251—Forest and Shade Tree Entomology (3 cr)
or ENT 3281—Veterinary Entomology (3 cr)

Electives

The course used to satisfy the minor requirement may not be used toward fulfilling this 9-credit elective requirement. Students may take a maximum of six credits, total, from the two special entomology courses (ENT 5910 and ENT 5920) toward the 9 credits.

Take 9 or more credit(s) from the following:

CFAN 3001—Pests and Crop Protection (3 cr)
ENT 3005—Insect Biology, BIOL (4 cr)
ENT 4015—Ornamentals and Turf Entomology (3 cr)
ENT 4251—Forest and Shade Tree Entomology (3 cr)
ENT 3281—Veterinary Entomology (3 cr)
ENT 3xxx
ENT 4xxx
ENT 5xxx
ENT 5910—Special Problems in Entomology (1–6 cr)
ENT 5920—Special Lectures in Entomology (1–3 cr)

Environmental Sciences, Policy and Management B.S.

College of Food, Agricultural and Natural Resource Sciences

- Required credits to graduate with this degree: 120.
- Required credits within the major: 46.
- This program requires summer terms.

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

The mission of the ESPM major is to

- improve the basis for environmental decision-making by integrating physical, biological, and social sciences with policy analysis and management;
- educate the next generation of environmental professionals and leaders;
- foster innovative approaches for the education of environmental professionals;
- facilitate science/social science/policy linkages within and beyond the University.

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

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

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

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

Communication Skills

COMM 1101—Introduction to Public Speaking (3 cr)

Physical and Biological Sciences

CHEM 1021—Chemical Principles I (4 cr)
or CHEM 1015—Introductory Chemistry: Lecture (3 cr)
and CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
or BIOL 1009—General Biology, BIOL (4 cr)

Integrated ESPM Core

ESPM 1011—Issues in the Environment, ENV (3 cr)
ESPM 2021—Environmental Sciences: Integrated Problem Solving (3 cr)
ESPM 3000—Seminar on Current Issues for ESPM (1 cr)
ESPM 1001—Freshmen Orientation to Environmental Sciences, Policy, and Management (1 cr)
or ESPM 1002—Transfer Orientation Seminar (1 cr)
ESPM 4021W—Problem Solving: Environmental Review, WI (4 cr)
or ESPM 4041W—Problem Solving for Environmental Change, WI (4 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Corporate Environmental Management (CEM) Sub-plan

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

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

Required Courses for the Sub-plan

Social Sciences

ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)
or APEC 1101—Principles of Microeconomics (3 cr)
or ECON 1101—Principles of Microeconomics, SOCS (4 cr)

ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)

or ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)

Prerequisite CEM Courses

ACCT 2050—Introduction to Financial Reporting (4 cr)

MATH 1271—Calculus I (4 cr)

MATH 1272—Calculus II (4 cr)

STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

MGMT 3001—Fundamentals of Management (3 cr)

PHYS 1301W—Introductory Physics for Science and Engineering I, PHYS, WI (4 cr)

PHYS 1302W—Introductory Physics for Science and Engineering II, PHYS, WI (4 cr)

CHEM 1022—Chemical Principles II (4 cr)

or BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)

CEM Track Required Courses

CE 3501—Environmental Engineering, ENV (3 cr)

ESPM 3602—Regulations and Corporate Environmental Management (3 cr)

ESPM 3603—Environmental Life Cycle Analysis (3 cr)

ESPM 3604—Environmental Management Systems and Strategy (3 cr)

ESPM 3606—Pollution Prevention: Principles, Technologies, and Practices (3 cr)

ESPM 5019—Business, Natural Environment, and Global Economy (2 cr)

ESPM 4096—Professional Experience Program: Internship (1 cr)

or ESPM 3111—Hydrology and Water Quality Field Methods (3 cr)

or appropriate study abroad

or take all of the following in the same term:

FR 2101—Identifying Forest Plants (1 cr)

FR 2102—Northern Forests: Field Ecology (2 cr)

FR 2104—Measuring Forest Resources (1 cr)

Track Contract Courses

Take 12 or more credit(s) from the following:

ESPM 2041—Natural Resources Consumption and Sustainability (3 cr)

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)

ESPM 3605—Recycling: Extending Raw Materials, TS (3 cr)

ESPM 4216—Contaminant Hydrology (2 cr)

ESPM 4607—Industrial Biotechnology and the Environment (3 cr)

ESPM 4608—Bioremediation (3 cr)

ESPM 4609—Air Pollution Impacts, Management, and Ethical Challenges (3 cr)

BBE 2201—Renewable Energy and the Environment, TS (3 cr)

BBE 5535—Assessment and Diagnosis of Impaired Waters (3 cr)

AFEE 5361—World Development Problems (3 cr)

APEC 3611—Environmental and Natural Resource Economics, ENV (3 cr)

Conservation and Resource Management (CRM)

Sub-plan

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

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

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

Required Courses for the Sub-plan

Social Sciences

ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)

or APEC 1101—Principles of Microeconomics (3 cr)

or ECON 1101—Principles of Microeconomics, SOCS (4 cr)

ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)

or ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)

CRM Core Courses

MATH 1142—Short Calculus (4 cr)

or MATH 1271—Calculus I (4 cr)

ESPM 3012—Statistical Methods for Environmental Scientists and Managers, MATH (4 cr)

or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

BIOL 2012—General Zoology (4 cr)

or BIOL 2022—General Botany (3 cr)

or ESPM 3101—Conservation of Plant Biodiversity (3 cr)

or ESPM 3108—Ecology of Managed Systems, ENV (3 cr)

or ESPM 3612W—Soil and Environmental Biology, WI (3 cr)

or FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)

or FR 3104—Forest Ecology (4 cr)

CHEM 1022—Chemical Principles II (4 cr)

or BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)

SOIL 1125—The Soil Resource (4 cr)

or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

Internship

Requires approval and supervision by faculty adviser from track.

ESPM 4096—Professional Experience Program: Internship (1 cr)

CRM Contract Courses

Courses taken to meet other requirements cannot be double counted here, nor can courses count for multiple groups. Course selections from contract area must be made through a faculty adviser. A contract is required.

Take 36 or more credit(s) including 4 or more sub-requirement(s) from the following:

Conservation and Management

Take 10 or more credit(s) from the following:

ESPM 3101—Conservation of Plant Biodiversity (3 cr)

ESPM 3108—Ecology of Managed Systems, ENV (3 cr)

ESPM 3221—Soil Conservation and Land-Use Management (3 cr)

ESPM 3575—Wetlands Conservation (3 cr)

ESPM 3612W—Soil and Environmental Biology, WI (3 cr)

ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)

ESPM 4216—Contaminant Hydrology (2 cr)

ESPM 4601—Soils and Pollution (3 cr)

ENT 3925—Insects, Aquatic Habitats, and Pollution (3 cr)

EEB 3603—Science, Protection, and Management of Aquatic Environments (3 cr)

FR 3104—Forest Ecology (4 cr)

FR 3114—Hydrology and Watershed Management (3 cr)

FR 3411—Managing Forest Ecosystems: Silviculture (3 cr)

FR 5153—Forest and Wetland Hydrology (3 cr)

FW 4102—Principles of Conservation Biology (3 cr)

FW 4103—Principles of Wildlife Management (3 cr)

FW 5411—Aquatic Toxicology (3 cr)

FW 5604W—Fisheries Ecology and Management, WI (3 cr)

HORT 5071—Restoration and Reclamation Ecology (4 cr)

SOIL 3416—Plant Nutrients in the Environment (3 cr)

SOIL 5555—Wetland Soils (3 cr)

SOIL 5711—Forest Soils (2 cr)

Take 7 or more credit(s) from the following:

- ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)
- ESPM 4021W—Problem Solving: Environmental Review, WI (4 cr)
- ESPM 4295W—GIS in Environmental Science and Management, WI (4 cr)
- FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)
- FR 3218—Measuring and Modeling Forests (3 cr)
- FR 3262—Remote Sensing of Natural Resources and Environment (4 cr)
- FR 5412—Digital Remote Sensing (3 cr)
- FW 5051—Analysis of Populations (4 cr)
- GEOG 3561—Principles of Geographic Information Science (4 cr)
- GIS 5571—ArcGIS I (3 cr)

Take 1 or more course(s) totaling 2–3 credit(s) from the following:

- ESPM 3031—Applied Global Positioning Systems for Geographic Information Systems (3 cr)
- ESPM 3111—Hydrology and Water Quality Field Methods (3 cr)
- PBIO 4321—Minnesota Flora (3 cr)
- SOIL 4093—Directed Study (1–7 cr)
- SOIL 4511—Field Study of Soils (2 cr)

Take all of the following in the same term:

- FR 2101—Identifying Forest Plants (1 cr)
- and FR 2102—Northern Forests: Field Ecology (2 cr)
- and FR 2104—Measuring Forest Resources (1 cr)

Take 3 or more credit(s) from the following:

- ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
- ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
- ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)
- ESPM 3602—Regulations and Corporate Environmental Management (3 cr)
- ESPM 3604—Environmental Management Systems and Strategy (3 cr)
- ESPM 4242—Methods for Environmental and Natural Resource Policy Analysis (3 cr)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

Environmental Education and Communication Sub-plan

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

Students may specialize in a content area through a minor, study abroad experience in ESPM topics, and/or a student designed content area. Students are encouraged to make choices that

strengthen their expertise in an area and/or provide comparative understanding from another culture or discipline.

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

Required Courses for the Sub-plan

Mathematical Thinking

- STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)
- or SOC 3811—Basic Social Statistics, MATH (4 cr)
- or ESPM 3012 Statistical Methods. (*Take only if your CLE mathematical thinking requirement is satisfied by another course.*)

Social Sciences

- ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)
- or APEC 1101—Principles of Microeconomics (3 cr)
- or ECON 1101—Principles of Microeconomics, SOCS (4 cr)
- ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
- or ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)

Education and Communication

- ESPM 2401—Environmental Education/Interpretation (3 cr)
- COMM 3441—Introduction to Organizational Communication (3 cr)
- or COMM 3451W—Intercultural Communication: Theory and Practice, IP, WI (3 cr)
- or ENGL 3501—Public Discourse: Coming to Terms With the Environment, C/PE, LIT (3 cr)
- or WRIT 3152W—Writing on Issues of Science and Technology, WI (4 cr)
- or WRIT 3221W—Communication Modes and Methods, WI (4 cr)
- or WRIT 3701W—Rhetorical Theory for Writing Studies, WI (4 cr)
- or WRIT 5664—Science Writing for Popular Audiences (3 cr)
- ESPM 4811—Environmental Interpretation (3 cr)
- or CI 5534—Studies in Science Education (3 cr)
- or CI 5537—Principles of Environmental Education (3 cr)
- or CI 5747—Global and Environmental Education: Content and Practice (3 cr)
- or REC 5301—Wilderness and Adventure Education (4 cr)
- or REC 5311—Programming Outdoor and Environmental Education (3 cr)
- EPSY 5243—Principles and Methods of Evaluation (3 cr)
- or REC 3281—Research and Evaluation in Recreation, Park, and Leisure Studies (4 cr)
- or RRM 5259—Visitor Behavior Analysis (3 cr)

Human Dimensions

- ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
- or PHIL 3301—Environmental Ethics (4 cr)
- Take 2 or more course(s) from the following:
- ESPM 2041—Natural Resources Consumption and Sustainability (3 cr)
- ESPM 3001—Treaty Rights and Natural Resources (3 cr)
- ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
- ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)
- ANTH 3041—Ecological Anthropology (3 cr)
- GEOG 3371W—Cities, Citizens, and Communities, DSJ, WI (4 cr)
- GEOG 3376—Political Ecology of North America, ENV (3 cr)
- HIST 3452—African Conservation Histories (3 cr)
- HSCI 3244—History of Ecology and Environmentalism (3 cr)
- POL 4210—Topics in Political Theory (3 cr)
- SOC 3451W—Cities and Social Change, WI (3 cr)
- SOC 4311—Race, Class, and the Politics of Nature (3 cr)
- WRIT 3302—Science, Religion, and the Search for Human Nature (3 cr)
- CSCL 3361—Visions of Nature: The Natural World and Political Thought (4 cr)
- or EEB 3361—Visions of Nature: The Natural World and Political Thought (4 cr)

Natural Sciences**Ecology**

- BIOL 3407—Ecology (3 cr)
 or BIOL 3408W—Ecology, WI (3 cr)
 or EEB 3001—Ecology and Society, ENV (3 cr)
 or FR 3104—Forest Ecology (4 cr)
 or FW 2003—Introduction to Marine Biology (3 cr)

Physical Environment

- ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)
 or BBE 2201—Renewable Energy and the Environment, TS (3 cr)
 or EEB 3603—Science, Protection, and Management of Aquatic Environments (3 cr)
 or EEB 5601—Limnology (3 cr)
 or FR 3114—Hydrology and Watershed Management (3 cr)
 or GEO 1001—Earth and Its Environments, PHYS, ENV (4 cr)
 or PHYS 1001W—Energy and the Environment, PHYS, WI (4 cr)
 or SOIL 1125—The Soil Resource (4 cr)

Organismal Biology

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

Plant

- Take 1 or more course(s) from the following:
 BIOL 2022—General Botany (3 cr)
 FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)
 PBIO 4321—Minnesota Flora (3 cr)
 PBIO 4511—Flowering Plant Diversity (3 cr)

Animal

- Take 1 or more course(s) from the following:
 BIOL 2012—General Zoology (4 cr)
 EEB 4129—Mammalogy (4 cr)
 EEB 4134—Introduction to Ornithology (4 cr)
 ENT 3005—Insect Biology, BIOL (4 cr)
 FW 4101—Herpetology (4 cr)

Complex Human and Natural Systems

- ESPM 3108—Ecology of Managed Systems, ENV (3 cr)
 or EEB 5146—Science and Policy of Global Environmental Change (3 cr)
 or FR 4501—Urban Forest Management: Managing Greenspaces for People (3 cr)
 or FR 5146—Science and Policy of Global Environmental Change (3 cr)
 or FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)
 or FW 4102—Principles of Conservation Biology (3 cr)
 or HORT 5071—Restoration and Reclamation Ecology (4 cr)
 or LA 3501—Environmental Design and Its Biological and Physical Context, ENV (3 cr)
 or URBS 3751—Understanding the Urban Environment, ENV (3 cr)

Field Experience

- ESPM 4096—Professional Experience Program: Internship (1 cr)
 or take all of the following in the same term:
 FR 2101—Identifying Forest Plants (1 cr)
 FR 2102—Northern Forests: Field Ecology (2 cr)
 FR 2104—Measuring Forest Resources (1 cr)

Environmental Science Sub-plan

The ES track focuses on the application and integration of basic and applied sciences to solve complex environmental problems. Students can earn professional licenses and certification in several areas and will be qualified to work as soil scientists, hydrologists, water quality and wetland ecology scientists, environmental remediation scientists, climatologists, and atmospheric scientist. Graduates find jobs with environmental regulatory agencies, private consulting firms, and nonprofit organizations. This track

provides a diverse basic and applied science background that also prepares students for scientific research through advanced graduate studies.

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

Required Courses for the Sub-plan**Social Sciences**

- ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)
 or APEC 1101—Principles of Microeconomics (3 cr)
 or ECON 1101—Principles of Microeconomics, SOCS (4 cr)
 ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
 or ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)

Additional Basic Science and Math Courses

- ESPM 3131—Environmental Physics (3 cr)
 CHEM 1022—Chemical Principles II (4 cr)
 PHYS 1101W—Introductory College Physics I, PHYS, WI (4 cr)
 MATH 1142—Short Calculus (4 cr)
 or MATH 1271—Calculus I (4 cr)
 BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
 or BIOL 2012—General Zoology (4 cr)
 or BIOL 2022—General Botany (3 cr)
 ESPM 3012—Statistical Methods for Environmental Scientists and Managers, MATH (4 cr)
 or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

Applied Sciences and Technology Courses

- ESPM 1425—The Atmosphere, PHYS, ENV (4 cr)
 ESPM 4096—Professional Experience Program: Internship (1 cr)
 FR 3114—Hydrology and Watershed Management (3 cr)
 GEO 1001—Earth and Its Environments, PHYS, ENV (4 cr)
 SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
 FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)
 or GEOG 3561—Principles of Geographic Information Science (4 cr)
 ESPM 3108—Ecology of Managed Systems, ENV (3 cr)
 or BIOL 3407—Ecology (3 cr)
 or BIOL 3408W—Ecology, WI (3 cr)
 or FR 3104—Forest Ecology (4 cr)

Take 2 or more credit(s) from the following:

- ESPM 3031—Applied Global Positioning Systems for Geographic Information Systems (3 cr)
 ESPM 3111—Hydrology and Water Quality Field Methods (3 cr)
 PBIO 4321—Minnesota Flora (3 cr)
 SOIL 3521—Soil Judging (1 cr)
 SOIL 4093—Directed Study (1–7 cr)
 SOIL 4511—Field Study of Soils (2 cr)

Take all of the following in the same term:

- FR 2101—Identifying Forest Plants (1 cr)
 FR 2102—Northern Forests: Field Ecology (2 cr)
 FR 2104—Measuring Forest Resources (1 cr)

ES Contract Courses

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

Take 15–21 credit(s) from the following:

Take 0–21 credit(s) from the following:

- ESPM 3221—Soil Conservation and Land-Use Management (3 cr)
 - ESPM 3612W—Soil and Environmental Biology, WI (3 cr)
 - GEO 4631W—Earth Systems: Geosphere/Biosphere Interactions, WI (3 cr)
 - GEO 4703—Glacial Geology (4 cr)
 - GEO 5108—Principles of Environmental Geology (3 cr)
 - GEOG 3441—Quaternary Landscape Evolution (3 cr)
 - SOIL 3416—Plant Nutrients in the Environment (3 cr)
 - SOIL 3521—Soil Judging (1 cr)
 - SOIL 4511—Field Study of Soils (2 cr)
 - SOIL 5515—Soil Genesis and Landscape Relations (3 cr)
 - SOIL 5555—Wetland Soils (3 cr)
 - SOIL 5711—Forest Soils (2 cr)
- Take 0–21 credit(s) from the following:
- ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)
 - ESPM 4216—Contaminant Hydrology (2 cr)
 - EEB 3603—Science, Protection, and Management of Aquatic Environments (3 cr)
 - EEB 5605—Limnology Laboratory (2 cr)
 - FR 5153—Forest and Wetland Hydrology (3 cr)
 - FW 5604W—Fisheries Ecology and Management, WI (3 cr)
 - GEO 5701—General Hydrogeology (3 cr)
 - PUBH 6190—Environmental Chemistry (3 cr)
 - WRS 5101—Water Policy (3 cr)
- Take 0–21 credit(s) from the following:
- ESPM 3612W—Soil and Environmental Biology, WI (3 cr)
 - ESPM 5131—Environmental Biophysics and Ecology (3 cr)
 - ESPM 5402—Biometeorology (3 cr)
 - AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 - AGRO 4505—Biology, Ecology, and Management of Invasive Plants (3 cr)
 - AGRO 4605—Management Strategies for Crop Production (3 cr)
 - AGRO 5321—Ecology of Agricultural Systems (3 cr)
 - BIOL 3002—Plant Biology: Function (2 cr)
 - BIOL 3005W—Plant Function Laboratory, WI (2 cr)
 - BIOL 3007W—Plant, Algal, and Fungal Diversity and Adaptation, WI (4 cr)
 - EEB 3963—Modeling Nature and the Nature of Modeling (3 cr)
 - EEB 4609W—Ecosystem Ecology, WI (3 cr)
 - EEB 4611—Biogeochemical Processes (3 cr)
 - EEB 4631—Global Ecology (4 cr)
 - EEB 5009—Quaternary Vegetation History and Climate (3 cr)
 - EEB 5122W—Plant Interactions with Animals and Microbes, WI (3 cr)
 - ENT 5361—Aquatic Insects (4 cr)
 - FR 3104—Forest Ecology (4 cr)
 - FR 3203—Forest Fire and Disturbance Ecology (3 cr)
 - FR 3204—Landscape Ecology and Management (3 cr)
 - FR 3411—Managing Forest Ecosystems: Silviculture (3 cr)
 - FR 4118—Trees: Structure and Function (3 cr)
 - FR 5146—Science and Policy of Global Environmental Change (3 cr)
 - FW 3565—Fisheries and Wildlife Ecology and Management: Field Trip (2 cr)
 - HORT 5071—Restoration and Reclamation Ecology (4 cr)
 - LA 3204—Holistic Landscape Ecology and Bioregional Practice (3 cr)
 - MICB 4121—Microbial Ecology and Applied Microbiology (3 cr)
- Take 0–21 credit(s) from the following:
- BIOL 3407—Ecology (3 cr)
 - or BIOL 3408W—Ecology, WI (3 cr)
- Take 0–21 credit(s) from the following:
- ESPM 3425—Atmospheric Composition: From Smog to Climate Change (3 cr)
 - ESPM 5131—Environmental Biophysics and Ecology (3 cr)
 - ESPM 5402—Biometeorology (3 cr)
 - GEO 3002—Climate Change and Human History, ENV (3 cr)
 - GEOG 5423—Climate Models and Modeling (3 cr)
 - GEOG 5426—Climatic Variations (3 cr)

- GEOG 5565—Geographical Analysis of Human-Environment Systems (3 cr)
 - ME 5115—Air Quality and Air Pollution Control (4 cr)
- Take 0–21 credit(s) from the following:
- ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)
 - ESPM 3603—Environmental Life Cycle Analysis (3 cr)
 - ESPM 4216—Contaminant Hydrology (2 cr)
 - ESPM 4295W—GIS in Environmental Science and Management, WI (4 cr)
 - ESPM 4601—Soils and Pollution (3 cr)
 - ESPM 5601—Principles of Waste Management (3 cr)
 - CE 3501—Environmental Engineering, ENV (3 cr)
 - CHEM 2301—Organic Chemistry I (3 cr)
 - ENT 5241—Ecological Risk Assessment (3 cr)
 - FR 3218—Measuring and Modeling Forests (3 cr)
 - FR 3262—Remote Sensing of Natural Resources and Environment (4 cr)
 - FR 5412—Digital Remote Sensing (3 cr)
 - FW 5411—Aquatic Toxicology (3 cr)
 - GEOG 3401—Geography of Environmental Systems and Global Change, ENV (4 cr)
 - GEOG 3531—Numerical Spatial Analysis (4 cr)
 - GEOG 5563—Advanced Geographic Information Science (3 cr)
 - GIS 5571—ArcGIS I (3 cr)
 - PUBH 6103—Exposure to Environmental Hazards (2 cr)
 - PUBH 6104—Environmental Health Effects: Introduction to Toxicology (2 cr)
 - PUBH 6105—Environmental and Occupational Health Policy (2 cr)
 - PUBH 6132—Air, Water, and Health (2 cr)
 - PUBH 6171—Exposure Assessment for Air Contaminants (3 cr)
 - PUBH 6175—Environmental Measurements Laboratory (2 cr)

Policy, Planning, Law and Society Sub-plan

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

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

Required Courses for the Sub-plan

PPLS Core Courses

- ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
- ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)
- ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)
- ESPM 3108—Ecology of Managed Systems, ENV (3 cr)
- ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)

FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)

RRM 4232W—Managing Recreational Lands, ENVT, WI (4 cr)

ESPM 3604—Environmental Management Systems and Strategy (3 cr)

or ESPM 4021W—Problem Solving: Environmental Review, WI (4 cr)

or ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)

or BBE 2201—Renewable Energy and the Environment, TS (3 cr)

or FR 3104—Forest Ecology (4 cr)

or FR 3114—Hydrology and Watershed Management (3 cr)

or FR 3411—Managing Forest Ecosystems: Silviculture (3 cr)

or FR 5146—Science and Policy of Global Environmental Change (3 cr)

or SOIL 1125—The Soil Resource (4 cr)

or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

or SOC 3811—Basic Social Statistics, MATH (4 cr)

or ESPM 3012 Statistical Methods. (*Take only if your CLE mathematical thinking requirement is satisfied by another course.*)

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)

ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)

ESPM 3251—Natural Resources in Sustainable International Development, GP (3 cr)

ESPM 4242—Methods for Environmental and Natural Resource Policy Analysis (3 cr)

ESPM 4256—Natural Resource Law and the Management of Public Lands and Waters (3 cr)

Field Session Options

ESPM 4096—Professional Experience Program: Internship (1 cr)

or

Cloquet Field Session

Take all of the following in the same term:

FR 2101—Identifying Forest Plants (1 cr)

FR 2102—Northern Forests: Field Ecology (2 cr)

FR 2104—Measuring Forest Resources (1 cr)

PPLS Contract Courses

Students must specialize in a content area to strengthen their expertise, through a minor, appropriate study abroad experience, and/or a student designed area. Courses listed in the track but not taken are good choices for use in a content area, as are courses listed below.

PPLS students should see their adviser for a list of appropriate minors.

Submit a contract for 12 credits of 3XXX or above credits, completed through prior consultation with your faculty adviser.

Take 12 or more credit(s) from the following:

ESPM 3xxx

AGRO 3xxx

APEC 3xxx

BBE 3xxx

COMM 3xxx

ECON 3xxx

FR 3xxx

FW 3xxx

GEOG 3xxx

GLOS 3xxx

MGMT 3xxx

POL 3xxx

RRM 3xxx

SOIL 3xxx

WRIT 3xxx

WRS 3xxx

Environmental Sciences, Policy and Management Minor

College of Food, Agricultural and Natural Resource Sciences

- Required credits in this minor: 16.

The environmental sciences, policy and management minor provides students in programs such as biology, education, journalism, political science, and others with the basic understanding to recognize, evaluate, and develop solutions to a range of environmental problems. Students interested in the minor should contact Student Services in 190 Coffey Hall.

Minor Requirements

Core Courses

Take 2 or more course(s) totaling 6–8 credit(s) from the following:

ESPM 1011—Issues in the Environment, C/PE, ENVT (3 cr)

ESPM 2041—Natural Resources Consumption and Sustainability, ENVT, IP (3 cr)

FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology, ENVT (3 cr)

SOIL 2125—Basic Soil Science, ENVT (4 cr)

BIOL 3407—Ecology, ENVT (3 cr)

or BIOL 3408W—Ecology, ENVT, WI (3 cr)

or EEB 3001—Ecology and Society, ENVT (3 cr)

or FR 3104—Forest Ecology (4 cr)

Electives

See your minor adviser for a list of these courses arranged by the following themes: environmental education and communication; environmental management and policy; and environmental and biological sciences. Students may but are not required to take all 10 credits in one thematic area.

Note: At least two courses MUST have an ESPM designator.

Take 10 or more credit(s) from the following:

ESPM 2401—Environmental Education/Interpretation (3 cr)

ESPM 3002—Colloquium: Exotic Plants and Animals (1 cr)

ESPM 3011W—Ethics in Natural Resources, C/PE, ENVT, WI (3 cr)

ESPM 3101—Conservation of Plant Biodiversity, ENVT (3 cr)

ESPM 3108—Ecology of Managed Systems (3 cr)

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, C/PE, WI (3 cr)

ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)

ESPM 3221—Soil Conservation and Land-Use Management (3 cr)

ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, C/PE, SSCI, WI (3 cr)

ESPM 3245—Sustainable Land Use Planning and Policy, ENVT (3 cr)

ESPM 3261—Economics and Natural Resources Management, ENVT, SSCI (4 cr)

ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)

ESPM 3575—Wetlands Conservation (3 cr)

ESPM 3601—Our Home, Our Environment (3 cr)

ESPM 3602—Regulations and Corporate Environmental Management (3 cr)

ESPM 3603—Environmental Life Cycle Analysis (3 cr)

ESPM 3604—Environmental Management Systems and Strategy (3 cr)

ESPM 3605—Recycling: Extending Raw Materials (3 cr)

ESPM 3606—Pollution Prevention: Principles, Technologies, and Practices (3 cr)

ESPM 3612W—Soil and Environmental Biology, WI (3 cr)

ESPM 4061W—Water Quality and Natural Resources, ENVT, WI (3 cr)

ESPM 4216—Contaminant Hydrology (2 cr)

ESPM 4256—Natural Resource Law and the Management of Public Lands and Waters (3 cr)

ESPM 4295W—GIS in Environmental Science and Management, WI (4 cr)

ESPM 4601—Soils and Pollution (3 cr)

ESPM 4607—Industrial Biotechnology and the Environment (3 cr)

ESPM 4608—Bioremediation (2 cr)

ESPM 4811—Environmental Interpretation (3 cr)

ESPM 5601—Principles of Waste Management (3 cr)
 BBE 2201—Renewable Energy and the Environment (3 cr)
 CI 5537—Principles of Environmental Education (3 cr)
 CI 5747—Global and Environmental Education: Content and Practice (3 cr)
 EEB 3603—Science, Protection, and Management of Aquatic Environments (3 cr)
 EEB 4609W—Ecosystem Ecology, WI (3 cr)
 EEB 4611—Biogeochemical Processes (3 cr)
 ENT 3925—Insects, Aquatic Habitats, and Pollution (3 cr)
 ENT 5241—Ecological Risk Assessment (3 cr)
 FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)
 FR 3114—Hydrology and Watershed Management (3 cr)
 FR 3131—Geographical Information Systems (GIS) for Natural Resources (4 cr)
 FR 3203—Forest Fire and Disturbance Ecology (3 cr)
 FR 3204—Landscape Ecology and Management (3 cr)
 FR 3218—Measuring and Modeling Forests (3 cr)
 FR 3411—Managing Forest Ecosystems: Silviculture (3 cr)
 FR 5146—Science and Policy of Global Environmental Change, ENVT (3 cr)
 FW 4102—Principles of Conservation Biology, ENVT (3 cr)
 FW 5411—Aquatic Toxicology, ENVT (3 cr)
 FW 5604W—Fisheries Ecology and Management, ENVT, WI (3 cr)
 HSCI 3244—History of Ecology and Environmentalism (3 cr)
 PBIO 4321—Minnesota Flora (3 cr)
 PBIO 4511—Flowering Plant Diversity (3 cr)
 PHIL 3301—Environmental Ethics, C/PE, ENVT (4 cr)
 PLPA 3002—Air Pollution, People, and Plants: The Science and the Ethics, C/PE, ENVT (3 cr)
 REC 5301—Wilderness and Adventure Education (4 cr)
 SOIL 5555—Wetland Soils (3 cr)
 SUST 3003—Sustainable People, Sustainable Planet, ENVT, C/PE (3 cr)
 WRIT 3404—Environmental Communication (3 cr)

Fisheries and Wildlife B.S.

Fisheries, Wildlife, and Conservation Biology

- Required credits to graduate with this degree: 120.
- Required credits within the major: 85 to 92.
- This program requires summer terms.

The fisheries and wildlife curriculum gives students 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, environmental law, and environmental education.

Students select an area of specialization, usually by the end of the sophomore year. Areas of specialization include conservation biology, fisheries, and wildlife. Although no computer course is required, students are expected to be computer literate and competent using word processing, spreadsheet, and email software.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

After completing a core curriculum that includes liberal education, communications, basic science, mathematics, and an orientation to the fields of fisheries, wildlife, and conservation biology, students complete additional credits in one of three areas of specialization: fisheries, wildlife, or conservation biology. Some of the core curriculum courses also fulfill diversified core and designated theme requirements. Electives to complete the required 120 credits are chosen in consultation with a program adviser.

Students may also 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.

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

Communication Skills

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

COMM 1101—Introduction to Public Speaking (3 cr)
 WRIT 3257—Scientific and Technical Presentations (3 cr)
 WRIT 3562W—Technical and Professional Writing, WI (4 cr)

Mathematical Thinking

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

MATH 1142—Short Calculus (4 cr)
 MATH 1271—Calculus I (4 cr)

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

FW 4001—Biometry, WI (4 cr)
 ESPM 3012—Statistical Methods for Environmental Scientists and Managers, MATH (4 cr)

Chemical, Biological, and Physical Sciences

CHEM 1021—Chemical Principles I (4 cr)
 BIOL 1009—General Biology, BIOL (4 cr)
 BIOL 2012—General Zoology (4 cr)
 GCD 3022—Genetics (3 cr)

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

BIOL 3407—Ecology (3 cr)
 BIOL 3408W—Ecology, WI (3 cr)
 BIOL 3807—Ecology (4 cr)

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

PHYS 1001W—Energy and the Environment, PHYS, WI (4 cr)
 PHYS 1101W—Introductory College Physics I, PHYS, WI (4 cr)
 PHYS 1201W—Introductory Physics for Biology and Pre-medicine I, PHYS, WI (5 cr)

Fisheries, Wildlife, and Conservation Biology Courses

FW 1001—Orientation in Fisheries, Wildlife, and Conservation Biology (1 cr)
 FW 4106—Important Plants in Fisheries and Wildlife Habitats (1 cr)
 FW 4108—Field Methods in Research and Conservation of Vertebrate Populations (3 cr)
 FW 4291—Independent Study: Fisheries (1–5 cr)
 or FW 4391—Independent Study: Wildlife (1–5 cr)
 or FW 3565—Fisheries and Wildlife Ecology and Management: Field Trip (2 cr)
 or FW 4701—Fisheries and Wildlife Problem Solving (2 cr)
 or FW 5625—Wildlife Handling and Immobilization for Research and Management (2 cr)
 or ESPM 4096—Professional Experience Program: Internship (1 cr)
 or Second field course

Social Science and Humanities

ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)
 or APEC 1101—Principles of Microeconomics (3 cr)
 or APEC 1102—Principles of Macroeconomics, IP, SSCI (3 cr)
 or ECON 1101—Principles of Microeconomics, SOCS (4 cr)
 or ECON 1102—Principles of Macroeconomics, IP, SSCI (4 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Conservation Biology Sub-plan

The conservation biology specialization is for students interested in careers dealing with a broad range of conservation issues in aquatic or terrestrial habitats. Positions typically focus on protection of endangered species and management for biodiversity. Careers as environmental educators or naturalists are also options.

All required courses in the specialization must be taken A-F and completed with a grade of at least C-.

Required Courses for the Sub-plan

Human Dimensions

Take 3 or more course(s) totaling 9 or more credit(s) from the following:

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
 ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)
 ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
 ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
 ESPM 3251—Natural Resources in Sustainable International Development, GP (3 cr)
 ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)
 ESPM 3001—Treaty Rights and Natural Resources (3 cr)
 SUST 3003—Sustainable People, Sustainable Planet, ENV (3 cr)

Animals and Plants

Take 2 or more course(s) from the following:

FW 2003—Introduction to Marine Biology (3 cr)
 FW 4136—Ichthyology (4 cr)
 FW 4101—Herpetology (4 cr)
 EEB 4129—Mammalogy (4 cr)
 EEB 4134—Introduction to Ornithology (4 cr)
 EEB 4839—Field Studies in Mammalogy (4 cr)
 EEB 4844—Field Ornithology (4 cr)
 ENT 5021—Insect Taxonomy and Phylogeny (4 cr)
 ENT 5361—Aquatic Insects (4 cr)

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

FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)
 PBIO 4321—Minnesota Flora (3 cr)
 PBIO 4511—Flowering Plant Diversity (3 cr)

Community and Ecosystem Ecology

FR 3204—Landscape Ecology and Management (3 cr)

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

FR 3104—Forest Ecology (4 cr)
 ESPM 3575—Wetlands Conservation (3 cr)
 EEB 3603—Science, Protection, and Management of Aquatic Environments (3 cr)
 EEB 4014—Ecology of Vegetation (3 cr)
 EEB 4609W—Ecosystem Ecology, WI (3 cr)

Conservation Biology

FW 4102—Principles of Conservation Biology (3 cr)
 FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)
 Take 1 or more course(s) from the following:
 FW 5051—Analysis of Populations (4 cr)
 FW 5601—Fisheries Population Analysis (3 cr)
 FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)
 FW 5604W—Fisheries Ecology and Management, WI (3 cr)

Fisheries Sub-plan

The fisheries area of specialization is for students who wish to pursue careers in fisheries and aquatic resource 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 Professional designation established by the American Fisheries Society, the major professional organization for fisheries scientists and managers in North America.

All required courses in the specialization must be taken A-F and completed with a grade of at least C-.

Required Courses for the Sub-plan

Human Dimensions

Take 2 or more course(s) totaling 6 or more credit(s) from the following:

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
 ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)
 ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
 ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
 ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)
 ESPM 3001—Treaty Rights and Natural Resources (3 cr)

Animals and Plants

FW 4136—Ichthyology (4 cr)
 FW 4401—Fish Physiology and Behavior (2 cr)
 Take 1 or more course(s) from the following:
 FW 2003—Introduction to Marine Biology (3 cr)
 FW 4101—Herpetology (4 cr)
 ENT 5021—Insect Taxonomy and Phylogeny (4 cr)
 ENT 5361—Aquatic Insects (4 cr)

Community and Ecosystem Ecology

EEB 5601—Limnology (3 cr)
 Take 1 or more course(s) from the following:
 FR 3114—Hydrology and Watershed Management (3 cr)
 FR 3204—Landscape Ecology and Management (3 cr)
 ESPM 3575—Wetlands Conservation (3 cr)
 ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)
 EEB 4609W—Ecosystem Ecology, WI (3 cr)

Fisheries

FW 5601—Fisheries Population Analysis (3 cr)
 FW 5604W—Fisheries Ecology and Management, WI (3 cr)
 CHEM 1022—Chemical Principles II (4 cr)
 BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
 or CHEM 2101—Introductory Analytical Chemistry Lecture (3 cr)
 or CHEM 2301—Organic Chemistry I (3 cr)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Pre-Veterinary Medicine sub-plan

This sub-plan is optional and does not fulfill the sub-plan requirement for this program.

The doctor of veterinary medicine degree (D.V.M.) is a rigorous four-year professional program preceded by three to four years of pre-professional study. Although a bachelor's degree is not required for admission to the D.V.M. program, approximately 70 percent of the students entering the program each year have completed their bachelor's degree. Fisheries and wildlife is one of the primary college majors at the University of Minnesota that offers a pre-veterinary program.

The following courses are required in addition to the fisheries and wildlife core requirements and courses in one of three areas of specialization. These courses may be substituted for the "suggested courses" in the areas of specialization.

Required Courses for the Sub-plan

CHEM 1022—Chemical Principles II (4 cr)
BIOC 3021—Biochemistry (3 cr)
CHEM 2301—Organic Chemistry I (3 cr)
CHEM 2311—Organic Lab (4 cr)
CHEM 2302—Organic Chemistry II (3 cr)
VBS 2032—General Microbiology With Laboratory (4 cr)
or MICB 3301—Biology of Microorganisms (5 cr)
PHYS 1101W—Introductory College Physics I, PHYS, WI (4 cr)
and PHYS 1102W—Introductory College Physics II, PHYS, WI (4 cr)
or PHYS 1201W—Introductory Physics for Biology and Pre-medicine I, PHYS, WI (5 cr)
and PHYS 1202W—Introductory Physics for Biology and Pre-medicine II, PHYS, WI (5 cr)
or PHYS 1301W—Introductory Physics for Science and Engineering I, PHYS, WI (4 cr)
and PHYS 1302W—Introductory Physics for Science and Engineering II, PHYS, WI (4 cr)

Other Recommended Courses

The following courses are not required to complete the pre-vet requirements.

ANSC 1101—Introductory Animal Science (4 cr)
FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)
FW 4103—Principles of Wildlife Management (3 cr)
ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
ESPM 3575—Wetlands Conservation (3 cr)
FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)
EEB 4129—Mammalogy (4 cr)
ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)
FW 5051—Analysis of Populations (4 cr)
EEB 4134—Introduction to Ornithology (4 cr)

Wildlife Sub-plan

The wildlife specialization is for students who wish to pursue careers in wildlife science, management, and administration; zoo biology; 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.

All required courses in the specialization must be taken A-F and completed with a grade of at least C-.

Required Courses for the Sub-plan

Human Dimensions

Take 2 or more course(s) from the following:

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)
ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)
ESPM 3001—Treaty Rights and Natural Resources (3 cr)

Animal and Plants

Take 2 or more course(s) from the following:

FW 4101—Herpetology (4 cr)
EEB 4129—Mammalogy (4 cr)
EEB 4134—Introduction to Ornithology (4 cr)
EEB 4839—Field Studies in Mammalogy (4 cr)
EEB 4844—Field Ornithology (4 cr)

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

FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)
PBIO 4321—Minnesota Flora (3 cr)
PBIO 4511—Flowering Plant Diversity (3 cr)

Community and Ecosystem Ecology

Take 1 or more course(s) totaling 3 or more credit(s) from the following:

FR 3204—Landscape Ecology and Management (3 cr)
FR 3104—Forest Ecology (4 cr)
ESPM 3575—Wetlands Conservation (3 cr)
EEB 4014—Ecology of Vegetation (3 cr)
EEB 4609W—Ecosystem Ecology, WI (3 cr)

Wildlife

FW 4103—Principles of Wildlife Management (3 cr)
FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)
FW 5051—Analysis of Populations (4 cr)
FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)

Fisheries and Wildlife Minor

Fisheries, Wildlife, and Conservation Biology

- Required credits in this minor: 16 to 18.

The fisheries and wildlife minor enables students in programs such as biology, communications, education, forestry, natural resources, environmental studies, and others to develop an understanding of the principles and practices of fisheries, wildlife, and conservation biology. An overview is provided of fish and wildlife biology and natural history and of the general principles applied to managing their populations and habitats. Students interested in the minor should contact the CFANS Student Services Office.

Minor Requirements

Ecology

BIOL 3407—Ecology, ENVT (3 cr)
 or BIOL 3408W—Ecology, ENVT, WI (3 cr)
 or FR 3104—Forest Ecology (4 cr)
 or any other ecology course

Principles of Fisheries, Wildlife and Conservation Biology

Take 1 or more course(s) totaling 3 or more credit(s) from the following:
 FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology, ENVT (3 cr)
 FW 2003—Introduction to Marine Biology (3 cr)
 FW 4102—Principles of Conservation Biology, ENVT (3 cr)
 FW 4103—Principles of Wildlife Management (3 cr)

Human Dimensions

Take 1 or more course(s) totaling 3 or more credit(s) from the following:
 ESPM 3001—Treaty Rights and Natural Resources, CD, HP (3 cr)
 SUST 3003—Sustainable People, Sustainable Planet, ENVT, C/PE (3 cr)
 ESPM 3011W—Ethics in Natural Resources, C/PE, ENVT, WI (3 cr)
 ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, C/PE, WI (3 cr)
 ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, C/PE, SSCI, WI (3 cr)
 ESPM 3245—Sustainable Land Use Planning and Policy, ENVT (3 cr)
 ESPM 3271—Environmental Policy, Law, and Human Behavior (3 cr)

Taxonomy

Take 1 or more course(s) totaling 4 or more credit(s) from the following:
 FW 4101—Herpetology (4 cr)
 EEB 4129—Mammalogy (4 cr)
 EEB 4134—Introduction to Ornithology (4 cr)

Advanced FW

Take 1 or more course(s) totaling 3 or more credit(s) from the following:
 FW 4108—Field Methods in Research and Conservation of Vertebrate Populations (3 cr)
 FW 5051—Analysis of Populations (4 cr)
 FW 5455—Sustainable Aquaculture, ENVT, IP (3 cr)
 FW 5601—Fisheries Population Analysis (3 cr)
 FW 5603W—Habitats and Regulation of Wildlife, ENVT, WI (3 cr)
 FW 5604W—Fisheries Ecology and Management, ENVT, WI (3 cr)

Food Science B.S.

Food Science and Nutrition

- Required credits to graduate with this degree: 120.
- Required credits within the major: 95.

Food science applies chemistry, microbiology, and engineering to the science and technology of making foods.

Chemistry—because foods undergo chemical reactions when they are heated, frozen, mixed with each other, and stored.

Microbiology—because many foods are made by microorganisms (e.g., bread, cheese, yogurt, sauerkraut, tempeh) and because microorganisms cause extensive, rapid, and often dangerous spoilage.

Physics and engineering—because foods must be constructed, moved through the factory, made safe, and distributed intact to the consumer.

Food science involves creating new food products and making current products more stable, nutritious, convenient, reliable, and safe.

The food science program is offered through the College of Food, Agricultural and Natural Resource Sciences.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Foundation Courses

BIOL 1009—General Biology, BIOL (4 cr)
 CHEM 1021—Chemical Principles I (4 cr)
 CHEM 1022—Chemical Principles II (4 cr)
 CHEM 2301—Organic Chemistry I (3 cr)
 CHEM 2302—Organic Chemistry II (3 cr)
 CHEM 2311—Organic Lab (4 cr)
 PHYS 1301W—Introductory Physics for Science and Engineering I, PHYS, WI (4 cr)
 STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)
 MATH 1142—Short Calculus (4 cr)
 or take this pair of courses
 MATH 1271—Calculus I (4 cr)
 and MATH 1272—Calculus II (4 cr)
 BIOC 3021—Biochemistry (3 cr)
 or take the following course pair
 BIOC 4331—Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4 cr)
 and BIOC 4332—Biochemistry II: Molecular Mechanisms of Signal Transduction and Gene Expression (4 cr)
 FSCN 2021—Introductory Microbiology (4 cr)
 or VBS 2032—General Microbiology With Laboratory (4 cr)
 or MICB 3301—Biology of Microorganisms (5 cr)
 BIOL 4003—Genetics (3 cr)
 or GCD 3022—Genetics (3 cr)

Professional Courses

BBE 4744—Engineering Principles for Biological Scientists (4 cr)
 FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)
 FSCN 1112—Principles of Nutrition (3 cr)
 FSCN 3102—Introduction to Food Science (3 cr)
 FSCN 4121—Food Microbiology (3 cr)
 FSCN 4122—Food Fermentations and Biotechnology (2 cr)
 FSCN 4131—Food Quality (3 cr)
 FSCN 4312W—Food Analysis, WI (4 cr)
 FSCN 4332—Food Processing Operations (3 cr)
 FSCN 4311—Chemical Reactions in Food Systems (2 cr)
 Take all of the following in the same term:
 FSCN 4349—Food Science Capstone (1–2 cr)
 FSCN 4xxx or 5xxx
 FSCN 4112—Food Chemistry and Functional Foods (3 cr)

Communication

WRIT 3562W—Technical and Professional Writing, WI (4 cr)
 COMM 1101—Introduction to Public Speaking (3 cr)
 or PSTL 1461—Multicultural Perspectives in Public Speaking (3 cr)

Professional Courses

Students are required to complete one of the following course groups.

Internship, UROP, or Study Abroad Experience

FSCN 4096—Professional Experience Program: Internship (1–4 cr)
 or UROP research project
 or Study abroad for one semester

Program Sub-plans

A sub-plan is not required for this program.

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Food Science Minor

Food Science and Nutrition

- Required credits in this minor: 20 to 28.

See major description for more information.

Minor Requirements

Many courses in the minor have prerequisites that do not count towards the 20 credits.

Minor Courses

Take 20 or more credit(s) from the following:

BBE 4744—Engineering Principles for Biological Scientists (4 cr)
 FSCN 1102—Food: Safety, Risks, and Technology, C/PE (3 cr)
 FSCN 3102—Introduction to Food Science (3 cr)
 FSCN 4112—Food Chemistry and Functional Foods (3 cr)
 FSCN 4121—Food Microbiology (3 cr)
 FSCN 4122—Food Fermentations and Biotechnology (2 cr)
 FSCN 4131—Food Quality (3 cr)
 FSCN 4312W—Food Analysis, WI (4 cr)
 FSCN 4332—Food Processing Operations (3 cr)
 FSCN 4349—Food Science Capstone (1–2 cr)

Food Systems and the Environment Minor

College of Food, Agricultural and Natural Resource Sciences

This is a free-standing minor.

- Required credits in this minor: 15.

This interdisciplinary minor, based in CFANS, serves students from other colleges who have an interest in and a desire to acquire some breadth about food systems and the environment. Students completing this minor will be better prepared to understand the complexity of modern global food systems, interdependence of rural and urban societies, and environmental impact of consumer driven food systems choices; manage natural resources used for food and fiber for the benefit of society; and make more responsible personal and public decisions impacting food systems and the environment.

Admission Requirements

This minor is limited to non-CFANS majors. Interested students should contact the minor adviser at 612-625-6754 or the CFANS Student Services Office at 612-624-6768.

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Minor Requirements

Minor Courses

Students may only choose one course from each designator, in consultation with the minor adviser.

Take 15 or more credit(s) from the following:

CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
 CFAN 3001—Pests and Crop Protection (3 cr)
 CFAN 3500—International Field Studies Seminar (1–3 cr)
 AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
 ANSC 1011—Animals and Society, CIV (3 cr)
 ANSC 1101—Introductory Animal Science (4 cr)
 APEC 3041W—Economic Development of U.S. Agriculture, WI (3 cr)
 APEC 3611—Environmental and Natural Resource Economics, ENV (3 cr)
 BBE 5203—Environmental Impacts of Food Production (3 cr)
 ENT 4015—Ornamentals and Turf Entomology (3 cr)
 ESPM 3221—Soil Conservation and Land-Use Management (3 cr)
 FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)
 FSCN 1112—Principles of Nutrition (3 cr)
 WRIT 3315—Writing on Issues of Land and the Environment, AH, DSJ (3 cr)
 SOIL 1125—The Soil Resource (4 cr)
 AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 or ANSC 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 AGRO 4103—World Food Problems, GP (3 cr)
 or APEC 4103—World Food Problems, GP (3 cr)

Forest Resources B.S.

Forest Resources

- Required credits to graduate with this degree: 120.
- Required credits within the major: 120.
- This program requires summer terms.

The forest resources curriculum prepares students to plan, implement, and research the management, protection, and sustainable use of forest and related resources and environments, including timber, water, wildlife, recreation, and aesthetic resources. The curriculum provides a unique integration of the physical, biological, and social sciences with managerial sciences and policy, field skill development, and technologies for measuring and monitoring natural resources. Students are also trained in problem solving approaches to address specific local, regional, and global issues. Students select one of three tracks: 1) forest management and planning, 2) forest conservation and ecosystem management, and 3) urban and community forestry. Students should choose one of these tracks early in their college careers. A minor is also available.

Graduates find positions as foresters, urban foresters, land and water resource managers, conservationists, researchers, habitat managers, ecologists, geographic information systems specialists, resource analysts/consultants, silviculture specialists, nursery managers, land acquisition specialists, environmental planners, and educators. Principal employers are federal, state and local forestry, wildlife, parks, conservation and related natural resource agencies; forest products industry companies; landowner organizations; consulting firms; and nongovernmental conservation organizations and international development agencies.

Additionally, the curriculum provides excellent preparation in the fundamental and applied sciences that is essential for graduate study and careers in research and teaching.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Communication Skills

COMM 1101—Introduction to Public Speaking (3 cr)

Mathematical Thinking

ESPM 3012—Statistical Methods for Environmental Scientists and Managers, MATH (4 cr)

or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

MATH 1142—Short Calculus (4 cr)

or MATH 1271—Calculus I (4 cr)

Physical and Biological Sciences

BIOL 2022—General Botany (3 cr)

BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)

or BIOL 1009—General Biology, BIOL (4 cr)

SOIL 1125—The Soil Resource (4 cr)

or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

Social Sciences

ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)

ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)

Professional Courses

FR 1001—Orientation and Information Systems (1 cr)

FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)

RRM 4232W—Managing Recreational Lands, ENVT, WI (4 cr)

FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)

FR 3104—Forest Ecology (4 cr)

FR 3411—Managing Forest Ecosystems: Silviculture (3 cr)

Field training in assessment and biology of forests courses are taught at the Cloquet Forestry Ctr

Take all of the following in the same term:

FR 2101—Identifying Forest Plants (1 cr)

FR 2102—Northern Forests: Field Ecology (2 cr)

FR 2104—Measuring Forest Resources (1 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Forest Conservation/Ecosystem Management Sub-plan

The forest conservation and ecosystem management track prepares students for forest and related resource management with a focus on conservation issues and strategies. It is designed for students who seek a thorough understanding of ecosystem structure and function and the role of forests and their management in environmental quality. Graduates pursue careers as forest managers and conservationists or provide

specialized expertise for resource management organizations. Principal employers are federal and state forestry, wildlife, parks and related agencies; forest products companies; and nongovernmental conservation organizations. This track includes courses in a field session.

All required courses in this track must be taken A-F and completed with a grade of at least C-.

Required Courses for the Sub-plan

Additional Physical and Biological Sciences

CHEM 1021—Chemical Principles I (4 cr)

CHEM 1022—Chemical Principles II (4 cr)

PHYS 1001W—Energy and the Environment, PHYS, WI (4 cr)
or “B” or better in H.S. physics

Forest Conservation and Ecosystem Management Core

FR 3218—Measuring and Modeling Forests (3 cr)

FR 3262—Remote Sensing of Natural Resources and Environment (4 cr)

FR 3471—Forest Planning and Management (3 cr)

FR 3114—Hydrology and Watershed Management (3 cr)

FR 5413—Managing Forest Ecosystems: Silviculture Lab (1 cr)

ESPM 3011W—Ethics in Natural Resources, WI (3 cr)

or ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)

FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)

or FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)

ENT 4251—Forest and Shade Tree Entomology (3 cr)

or PLPA 3003—Diseases of Forest and Shade Trees (3 cr)

Additional Professional Courses

With faculty adviser approval, students select professional courses chosen from the list below. Courses used to satisfy other requirements may not be used to fill this 12-credit requirement.

Take 12 or more credit(s) from the following:

ESPM 2041—Natural Resources Consumption and Sustainability (3 cr)

ESPM 3002—Colloquium: Exotic Plants and Animals (1 cr)

ESPM 3101—Conservation of Plant Biodiversity (3 cr)

ESPM 3031—Applied Global Positioning Systems for Geographic Information Systems (3 cr)

ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)

ESPM 3251—Natural Resources in Sustainable International Development, GP (3 cr)

ESPM 3703—Agroforestry in Watershed Management (3 cr)

ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)

ENT 5241—Ecological Risk Assessment (3 cr)

ESPM 5555—Wetland Soils (3 cr)

FR 3203—Forest Fire and Disturbance Ecology (3 cr)

FR 3204—Landscape Ecology and Management (3 cr)

FR 3431—Timber Harvesting and Road Planning (2 cr)

FR 3612—Silviculture and Timber Harvesting Practices in Minnesota (1 cr)

FR 4118—Trees: Structure and Function (3 cr)

FR 5142—Tropical Forest Ecology (3 cr)

FR 5153—Forest and Wetland Hydrology (3 cr)

FR 5228—Advanced Assessment and Modeling (3 cr)

FR 5264—Advanced Forest Management Planning (3 cr)

FR 4511—Field Silviculture (2 cr)

FR 4515—Field Remote Sensing and Resource Survey (2 cr)

FW 5003—Human Dimensions of Biological Conservation (3 cr)

FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)

FW 5604W—Fisheries Ecology and Management, WI (3 cr)

GEO 1001—Earth and Its Environments, PHYS, ENV (4 cr)

HORT 5071—Restoration and Reclamation Ecology (4 cr)

LA 3501—Environmental Design and Its Biological and Physical Context, ENV (3 cr)

SOIL 3416—Plant Nutrients in the Environment (3 cr)

BIOL 3407—Ecology (3 cr)

or EEB 4014—Ecology of Vegetation (3 cr)
or EEB 4609W—Ecosystem Ecology, WI (3 cr)
ENT 4251—Forest and Shade Tree Entomology (3 cr)
or PLPA 3003—Diseases of Forest and Shade Trees (3 cr)
ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
or ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)

Electives

Choose electives from courses listed above, or consult with your adviser about other options to reach the required 120 credits.

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Forest Management and Planning Sub-plan

Students taking the forest management and planning track learn the principles, practices, and techniques of forest and related resource management. It is designed for students who wish to become directly involved in forest land management or specializations such as resource analysis, planning, timber harvesting, forest protection, or policy. Graduates may also pursue advanced positions in these areas. Principal employers include federal and state forestry, wildlife, and conservation agencies; forest products companies; landowner organizations; consulting firms; and international agencies. This track includes courses in two field sessions at the Cloquet Forestry Center.

All required courses in this track must be taken A-F and completed with a grade of at least C-.

Required Courses for the Sub-plan

Additional Physical and Biological Sciences

CHEM 1015—Introductory Chemistry: Lecture (3 cr)
CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
or CHEM 1021—Chemical Principles I (4 cr)
CHEM 1022—Chemical Principles II (4 cr)

Physics Requirement

PHYS 1001W—Energy and the Environment, PHYS, WI (4 cr)
or “B” or better in H.S. physics

Forest Management and Planning Core

BBE 1002—Wood and Fiber Science (3 cr)
FR 3114—Hydrology and Watershed Management (3 cr)
FR 3218—Measuring and Modeling Forests (3 cr)
FR 3262—Remote Sensing of Natural Resources and Environment (4 cr)
FR 3431—Timber Harvesting and Road Planning (2 cr)
FR 3471—Forest Planning and Management (3 cr)
FR 3612—Silviculture and Timber Harvesting Practices in Minnesota (1 cr)
FR 5413—Managing Forest Ecosystems: Silviculture Lab (1 cr)

ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
or ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
ENT 4251—Forest and Shade Tree Entomology (3 cr)
or PLPA 3003—Diseases of Forest and Shade Trees (3 cr)
FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)
or FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)

Advanced Training in Assessment and Management of Forests

These courses are taught at the Cloquet Forestry Center during May session.

FR 4511—Field Silviculture (2 cr)
FR 4515—Field Remote Sensing and Resource Survey (2 cr)
FR 4521—Field Timber Harvesting and Road Planning (2 cr)

Additional Professional Courses

With faculty adviser approval, students select professional courses from the list below. Courses used to satisfy other requirements may not be used to fill the 6-credit professional requirement.

Take 6 or more credit(s) from the following:

ESPM 3031—Applied Global Positioning Systems for Geographic Information Systems (3 cr)
ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)
ESPM 3251—Natural Resources in Sustainable International Development, GP (3 cr)
ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)
FR 3203—Forest Fire and Disturbance Ecology (3 cr)
FR 3204—Landscape Ecology and Management (3 cr)
FR 4118—Trees: Structure and Function (3 cr)
FR 5142—Tropical Forest Ecology (3 cr)
FR 5153—Forest and Wetland Hydrology (3 cr)
FR 5228—Advanced Assessment and Modeling (3 cr)
FR 5264—Advanced Forest Management Planning (3 cr)
FR 5412—Digital Remote Sensing (3 cr)
FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)
FW 5604W—Fisheries Ecology and Management, WI (3 cr)
GEO 1001—Earth and Its Environments, PHYS, ENV (4 cr)
ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
or ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
ENT 4251—Forest and Shade Tree Entomology (3 cr)
or PLPA 3003—Diseases of Forest and Shade Trees (3 cr)

Urban and Community Forestry Sub-plan

The urban and community forestry track prepares students for planning and managing vegetation and related resources in or near urban communities, and for specializations such as urban planning and environmental education. Urban forests include areas along streets, in parks, private lands, greenbelts, and open spaces. Graduates help plan, design, and protect these forests including supervision of tree selection, planting, and plant health care programs. Employers include city government, tree care/arboreal firms, state and federal forestry agencies, nurseries, and utility companies. Graduates may also qualify for traditional forestry positions. This track includes a field session.

All required courses in this track must be taken A-F and completed with a grade of at least C-.

Required Courses for the Sub-plan

Additional Physical and Biological Sciences

CHEM 1015—Introductory Chemistry: Lecture (3 cr)
CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
or CHEM 1021—Chemical Principles I (4 cr)
CHEM 1022—Chemical Principles II (4 cr)

Additional Social Science

POL 1001—American Democracy in a Changing World, SOCS (4 cr)

Urban and Community Forestry Core

HORT 1015—Woody and Herbaceous Plants (4 cr)

FR 3501—Arboriculture: Selection and Maintenance of Trees (3 cr)

FR 4501—Urban Forest Management: Managing Greenspaces for People (3 cr)

ENT 4251—Forest and Shade Tree Entomology (3 cr)

PLPA 3003—Diseases of Forest and Shade Trees (3 cr)

URBS 1001W—Introduction to Urban Studies: The Complexity of Metropolitan Life, WI (3 cr)

FR 3218—Measuring and Modeling Forests (3 cr)

or ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)

FR 3114—Hydrology and Watershed Management (3 cr)

or ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)

FR 4118—Trees: Structure and Function (3 cr)

or BIOL 3002—Plant Biology: Function (2 cr)

Additional Professional Courses

With faculty adviser approval, students select professional courses from the list below. Courses used to satisfy other requirements may not be used to fill the 6-credit professional requirement.

Take 6 or more credit(s) from the following:

ANTH 3041—Ecological Anthropology (3 cr)

BBE 1002—Wood and Fiber Science (3 cr)

COMM 3411—Introduction to Small Group Communication (3 cr)

FR 3204—Landscape Ecology and Management (3 cr)

FR 3262—Remote Sensing of Natural Resources and Environment (4 cr)

FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)

FW 5603W—Habitats and Regulation of Wildlife, WI (3 cr)

GEOG 3371W—Cities, Citizens, and Communities, DSJ, WI (4 cr)

LA 3501—Environmental Design and Its Biological and Physical Context, ENV (3 cr)

MGMT 3001—Fundamentals of Management (3 cr)

ESPM 3031—Applied Global Positioning Systems for Geographic Information Systems (3 cr)

ESPM 3101—Conservation of Plant Biodiversity (3 cr)

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)

ESPM 3703—Agroforestry in Watershed Management (3 cr)

SOC 1001—Introduction to Sociology, SOCS (4 cr)

SOC 3451W—Cities and Social Change, WI (3 cr)

SOIL 3416—Plant Nutrients in the Environment (3 cr)

Forest Resources Minor**Forest Resources**

- Required credits in this minor: 18.

The forest resources minor helps students in natural resources and other areas gain deeper understanding of the scientific foundations of forestry, the management of forest resources, and the importance of forest resources to society. Students select from an array of courses in forest assessment, forest biology and management, and forest economics and policy. Students may include a three-week, hands-on field session at the Cloquet Forestry Center as part of their minor. Students interested in the minor should contact the CFANS Student Services Office.

Minor Requirements

The sequence of courses in the Cloquet Forestry Center may be used to either meet the minor courses requirement or as an elective, but they cannot be used to satisfy both requirements.

Minor Courses

FR 3104—Forest Ecology (4 cr)

FR 3411—Managing Forest Ecosystems: Silviculture (3 cr)

Take one of the following field experiences.

FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)

or

Cloquet Forestry Session

Take all of the following in the same term:

FR 2101—Identifying Forest Plants (1 cr)

FR 2102—Northern Forests: Field Ecology (2 cr)

FR 2104—Measuring Forest Resources (1 cr)

Electives

Take 8 or more credit(s) from the following:

Forest Policy, Management, and Planning

If student takes the Cloquet Forestry Session, only 7 credits are required.

Take 3 or more credit(s) from the following:

ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, C/PE, SSCI, WI (3 cr)

ESPM 3261—Economics and Natural Resources Management, ENVT, SSCI (4 cr)

FR 3471—Forest Planning and Management (3 cr)

FR 4501—Urban Forest Management: Managing Greenspaces for People, C/PE (3 cr)

RRM 4232W—Managing Recreational Lands, ENVT, WI (4 cr)

Resource Assessment

Take 0 or more credit(s) from the following:

FR 3131—Geographical Information Systems (GIS) for Natural Resources (4 cr)

FR 3218—Measuring and Modeling Forests (3 cr)

FR 3262—Remote Sensing of Natural Resources and Environment (4 cr)

Management of Vegetation, Wildlife, Water and Soil Resources

Take 0 or more credit(s) from the following:

ESPM 3703—Agroforestry in Watershed Management (3 cr)

ENT 4251—Forest and Shade Tree Entomology (3 cr)

FR 3501—Arboriculture: Selection and Maintenance of Trees (3 cr)

FR 3114—Hydrology and Watershed Management (3 cr)

FR 3431—Timber Harvesting and Road Planning (2 cr)

FR 5142—Tropical Forest Ecology, ENVT (3 cr)

FR 5413—Managing Forest Ecosystems: Silviculture Lab (1 cr)

PLPA 3003—Diseases of Forest and Shade Trees (3 cr)

Cloquet Forestry Session

Take all of the following in the same term:

FR 2101—Identifying Forest Plants (1 cr)

FR 2102—Northern Forests: Field Ecology (2 cr)

FR 2104—Measuring Forest Resources (1 cr)

Horticulture B.S.**Horticultural Science**

- Required credits to graduate with this degree: 120.
- Required credits within the major: 70 to 75.

The horticulture major educates students for rewarding careers in diverse areas such as research (plant breeding/genetics or plant molecular biology); food and plant production (sustainable/organic); plant use and function (design/reclamation/restoration); and recreation (golf courses/parks). Students gain experience in the use of plants to alter environments, restore damaged landscapes, improve health and well-being of individuals, educate people about science and agriculture, improve community

environments, and provide recreational and practical benefits to the public.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

Applied courses in horticultural science, soil science, entomology, plant pathology, and applied economics vary depending on program.

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

Core Courses

HORT 1001—Plant Propagation, BIOL (4 cr)
 HORT 1015—Woody and Herbaceous Plants (4 cr)
 HORT 3005W—Environmental Effects on Horticultural Crops, WI (4 cr)
 HORT 4096—Professional Experience Program: Internship (1 cr)
 SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
 BIOL 1009—General Biology, BIOL (4 cr)
or BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
 CHEM 1021—Chemical Principles I (4 cr)
or CHEM 1015—Introductory Chemistry: Lecture (3 cr)
 and CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
 MATH 1031—College Algebra and Probability, MATH (3 cr)
or MATH 1142—Short Calculus (4 cr)
or MATH 1271—Calculus I (4 cr)
 HORT 2100—Agricultural Biochemistry (3 cr)
or BIOC 3021—Biochemistry (3 cr)
 HORT 4401—Plant Genetics and Breeding (4 cr)
or HORT 4071W—Applications of Biotechnology to Plant Improvement, WI (4 cr)

Electives

In consultation with their adviser, students develop a program of study consisting of at least 24 credits, eight credits must have a HORT designator at 3xxx or above. From the total 24 credits, a minimum of 18 credits must be at 3xxx or above.

Horticulture Options

Students are required to complete one of the following course groups:

Science Option

Recommended for students considering graduate education or a career involving a detailed understanding of plants, their interactions with the environment, plant breeding, and other activities related to plant growth and development.

CHEM 1022—Chemical Principles II (4 cr)
 CHEM 2301—Organic Chemistry I (3 cr)
 PHYS 1101W—Introductory College Physics I, PHYS, WI (4 cr)

Business Option

Recommended for students interested in careers in wholesale, retail, or service industries and where continued education could focus on business, law, or other aspects of commercial horticultural practice and/or marketing.

APEC 1101—Principles of Microeconomics (3 cr)
Take 3 or more course(s) from the following:
 HORT 4461—Horticultural Marketing (3 cr)
 MGMT 3001—Fundamentals of Management (3 cr)
 MGMT 3010—Introduction to Entrepreneurship (4 cr)
 ACCT 2050—Introduction to Financial Reporting (4 cr)
or APEC 1251—Principles of Accounting (3 cr)
 OMS 2550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)
or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

Program Sub-plans

A sub-plan is not required for this program.

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Horticulture Minor

Horticultural Science

- Required credits in this minor: 18.

Plants provide many practical and recreational benefits to society—whether it is the food we eat, the parks we play in, or the gardens we enjoy admiring. The horticulture minor is geared toward students who want to learn more about plants and their many, diverse uses in the landscape. Coursework is flexible and can easily be tailored to specific horticultural interests, including floriculture and nursery production, turfgrass science, landscape design and maintenance, fruit and vegetable production, sustainable and organic production practices, therapeutic horticulture, plant physiology, and genetics. Students wishing to complete a minor in horticulture should contact the Department of Horticultural Science, 305 Alderman Hall for assistance.

Minor Requirements

Course Required for the Minor

HORT 1001—Plant Propagation, BIOL SCI/L (4 cr)

Electives

At least 14 credits (6 credits must be taken at UMTC) from courses with a HORT designator, of which one horticulture related elective course may be substituted (such as SOILS, ENT, PLPA, and BIOL). At least two HORT courses must be at the 4XXX or 5XXX level. A maximum of 3 credits of HORT 3090—Directed Studies may be applied.

Integrated Pest Management in Cropping Systems Minor

Agronomy and Plant Genetics

This is a free-standing minor.

- Required credits in this minor: 20.

Students selecting this interdisciplinary minor learn how the environment and cropping systems interact with the biology of the major agronomic or horticultural crop pests. Students also learn to select and apply efficient, environmentally sound pest management procedures. Courses come from agronomy and plant

genetics; entomology; horticultural science; plant pathology; and soil, water, and climate.

The minor provides sufficient knowledge and skills for employment in agricultural crop protection, product development and sales, crop management consultation, pest regulation, research, or application of agricultural crop protection materials. Students must complete at least 20 credits for this minor.

Minor Requirements

Minor Courses

AGRO 2501—Plant Identification for Urban and Rural Landscapes (2 cr)
 AGRO 4505—Biology, Ecology, and Management of Invasive Plants (3 cr)
 ENT 3005—Insect Biology, BIOL (4 cr)
 AGRO 4005—Applied Crop Physiology and Development (4 cr)
 or BIOL 3002—Plant Biology: Function (2 cr)
 and HORT 3005W—Environmental Effects on Horticultural Crops, WI (4 cr)

Management

AGRO 4605—Management Strategies for Crop Production (3 cr)
 or ENT 5211—Insect Pest Management (3 cr)
 or HORT 4061W—Turfgrass Management, WI (3 cr)
 or HORT 5032—Organic Vegetable Production (3 cr)
 or PLPA 5204—Plant Disease Management (3 cr)

Applied Courses

AGRO 4603—Field Crop Scouting and Problem Diagnosis (3 cr)
 or AGRO 4888—Issues in Sustainable Agriculture (2 cr)
 or ESPM 3612W—Soil and Environmental Biology, WI (3 cr)
 or PLPA 5202—Field Plant Pathology (2 cr)

International Agriculture Minor

College of Food, Agricultural and Natural Resource Sciences

This is a free-standing minor.

- Required credits in this minor: 18.

Due to the international nature of food and agricultural systems, and the interdependence of environmental systems, CFANS students are strongly encouraged to incorporate an international experience during their academic degree program. Students with a particular interest in international agriculture can minor in international agriculture and choose between a self-contained block of courses or a series of courses integrated into the degree program. The minor is structured to include a general overview of international agriculture, followed by area, culture, or language studies; expanded coursework in agriculture; and an international experience. Students are required to travel outside the United States for a minimum two-week academic experience.

The program for a minor in international agriculture must be developed in coordination with International Programs in the college. Students must complete 18 credits with a minimum GPA of 2.00.

Minor Requirements

International Opportunities:

The University of Minnesota is partnering with universities in Austria, Germany, and Italy to provide semester study abroad opportunities comparing U.S. and the European Union's biotechnology, food safety, and regulatory policies. The US-EU FIPSE Program offers courses taught in English, as well as the chosen country's language. Courses include: agricultural

economics, tropical agriculture, organic food chain management, and environmental and agricultural food production. German or Italian language studies are required of participants. Admitted students will receive financial support for language classes and a semester of study at one of the EU partner universities.

Additional international practical or internship experiences may qualify for the minor. Arrangements can be made through MAST International or the St. Paul Campus Career Center.

Travel grants for overseas experience are available through the Academic Enrichment Program. Students are also eligible for scholarships through the Learning Abroad Center.

Minor Courses

Take 6 credits 3xxx or 4xxx area culture or language studies

Take 2 or more credit(s) from the following:

CFAN 3000—Directed Studies in International Agriculture (2–4 cr)

Take 3 or more credit(s) from the following:

CFAN 3500—International Field Studies Seminar (1–3 cr)

Take 7 or more credit(s) from the following:

AFEE 5331—History, Philosophy, and Systems of Extension (3 cr)

AFEE 5361—World Development Problems (3 cr)

AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)

APEC 3007—Applied Macroeconomics: Policy, Trade, and Development, GP (3 cr)

APEC 3071—Agriculture and Economic Growth in Developing Countries (3 cr)

APEC 5751—Global Trade and Policy, IP (3 cr)

FSCN 3615—Sociocultural Aspects of Food, Nutrition, and Health (3 cr)

PLPA 3001—Plant Disease Biology and Management (1 cr)

COMM 3676W—Communicating Terrorism, GP, WI (3 cr)

AGRO 4103—World Food Problems, GP (3 cr)

or APEC 4103—World Food Problems, GP (3 cr)

Nutrition B.S.

Food Science and Nutrition

- Required credits to graduate with this degree: 120.
- Required credits within the major: 95 to 100.

The major explores how nutrients and the foods from which they are derived aid the body in health, growth, and development. With major national and international concern for how food and nutrition affect health and disease, registered dietitians and nutritionists have many career opportunities. Students choose one of two options: nutrition and dietetics or nutritional science.

Students expecting to apply to an internship or graduate school should maintain a GPA of at least 3.00. A cumulative GPA of at least 3.30 is highly recommended.

The Didactic Program in Dietetics (nutrition and dietetics option) is currently granted accreditation by the Commission on Accreditation for Dietetics Education of the American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995 (312-899-4772).

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Foundation Courses

CHEM 1021—Chemical Principles I (4 cr)
 CHEM 1022—Chemical Principles II (4 cr)
 CHEM 2301—Organic Chemistry I (3 cr)
 BIOC 3021—Biochemistry (3 cr)
 WRIT 3562W—Technical and Professional Writing, WI (4 cr)
 COMM 1101—Introduction to Public Speaking (3 cr)
or PSTL 1461—Multicultural Perspectives in Public Speaking (3 cr)
 BIOL 1009—General Biology, BIOL (4 cr)
or PSTL 1131—Principles of Biological Science, BIOL (4 cr)
 ANSC 3301—Human and Animal Physiology (3 cr)
or PHSL 3051—Human Physiology (4 cr)
or BIOL 3211—Animal Physiology (3 cr)
 VBS 2032—General Microbiology With Laboratory (4 cr)
or MICB 3301—Biology of Microorganisms (5 cr)
or FSCN 2021—Introductory Microbiology (4 cr)
 STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)
or STAT 3021—Introduction to Probability and Statistics (3 cr)
or STAT 5021—Statistical Analysis (4 cr)

Major Courses

AHS 1102—Orientation to Health Careers (1–2 cr)
 FSCN 1102—Food: Safety, Risks, and Technology, CIV (3 cr)
 FSCN 1112—Principles of Nutrition (3 cr)
 FSCN 3102—Introduction to Food Science (3 cr)
 FSCN 3612—Life Cycle Nutrition (3 cr)
 FSCN 4612—Advanced Human Nutrition (4 cr)
 FSCN 4613—Experimental Nutrition (2 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Didactic Program in Dietetics Sub-plan

The Didactic Program in Dietetics (DPD) provides excellent undergraduate preparation to meet the knowledge requirements delineated by the American Dietetic Association (ADA) for entry-level dietitians. The DPD training includes a strong science component of biological sciences, chemistry, and biochemistry courses appropriate for admission to graduate school. A liberal arts core and specialized courses in nutrition, nutritional biochemistry, clinical nutrition, food chemistry, menu planning, and food service management provide depth and breadth. The mission of the University of Minnesota DPD is to prepare

students for entry into and successful completion of a dietetic internship, a variety of employment opportunities related to food and nutrition, or graduate/professional programs.

Students who plan to become registered dietitians must apply to the DPD according to specified criteria. There is no difference in the required courses, however only those students who are accepted into the DPD will receive a Verification Statement, which is needed to enter into a dietetic internship.

Required Courses for the Sub-plan

Nutrition Courses

FSCN 3614—Nutrition Education and Counseling (3 cr)
 FSCN 3615—Sociocultural Aspects of Food, Nutrition, and Health (3 cr)
 FSCN 3731—Food Service Operations Management Laboratory (2 cr)
 FSCN 3732—Food Service Operations Management (3 cr)
 FSCN 4614—Community Nutrition, CD (3 cr)
 FSCN 4621W—Nutrition and Metabolism, WI (4 cr)
 FSCN 4665—Medical Nutrition Therapy I (3 cr)
 FSCN 4666—Medical Nutrition Therapy II (3 cr)
 FSCN 4732—Food and Nutrition Management (3 cr)
 MATH 1031—College Algebra and Probability, MATH (3 cr)
 FSCN 4112—Food Chemistry and Functional Foods (3 cr)
or FSCN 4121—Food Microbiology (3 cr)

Nutritional Science Sub-plan

The nutritional science option is for students planning to do graduate work in nutrition, related sciences, or professional programs such as medicine or dentistry.

Required Courses for the Sub-plan

Nutritional Science Courses

CHEM 2302—Organic Chemistry II (3 cr)
 CHEM 2311—Organic Lab (4 cr)
 PHYS 1201W—Introductory Physics for Biology and Pre-medicine I, PHYS, WI (5 cr)
 PHYS 1202W—Introductory Physics for Biology and Pre-medicine II, PHYS, WI (5 cr)
 FSCN 4621W—Nutrition and Metabolism, WI (4 cr)
 FSCN 4622—Nutritional Toxicology, the basic science of diet-related toxicants (3 cr)
 BIOL 4003—Genetics (3 cr)
or GCD 3022—Genetics (3 cr)
 MATH 1142—Short Calculus (4 cr)
or MATH 1271—Calculus I (4 cr)
and MATH 1272—Calculus II (4 cr)
 FSCN 4112—Food Chemistry and Functional Foods (3 cr)
or FSCN 4121—Food Microbiology (3 cr)
or NUTR 5622—Vitamin and Mineral Biochemistry (3 cr)
or NUTR 5624—Nutrition and Genetics (2 cr)

Nutrition Minor

Food Science and Nutrition

- Required credits in this minor: 14 to 16.

The nutrition minor gives students a basic understanding of human nutritional needs through the three required core courses. Based on the elective courses chosen, students then have the ability to focus in a specific area such as metabolism or foods.

Minor Requirements

Some of the courses listed in the minor have prerequisites that do not count toward the 14–16 credits.

Minor Courses

FSCN 1112—Principles of Nutrition, ENVT (3 cr)
 FSCN 3612—Life Cycle Nutrition (3 cr)

FSCN 4612—Human Nutrition (3 cr)

Take 2 or more course(s) from the following:

FSCN 3614—Nutrition Education and Counseling (3 cr)

FSCN 3615—Sociocultural Aspects of Food, Nutrition, and Health, CD, SSCI (3 cr)

FSCN 4613—Experimental Nutrition (2 cr)

FSCN 4614—Community Nutrition, CD (3 cr)

FSCN 4621W—Nutrition and Metabolism, WI (4 cr)

FSCN 1102—Food: Safety, Risks, and Technology, C/PE (3 cr)

FSCN 3102—Introduction to Food Science (3 cr)

FSCN 5601—Management of Eating Disorders (3 cr)

Recreation Resource Management B.S.

Forest Resources

- Required credits to graduate with this degree: 120.
- Required credits within the major: 120.
- This program requires summer terms.

The recreation resources management curriculum prepares students to plan and manage natural and non-urban recreational land and water, as well as manage the people and organizations that depend on these important resources. The curriculum emphasizes natural and managed non-urban areas; natural resources-oriented recreation programs in public and private sectors; social science aspects of natural resources use; and skills in communication, planning, and management. Students select between two tracks: 1) recreation resource management and 2) resource based tourism. Students taking the recreation resource management track receive more training in principles and techniques of resource management; students taking the resource based tourism track receive more training in organizational and visitor management, policy, and administration. Graduates serve as educators, naturalists, wilderness managers, park or river rangers, adventure trip leaders, recreation supervisors, or recreation area and facilities planners and managers. Principal employers are federal, state and local parks, forestry, wildlife, nature conservation and related natural resource agencies and nongovernmental education and conservation organizations. Graduates may also work with tourism boards, related planning organizations, and with hospitality and resort industries. A minor is also available. Additionally, this curriculum provides excellent preparation in the human dimensions of natural resource sciences that is essential for graduate study and careers in research and teaching.

Admission Requirements

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Program Requirements

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

Communication Skills

COMM 1101—Introduction to Public Speaking (3 cr)

Mathematical Thinking

MATH 1031—College Algebra and Probability, MATH (3 cr)

or MATH 1051—Precalculus I (3 cr)

SOC 3811—Basic Social Statistics, MATH (4 cr)

or ESPM 3012—Statistical Methods for Environmental Scientists and Managers, MATH (4 cr)

or STAT 3011—Introduction to Statistical Analysis, MATH (4 cr)

or STAT 5021—Statistical Analysis (4 cr)

Social Sciences

ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)

PSY 1001—Introduction to Psychology, SSCI (4 cr)

or SOC 1001—Introduction to Sociology, SOCS (4 cr)

PSY 3201—Introduction to Social Psychology (4 cr)

or SOC 3411W—Organizations and Society, WI (3 cr)

or SOC 3711—Principles of Social Organization (3 cr)

or SOC 3721—Principles of Social Psychology (3 cr)

Professional Orientation

RRM 1001—Orientation and Information Systems (1 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans. (Note for the Twin Cities and Morris campuses: The honors sub-plan does not meet this requirement. Honors students are required to complete one sub-plan plus the honors sub-plan. Please see an adviser if no honors sub-plan is listed for the program.)

Recreation Resource Management Sub-plan

The recreation resource management (RRM) track is designed for students who wish to develop careers in planning or managing the use of recreational land and water, and for students wishing to pursue graduate study in this area. Graduates may become directly involved in recreation resource management and planning and public relations. Principal employers are federal, state, and county land management agencies with recreation resource responsibilities. Nongovernmental organizations and conservation foundations are also significant employers. Graduates may also pursue graduate study to facilitate career advancement or develop a foundation for research and teaching in this area.

Required Courses for the Sub-plan

Physical and Biological Sciences

BIOL 2022—General Botany (3 cr)

GEO 1001—Earth and Its Environments, PHYS, ENV (4 cr)

BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)

or CHEM 1015—Introductory Chemistry: Lecture (3 cr)

and CHEM 1017—Introductory Chemistry: Laboratory (1 cr)

BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)

or BIOL 1009—General Biology, BIOL (4 cr)

SOIL 1125—The Soil Resource (4 cr)

or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

Professional Courses

ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)

FR 3131—Geographical Information Systems (GIS) for Natural Resources, TS (4 cr)

FR 1101—Dendrology: Identifying Forest Trees and Shrubs (3 cr)

and FR 3411—Managing Forest Ecosystems: Silviculture (3 cr)

and BIOL 3407—Ecology (3 cr)

or BIOL 3408W—Ecology, WI (3 cr)

or EEB 3001—Ecology and Society, ENV (3 cr)

or FR 3104—Forest Ecology (4 cr)

and ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)

or FR 3114—Hydrology and Watershed Management (3 cr)

and ESPM 3101—Conservation of Plant Biodiversity (3 cr)

or FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)

ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)

ESPM 4041W—Problem Solving for Environmental Change, WI (4 cr)

RRM 4232W—Managing Recreational Lands, ENVT, WI (4 cr)

RRM 5259—Visitor Behavior Analysis (3 cr)

and ESPM 3011W—Ethics in Natural Resources, WI (3 cr)

- or ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
and RRM 3201—Introduction to Travel and Tourism (3 cr)
or APEC 4311—Tourism Development: Principles, Processes, Policies (3 cr)

Additional Professional Courses

Take 9-10 credits, choosing one course from each of the three groups. RRM 3201 may be used only if it was not used to fulfill another requirement.

Social and Managerial Sciences

- ANTH 3041—Ecological Anthropology (3 cr)
or APEC 5321—Regional Economic Analysis (3 cr)
or ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
or GEOG 3361W—Geography and Public Policy, WI (3 cr)
or GEOG 5393—Rural Landscapes and Environments (4 cr)
or COMM 3411—Introduction to Small Group Communication (3 cr)

Recreation Programming and Management Services

- ESPM 4811—Environmental Interpretation (3 cr)
or REC 3551—Administration and Finance of Leisure Services (4 cr)
or REC 5191—Commercial Recreation and Tourism (3 cr)
or REC 5301—Wilderness and Adventure Education (4 cr)
or REC 5311—Programming Outdoor and Environmental Education (3 cr)
or REC 5801—Legal Aspects of Sport and Recreation (4 cr)
or RRM 3201—Introduction to Travel and Tourism (3 cr)

Management of Vegetation, Soil, and Water Resources

- FR 3204—Landscape Ecology and Management (3 cr)
or FR 3262—Remote Sensing of Natural Resources and Environment (4 cr)
or GEOG 5565—Geographical Analysis of Human-Environment Systems (3 cr)
or HORT 5071—Restoration and Reclamation Ecology (4 cr)
or LA 3204—Holistic Landscape Ecology and Bioregional Practice (3 cr)
or LA 3501—Environmental Design and Its Biological and Physical Context, ENV (3 cr)

or

Cloquet Program

Take all of the following in the same term:

- FR 2101—Identifying Forest Plants (1 cr)
and FR 2102—Northern Forests: Field Ecology (2 cr)
and FR 2104—Measuring Forest Resources (1 cr)

Resource Based Tourism Sub-plan

The resource based tourism (RBT) track is intended for students who wish to understand the fundamentals of resource management, but focus on managing the businesses and visitors who depend on these resources for recreation and revenue. Graduates are likely to pursue opportunities developing and managing resource based tourism operations, programs, and visitors in both domestic and international locations. Principle employers are hospitality and resort industries and state, county, and local tourism based agencies and providers. Graduates may also pursue graduate study to facilitate career advancement or develop a foundation for research and teaching in this area.

Required Courses for the Sub-plan

Physical and Biological Sciences

- BIOL 2022—General Botany (3 cr)
BIOC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
or CHEM 1015—Introductory Chemistry: Lecture (3 cr)
and CHEM 1017—Introductory Chemistry: Laboratory (1 cr)
BIOL 1001—Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL (4 cr)
or BIOL 1009—General Biology, BIOL (4 cr)

- GEO 1001—Earth and Its Environments, PHYS, ENV (4 cr)
or SOIL 1125—The Soil Resource (4 cr)
or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

Professional Courses

- ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, WI (3 cr)
ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)
REC 5191—Commercial Recreation and Tourism (3 cr)
RRM 3101—Nature and Heritage Based Tourism (3 cr)
RRM 3201—Introduction to Travel and Tourism (3 cr)
RRM 4232W—Managing Recreational Lands, ENVT, WI (4 cr)
and BLAW 3058—The Law of Contracts and Agency (4 cr)
or REC 5801—Legal Aspects of Sport and Recreation (4 cr)
and ESPM 4811—Environmental Interpretation (3 cr)
or REC 5311—Programming Outdoor and Environmental Education (3 cr)
and MKTG 3010—Marketing Research (4 cr)
or RRM 5259—Visitor Behavior Analysis (3 cr)
ESPM 3251—Natural Resources in Sustainable International Development, GP (3 cr)
and BIOL 3407—Ecology (3 cr)
or BIOL 3408W—Ecology, WI (3 cr)
or EEB 3001—Ecology and Society, ENV (3 cr)
or FR 3104—Forest Ecology (4 cr)
MGMT 3001—Fundamentals of Management (3 cr)
MKTG 3001—Principles of Marketing (3 cr)

Additional Professional Courses

Area of Concentration Contract required. Course selections must be made in consultation with a faculty adviser and have faculty adviser signature.

Take 15 or more credit(s) from the following:

- COMM 5451W—Intercultural Communication Processes, IP, WI (3 cr)
ESPM 1011—Issues in the Environment, ENV (3 cr)
ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
FINA 3001—Finance Fundamentals (3 cr)
FR 3204—Landscape Ecology and Management (3 cr)
FW 2001—Introduction to Fisheries, Wildlife, and Conservation Biology (3 cr)
FW 4104—Hunting and Fishing Traditions: Field Sports Reflected in Arts, Literature, and Practice (3 cr)
FW 5003—Human Dimensions of Biological Conservation (3 cr)
GEOG 3379—Environment and Development in the Third World, SOCS, ENV (3 cr)
GEOG 3361W—Geography and Public Policy, WI (3 cr)
JOUR 3201—Principles of Strategic Communication: Advertising (3 cr)
LA 3501—Environmental Design and Its Biological and Physical Context, ENV (3 cr)
MGMT 4008—Entrepreneurial Management (4 cr)
MKTG 4030—Sales Management (4 cr)
MKTG 3040—Buyer Behavior (4 cr)
MKTG 4050—Integrated Marketing Communications (4 cr)
MKTG 4060—Marketing Channels (4 cr)
MST 5011—Museum History and Philosophy (3 cr)
MST 5012—Museum Practices (3 cr)
REC 5301—Wilderness and Adventure Education (4 cr)
SOC 4305—Society and the Environment: A Growing Conflict (3 cr)

Honors (UHP) Sub-plan

Students admitted to the University Honors Program (UHP) must fulfill UHP requirements in addition to degree program requirements. Honors courses used to fulfill degree program requirements will also fulfill UHP requirements. Current departmental honors course offerings are listed at www.honors.umn.edu/academics/curriculum/dept_courses_current.html.

Honors students complete an honors thesis project in the final year, most often in conjunction with an honors thesis course, or with an honors directed studies or honors directed research course. Students select honors courses and plan for a thesis project in consultation with their UHP adviser and their departmental faculty adviser.

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

Recreation Resource Management Minor

Forest Resources

- Required credits in this minor: 19 to 20.

Students may pursue a recreation resource management (RRM) minor in either one of three tracks: resource based tourism (RBT), standard RRM, or international tourism (IT). Students must complete the minor core courses and then choose either the RBT track or the RRM track or the IT track.

Minor Requirements

Minor Courses

ESPM 3245—Sustainable Land Use Planning and Policy, ENVT (3 cr)
RRM 4232W—Managing Recreational Lands, ENVT, WI (4 cr)
RRM 5259—Visitor Behavior Analysis (3 cr)

Recreation Resource Management Options

Students are required to complete one of the following course groups.

Recreation Resource Management

Take 3 or more course(s) from the following:

ESPM 3202W—Environmental Conflict Management, Leadership, and Planning, C/PE, WI (3 cr)
ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, C/PE, SSCI, WI (3 cr)
FR 3104—Forest Ecology (4 cr)
ESPM 4811—Environmental Interpretation (3 cr)
or REC 5311—Programming Outdoor and Environmental Education (3 cr)

Resource Based Tourism

REC 5191—Commercial Recreation and Tourism (3 cr)
RRM 3101—Nature and Heritage Based Tourism (3 cr)
RRM 3201—Introduction to Travel and Tourism (3 cr)

International Tourism Option A/On Campus

RRM 3201—Introduction to Travel and Tourism (3 cr)
RRM 3301—International Tourism (3 cr)
CFAN 3500—International Field Studies Seminar (1–3 cr)

International Tourism Option B/Partner Institute

Nine credits international tourism coursework at partner institute selected in consultation with and approved by minor adviser.

Soil Science Minor

Soil, Water, and Climate

This is a free-standing minor.

- Required credits in this minor: 20.

This minor provides a strong background in basic soil sciences, covering such topics as soil biology, conservation, contaminants, water movement, and land use. Students completing the minor meet the minimum requirements for employment with the Natural Resources Conservation Service as a soil conservationist. They are also prepared to take the Professional Soil Science Examination for geoscientists. Students must complete at least 20 credits for the minor.

Minor Requirements

Minor Courses

SOIL 3416—Plant Nutrients in the Environment (3 cr)
SOIL 4511—Field Study of Soils (2 cr)
ESPM 3221—Soil Conservation and Land-Use Management (3 cr)
ESPM 3612W—Soil and Environmental Biology, WI (3 cr)
ESPM 4601—Soils and Pollution (3 cr)
SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)
or SOIL 1125—The Soil Resource (4 cr)

Electives

SOIL 5515—Soil Genesis and Landscape Relations (3 cr)
or ESPM 4021W—Problem Solving: Environmental Review, WI (4 cr)
or ESPM 4216—Contaminant Hydrology (2 cr)
or ESPM 5555—Wetland Soils (3 cr)

Sustainability Studies Minor (Minor Only)

College of Food, Agricultural and Natural Resource Sciences

This is a free-standing minor.

- Required credits in this minor: 15 to 18.

One of the greatest challenges facing the world in the 21st century is jointly sustaining the environment as well as human health and well-being. The sustainability studies minor provides students from across the University with a unique opportunity to address this sustainability challenge. Students will explore the fundamental ecological, social, ethical, political, and economic forces that influence the long-term quality and viability of human society and the natural environment. The introductory core course provides a conceptual overview of various models for understanding sustainability, and uses case studies to demonstrate the challenges of putting sustainability into practice. Additional electives are chosen from courses that explore multiple disciplinary perspectives related to sustainability. Finally, the capstone experience allows students to synthesize and apply their knowledge to real sustainability problems.

For this minor, students must complete 6 credits of required courses for the core and the capstone, and 9–12 restricted electives, for a total of 15–18 credits.

Minor Requirements

Core

SUST 4004—Sustainable Communities (3 cr)
SUST 3003—Sustainable People, Sustainable Planet, ENV (3 cr)
or GLOS 3304—Sustainable People, Sustainable Planet (3 cr)

Electives

Interdisciplinary

Choose one course from the following:

- AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 or ANSC 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 or AGRO 5321—Ecology of Agricultural Systems (3 cr)
 or ENT 5321—Ecology of Agricultural Systems (3 cr)
 or EEB 5146—Science and Policy of Global Environmental Change (3 cr)
 or FR 5146—Science and Policy of Global Environmental Change (3 cr)
 or ESPM 3603—Environmental Life Cycle Analysis (3 cr)
 or ESPM 3245—Sustainable Land Use Planning and Policy (3 cr)
 or ESPM 3251—Natural Resources in Sustainable International Development, GP (3 cr)
 or FW 5455—Sustainable Aquaculture (3 cr)
 or ID 3592—HECUA Off-Campus Study Program: Environmental Sustainability: Dimensions of Environmental Change (4 cr)
 or HSCI 3244—History of Ecology and Environmentalism (3 cr)
 or PHIL 3301—Environmental Ethics (4 cr)

Maximum of one course from each grouping

Take 2 or more course(s) from the following:

Economics and Policy

- APEC 3611—Environmental and Natural Resource Economics, ENV (3 cr)
 or ECON 3611—Environmental Economics (3 cr)
 or APEC 5611—Economic Aspects of Environmental Management (3 cr)
 or AFEE 5361—World Development Problems (3 cr)
 or CE 5212—Transportation Policy, Planning, and Deployment (4 cr)
 or PA 5232—Transportation Policy, Planning, and Deployment (4 cr)
 or CE 5214—Transportation Systems Analysis (4 cr)
 or ESPM 3261—Economics and Natural Resources Management, SOCS, ENV (4 cr)
 or ESPM 3241W—Natural Resource and Environmental Policy: History, Creation, and Implementation, SOCS, CIV, WI (3 cr)
 or ESPM 3604—Environmental Management Systems and Strategy (3 cr)

Social Science and Humanities

- ANTH 3041—Ecological Anthropology (3 cr)
 or ANTH 3212—Globalization, Markets, and Inequality (3 cr)
 or GLOS 3212—Globalization, Markets, and Inequality (3 cr)
 or ANTH 4053—Economy, Culture, and Critique, SOCS, GP (3 cr)
 or ANTH 4069—Environmental Archaeology, SSCI, ENVT (3 cr)
 or ENGL 3501—Public Discourse: Coming to Terms With the Environment, C/PE, LIT (3 cr)
 or ESPM 3011W—Ethics in Natural Resources, WI (3 cr)
 or GEOG 3379—Environment and Development in the Third World, SOCS, ENV (3 cr)
 or GLOS 3303—Environment and Development in the Third World (3 cr)
 or HIST 3452—African Conservation Histories (3 cr)
 or SOC 3613W—Food, Culture, and Society, SOCS, GP, WI (3 cr)
 or SOC 4305—Society and the Environment: A Growing Conflict (3 cr)
 or SOC 4311—Race, Class, and the Politics of Nature (3 cr)

Biophysical Sciences

- BIOL 3407—Ecology (3 cr)
 or BIOL 3408W—Ecology, WI (3 cr)
 or EEB 3001—Ecology and Society, ENV (3 cr)
 or EEB 4609W—Ecosystem Ecology, WI (3 cr)
 or FW 4102—Principles of Conservation Biology (3 cr)
 or GEOG 3401—Geography of Environmental Systems and Global Change, ENV (4 cr)
 or GEO 3005—Earth Resources (3 cr)
 or ID 3591—HECUA Off-Campus Study Program: Environmental Sustainability: Adaptive Ecosystem Management (4 cr)

Design and Technology

- ARCH 4561—Architecture and Ecology (3 cr)
 or BBE 4733—Renewable Energy Technologies (3 cr)
 or CE 3501—Environmental Engineering, ENV (3 cr)
 or CE 4561—Solid Hazardous Wastes (3 cr)
 or CHEN 5551—Survey of Renewable Energy Technologies (3 cr)
 or ESPM 3601—Our Home, Our Environment (3 cr)
 or HSG 3482—Our Home, Our Environment (3 cr)
 or LA 3501—Environmental Design and Its Biological and Physical Context, ENV (3 cr)
 or LA 4755—Infrastructure, Natural Systems, and Space of Inhabited Landscapes, TS (3 cr)
 or URBS 3751—Understanding the Urban Environment, ENV (3 cr)

Sustainable Agriculture Minor

College of Food, Agricultural and Natural Resource Sciences

This is a free-standing minor.

- Required credits in this minor: 17.

This minor allows students to study the sustainability of agricultural food systems from an integrated perspective, including coursework, practical experience, and community reflection. Required courses and courses from the foundational clusters—land and public policy; agriculture, environment, and natural resources; and citizens, science, and society—define the students' minor curriculum.

In addition, each student works with a minor adviser to design an individualized practical experience (e.g., internship, experiential learning opportunity) in some aspect of sustainable agriculture. Through the student-led seminar series, What's Up in Sustainable Agriculture (WUSA), and the senior capstone, students synthesize their learning about sustainability for local, national and global agricultural food systems. For this minor, students must complete 8-10 credits of required courses and a minimum of 9 credits of foundational coursework, for a total of at least 17 credits.

Minor Requirements

Minor Courses

AGRO 4660 should be taken concurrently with or after completion of the internship.

- AGRO 4660—Senior Capstone (2 cr)
 AGRO 4888—Issues in Sustainable Agriculture (2 cr)
 AGRO 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)
 or ANSC 3203W—Environment, Global Food Production, and the Citizen, GP, WI (3 cr)

Take 1–3 credit(s) from the following:

- AFEE 3096—Experiential Learning: Production and Business (1–8 cr)
 AGRO 4096—Professional Experience Program: Internship (1–3 cr)
 ANSC 4096—Professional Experience Program: Internship (1–3 cr)
 APEC 4096—Professional Experience Program: Internship (1–3 cr)
 ESPM 4096—Professional Experience Program: Internship (1 cr)
 HORT 4096—Professional Experience Program: Internship (1 cr)
 FSCN 4096—Professional Experience Program: Internship (1–4 cr)
 PLPA 4096—Professional Experience Program: Internship (1–3 cr)

Foundation Course Clusters

Select one course from each of the following clusters. Other courses may be substituted with approval of the minor adviser and coordinator.

Take 9 or more credit(s) including 3 or more sub-requirement(s) from the following:

Land and Public Policy

- APEC 3041W—Economic Development of U.S. Agriculture, WI (3 cr)
- or GEOG 3361W—Geography and Public Policy, WI (3 cr)
- or PA 5002—Introduction to Policy Analysis (1.5 cr)
- or WRIT 3315—Writing on Issues of Land and the Environment, AH, DSJ (3 cr)
- or AGRO 4103—World Food Problems, GP (3 cr)
- or APEC 4103—World Food Problems, GP (3 cr)

Agriculture/Environment and Natural Resources

- CFAN 3001—Pests and Crop Protection (3 cr)
- or AGRO 1103—Crops, Environment, and Society, ENV (4 cr)
- or AGRO 5999—Special Topics: Workshop in Agronomy (1–6 cr)
- or ANSC 1101—Introductory Animal Science (4 cr)
- or ESPM 3221—Soil Conservation and Land-Use Management (3 cr)
- or GEOG 3355—Environmental Quality (3 cr)
- or SOIL 1125—The Soil Resource (4 cr)
- or SOIL 2125—The Soil Resource, PHYS, ENV (4 cr)

Citizens/Science and Society

- CFAN 1501—Biotechnology, People, and the Environment, TS (3 cr)
- or BBE 5212—Safety and Environmental Health Issues in Plant and Animal Production and Processing, H (3 cr)
- or GEOG 3371W—Cities, Citizens, and Communities, DSJ, WI (4 cr)
- or WRIT 3371—Technology, Self, and Society (3 cr)
- or SOC 3451W—Cities and Social Change, WI (3 cr)

Urban and Community Forestry Minor

Forest Resources

This is a free-standing minor.

- Required credits in this minor: 18.

The urban and community forestry minor enables students in programs such as education, landscape architecture, horticultural sciences, natural resources, and related areas to understand the science and practice underlying the management of urban and community forests. The minor incorporates fundamental science, arboriculture, forest health, and resource management coursework. Students must complete 18 credits for this minor. Students interested in the minor should contact the CFANS Student Services Office.

Minor Requirements

Minor Courses

- ENT 4251—Forest and Shade Tree Entomology (3 cr)
- or PLPA 3003—Diseases of Forest and Shade Trees (3 cr)
- FR 3501—Arboriculture: Selection and Maintenance of Trees (3 cr)
- FR 4501—Urban Forest Management: Managing Greenspaces for People (3 cr)

Electives

Take 9 or more credit(s) from the following:

- ESPM 3211—Survey, Measurement, and Modeling for Environmental Analysis (3 cr)
- FR 3104—Forest Ecology (4 cr)
- FR 3218—Measuring and Modeling Forests (3 cr)
- FR 4118—Trees: Structure and Function (3 cr)
- HORT 1015—Woody and Herbaceous Plants (4 cr)
- RRM 4232W—Managing Recreational Lands, ENVT, WI (4 cr)

Cloquet Program

Take all of the following in the same term:

- FR 2101—Identifying Forest Plants (1 cr)
- FR 2102—Northern Forests: Field Ecology (2 cr)
- FR 2104—Measuring Forest Resources (1 cr)

Water Science Minor

Soil, Water, and Climate

This is a free-standing minor.

- Required credits in this minor: 20.

The minor provides students the opportunity to broaden their expertise in the area of water science. Students interested in qualifying as a hydrologist should determine the exact requirements for the Minnesota civil service position by checking the Hydrologist I (Hydrogeology) and Hydrologist I (Water Resources) position descriptions.

Students must complete at least 20 credits for the minor.

Minor Requirements

Minor Courses

- FR 3114—Hydrology and Watershed Management (3 cr)
- GEO 5701—General Hydrogeology (3 cr)
- or EEB 5601—Limnology (3 cr)
- ESPM 5555—Wetland Soils (3 cr)
- or SOIL 5232—Vadose Zone Hydrology (3 cr)

Electives

Courses used to fulfill requirements above cannot be chosen to fulfill electives.

Take 11 or more credit(s) from the following:

- CE 5541—Environmental Water Chemistry (3 cr)
- EEB 5605—Limnology Laboratory (2 cr)
- ESPM 4061W—Water Quality and Natural Resources, WI (3 cr)
- ESPM 4216—Contaminant Hydrology (2 cr)
- ESPM 5131—Environmental Biophysics and Ecology (3 cr)
- GEOE 4351—Groundwater Mechanics (3 cr)
- FR 5153—Forest and Wetland Hydrology (3 cr)
- or GEO 5701—General Hydrogeology (3 cr)
- ESPM 5555—Wetland Soils (3 cr)
- or SOIL 5232—Vadose Zone Hydrology (3 cr)

