# College of Agricultural, Food and Environmental Sciences

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College of Agricultural, Food and Environmental Sciences

General Information

Students studying in the College of Agricultural, Food and Environmental Sciences (COAFES) work on issues that make a real difference in the quality of our daily lives. In 2003-04, more than 1100 students were enrolled in COAFES programs leading to careers in science, animal science (including pre-vet), food science, nutrition, environmental science, environmental horticulture, and plant science, as well as business, communication, and education.

Consistently ranked at the top nationally, its programs attract an excellent faculty and student body. Hundreds of acres and animal and plant facilities border its buildings, offering hands-on learning experiences and a sizeable research laboratory for undergraduate and graduate education. Five research and outreach centers throughout the state provide students with internships and other experiences in woodlands and prairies, and all programs are set up so that students may also study abroad, with no increase in time toward graduation.

COAFES is committed to enhancing students’ educational experiences and offers the advantages of a small, friendly learning community along with the opportunities of a premier research university. Experienced faculty advisers work closely with students from orientation to job placement and beyond. A large majority of students do internships, increasing numbers take advantage of international experiences, and well over 90 percent of COAFES students find jobs related to their majors.

Admission

Guidelines for admission to COAFES for high school graduates, non-degree seeking students, and transfer students are explained below. For more information, call COAFES Admissions, 612-624-3045 or 1-800-866-AGRI (toll-free).

Deadlines—The Office of Admissions typically accepts applications for fall semester beginning October 1 of the preceding year and admits students as long as space is available. Freshman applicants who meet the admission guidelines and apply by December 15 are guaranteed space in the following fall semester class. Final deadlines are June 1 for fall semester and October 15 for spring semester.

High School Graduates—High school graduates need to complete the University’s high school course preparation requirements (see Freshman Admission in the General Information section of this catalog).

Transfer Students—Students may apply for admission to COAFES from other colleges or universities. Applicants may be accepted if they meet the entrance requirements of COAFES and of the major they wish to enter. To be competitive for admission, transfer applicants who graduated from high school after 1987 or later should have completed the following:

- intermediate algebra with a grade of at least C;
- at least a C average in transfer coursework;
- a solid foundation in math and science;
- other high school preparation requirements, including foreign language. (See High School Course Preparation in the General Information section of this catalog.)

Applicants who did not complete this coursework during high school may submit equivalent college coursework. COAFES may admit some students who have not met these guidelines. Students who are admitted but lack preparation requirements must complete all deficiencies early in their program.

Applicants who graduated from high school before 1987 must meet current entrance standards except for the high school preparation and foreign language requirements.

After a transfer applicant has been accepted as a student, the Office of Admissions and COAFES evaluate all previous college work according to the standards of the University and COAFES. The student is then provided with a Transfer Credit Evaluation showing how previous work has been evaluated.

Transfer students must complete all specific course and area distribution requirements of COAFES regardless of the number of credits accepted for transfer. Therefore, students who begin degree work elsewhere and intend to transfer later should carefully plan pre-transfer courses to meet as many COAFES requirements as possible.

Note: A maximum of 4 internship or practical experience credits may be transferred into COAFES.

In the college’s latest survey of its graduates, 95% found employment within six months of graduation, 93% expressed job satisfaction, and 88% work in a field directly related to their major.

Change of College Within the University—To transfer to COAFES from another college within the University, students must meet COAFES entrance guidelines. Students must complete an Application for Undergraduate Change of College and apply for transfer at the Registration Center on the campus where they are currently registered or where they last attended classes. Application deadlines are consistent with posted University admission deadlines.

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

Students who enter COAFES 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.
### Key to Majors

- **AgBu** .... Agricultural and Food Business Management
- **AgEd** .... Agricultural Education
- **AIM** ...... Agricultural Industries and Marketing
- **AnSc** ..... Animal Science
- **ApEc** ...... Applied Economics
- **BAE** ...... Biosystems and Agricultural Engineering
- **CSPM** .... Crop, Soil, and Pest Management
- **EH** ........ Environmental Horticulture
- **ES** ........ Environmental Science
- **FdSc** ..... Food Science
- **Nutr** ..... Nutrition
- **PreLA** .... Pre-Landscape Architecture
- **ScAg** ..... Science in Agriculture
- **STC** ...... Scientific and Technical Communication

### Finding your way around the college

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<th>COMFES majors</th>
<th>Occupations</th>
<th>Primary COA departments</th>
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<tr>
<td>Animals</td>
<td>AIM, ArSc, BAE, AgEd</td>
<td>Animal breeder, designer of animal housing, animal nutritionist, dairy inspector, equipment designer, livestock production specialist, farm manager, animal nutrition consultant for feed company, artificial insemination technician, representative for breeding and registry associations, animal equipment technician, meat industry representative, inspector</td>
<td>Animal Science; Biosystems, Agricultural Engineering; Agricultural Education</td>
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<tr>
<td>Biotechnology</td>
<td>BAE, FdSc, ES, AnSc</td>
<td>Lab technician, scientist, bioremediation specialist</td>
<td>Agronomy &amp; Plant Genetics; Biosystems and Agricultural Engineering; Animal Science; Food Science &amp; Nutrition; Horticulture; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Business and financial management</td>
<td>AIM, AgBu, ApEc, AgEd</td>
<td>Loan officer, commodity merchandiser, sales representative, market analyst, government adviser, operations manager, food/grain broker, accounts specialist, financial planner, administrative manager, plant manager, farm manager, general manager</td>
<td>Applied Economics; Agricultural Education</td>
</tr>
<tr>
<td>Communication</td>
<td>AgEd, AIM, STC</td>
<td>Group process facilitator, interviewer, extension specialist, educator, state and county fair manager, agricultural journalist, public relations specialist, breed association and special interest groups promotion and public relations</td>
<td>Agricultural Education, Rhetoric</td>
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<tr>
<td>Environmental horticulture (landscape, nursery floriculture)</td>
<td>EH</td>
<td>Landscape design and management, nursery/garden center management and production, floral designer flower and foliage grower</td>
<td>Entomology; Horticultural Science; Plant Pathology; Soil, Water, and Climate</td>
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<tr>
<td>Environmental science</td>
<td>AgEd, BAE, ES, ScAg</td>
<td>Soil scientist, environmental protection analyst, waste manager, recycling specialist, environmental scientist, bioremediation specialist, teacher</td>
<td>Agricultural Education; Biosystems and Agricultural Engineering; Soil, Water, and Climate</td>
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<tr>
<td>Field crop production (corn, soybeans, wheat, oats, barley, sunflowers, hay, flax)</td>
<td>AIM, CSPM, ScAg, AgEd</td>
<td>Seed producer/conditioner, agronomist, crop consultant, farmer, elevator/co-op manager, regulatory agent, plant protection representative, horticulturalist, crop production specialist, seed technologist, machinery and systems designer</td>
<td>Biosystems and Agricultural Engineering; Agricultural Education; Food Science and Nutrition</td>
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<tr>
<td>Food</td>
<td>FdSc</td>
<td>Food product developer, production manager quality control supervisor, food inspector, technical service representative</td>
<td>Food Science and Nutrition</td>
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<tr>
<td>Food processing and food safety</td>
<td>BAE, FdSc</td>
<td>System designer for handling and preparing food, engineer for transporting and storing grain and feed, packaging consultant, plant manager</td>
<td>Biosystems and Agricultural Engineering; Food Science and Nutrition</td>
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<tr>
<td>Horticultural food crops (fruits, vegetables)</td>
<td>AIM, CSPM, ScAg</td>
<td>Vegetable grower, orchard manager, greenhouse or garden center worker, nursery stock producer, plant breeder, arboriculture assistant, bedding plant grower</td>
<td>Agronomy &amp; Plant Genetics; Horticultural Science; Soil, Water, and Climate</td>
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<tr>
<td>Human nutrition</td>
<td>Nutr</td>
<td>Dietitian, nutrition educator, hospital consultant, medical student</td>
<td>Food Science and Nutrition</td>
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<tr>
<td>Insects</td>
<td>AIM, CSPM, EH, ScAg</td>
<td>Crop/environmental consultant, research biologist, biological control specialist, technical sales representative, public health inspector, commercial honey producer, plant health care specialist</td>
<td>Entomology; Plant Pathology; Horticultural Science</td>
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<tr>
<td>International agriculture</td>
<td>AgBu, AgEd, AIM, ApEc, FdSc, Nutr</td>
<td>Peace Corps volunteer, agricultural development specialist, international trade economist</td>
<td>Animal Science; Applied Economics; Agricultural Education; Food Science and Nutrition</td>
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<td>Landscape design</td>
<td>EH, PreLA</td>
<td>Landscape architect, site planner, urban planner, recreation consultant, landscape designer</td>
<td>Horticultural Science; Landscape Architecture (CALA)</td>
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<tr>
<td>Plants</td>
<td>AIM, CSPM, EH, ScAg</td>
<td>Plant breeder, nursery/greenhouse manager, plant health care specialist</td>
<td>Agronomy &amp; Plant Genetics; Entomology; Horticultural Science; Plant Pathology; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Sales and marketing</td>
<td>AgBu, ApEc, AIM, AgEd, FdSc</td>
<td>Company sales representative, seller of products to farmers, seller of agricultural products to food companies, inventory controller, district sales manager; advertiser, training and development personnel, technical sales</td>
<td>Applied Economics; Agricultural Education; Food Science and Nutrition; Rhetoric</td>
</tr>
<tr>
<td>Soil and water resources</td>
<td>BAE, CSPM, ES, ScAg</td>
<td>Pollution control agent, land/ water use planner, waste manager, fertilizer sales representative, irrigation and drainage system designer; conservator, soil scientist</td>
<td>Applied Economics; Agricultural Education; Biosystems and Agricultural Engineering; Soil, Water, and Climate</td>
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<tr>
<td>Teaching</td>
<td>AgEd</td>
<td>Middle, high school, or adult agriscience/agribusiness teacher; natural resources, horticulture, agrimechanics teacher; extension educator; Peace Corps volunteer; international development agent; FFA and 4H adviser; environmental education teacher; nature or environmental center educator</td>
<td>Agricultural Education</td>
</tr>
<tr>
<td>Technical communication</td>
<td>STC</td>
<td>Technical writer, scientific illustrator, educational video producer, document designer, manager of telecommunications, training and development specialist</td>
<td>Rhetoric</td>
</tr>
<tr>
<td>Turfgrass</td>
<td>EH</td>
<td>Golf course superintendent, grounds maintenance, athletic facilities manager, lawn service owner</td>
<td>Entomology; Horticultural Science; Plant Pathology; Soil, Water, and Climate</td>
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<tr>
<td>Veterinary medicine</td>
<td>ArSc</td>
<td>Veterinarian</td>
<td>Animal Science</td>
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Degrees/Majors

Bachelor's Degrees—The major curricula of COAFES lead to a bachelor of science.

Graduate Degrees—COAFES departments offer master of science and doctor of philosophy degrees through the Graduate School. For more information, see the Graduate School Catalog. COAFES also offers a master of agriculture degree, with an emphasis in horticultural science. Interested students should contact the Department of Horticultural Science or COAFES Student Services, 190 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108.

Majors
COAFES offers the following 12 interdisciplinary majors and areas of emphasis.

COAFES is also developing an applied plant sciences major to meet the emerging needs of a wide variety of food-related industries. This new major integrates knowledge of science, environment, production, and industry to prepare students for careers in the improvement of plants and food sources; industry, government, and universities as research scientists; agencies and organizations concerned with environmental assessments and sustainable production practices; bio-safety and food security; and related fields of biology and biotechnology. See the COAFES Web site at www.coafes.umn.edu for more information.

Detailed information about all majors follows in the Degree Programs section.

Agricultural and Food Business Management
- Business management
- Financial management
- Marketing, sales and food industry management

Agricultural Education
- Agricultural science and technology education
- Agricultural leadership, training, and development
- Natural and managed environmental education

Agricultural Industries and Marketing
- Crops and soils industries
- Food industries

Animal Science
- Industry
- Production
- Science/pre-vet

Applied Economics
- Management and finance
- Marketing
- Food retailing
- Regional and public economics
- Resources and environment
- Trade and development

Crop, Soil, and Pest Management

Environmental Horticulture
- Floriculture/nursery production and retail management
- Landscape implementation and management
- Landscape design

Environmental Science
- Environmental management
- Environmental remediation and waste management
- Land-use management
- Precision management and information technology
- Environmental monitoring and analysis
- Environmental monitoring and measurement
- Land resources analysis
- Land and atmospheric sciences
- Biogeochemical cycling
- Climatology

Soil and water sciences
- Soil and water conservation
- Soil science
- Water quality
- Wetland science

Food Science
Nutrition
- Coordinated program in dietetics
- Nutrition
- Nutrition science

Science in Agriculture
- Biotechnology
- Food science
- Nutrition
- Plant science
- Soil science

Scientific and Technical Communication

Pre-professional Opportunities
Students may prepare in COAFES for the following upper division/professional programs.

- Pre-agricultural education
- Pre-biosystems and agricultural engineering
- Pre-landscape architecture
- Pre-medicine and dentistry
- Pre-veterinary medicine

Double Majors
Students may find it advantageous to complete the requirements for a second major as part of their undergraduate program. In some cases this can be done by concentrating electives in the second area and thereby completing a second major without taking more than the minimum number of credits required for a bachelor’s degree. In most cases, however, completing both majors requires that students take additional credits. For further information or an application, students should go to the COAFES Student Services Office. Students must file the application form before completing the required coursework for the second major.

Minors
COAFES offers the following minors:

- Agronomy
- Animal science
- Applied economics
- Climatology
- Designing documents with new and emerging technologies
- Entomology
- Food science
- Food systems and the environment
- Horticultural science
- Integrated pest management in cropping systems
- International agriculture
- Internet, science, and society
- Land, nature, and environmental values
- Nutrition
- Soil science
- Sustainable agriculture
- Technical communication
- Water science

To receive a minor, students must have an average GPA of 2.00 or higher, and a C- or better in the courses used in a program. To identify the appropriate electives, students should consult with an adviser.
Honors

The COAFES Honors Program provides a special educational opportunity to broaden, deepen, and enrich their education. The program gives students and faculty from diverse areas of interest and expertise the opportunity to interact with each other academically and socially. Honors students explore broad and varied aspects of agriculture through an honors colloquium course series (Agri 1000) and enhance their backgrounds through an honors experience course (Agri 3100). The honors experience course is student-designed and is supervised by COAFES faculty. Completion of the honors program, along with meeting the GPA requirement, leads to the cum laude degree designations in all COAFES majors.

For more information or an application, check with the COAFES Student Services Office.

Graduation Requirements

Bachelor’s Degrees—Candidates are recommended for graduation after they

• complete the prescribed curriculum, including required courses and electives to meet the total number of credits required;
• earn a GPA of at least 2.00 in all coursework taken at the University;
• earn a GPA of at least 2.00 in coursework in the major and have a grade of at least C- in all courses labeled as professional courses in the major;

Graduation application deadlines are set by the Office of the Registrar and can be found at http://onestop.umn.edu/registrar/Graduating/index.html. Extensions of deadlines are rarely granted. Students may turn in their application, with an APAS report or official program sheet signed by their adviser, to the One Stop Student Services Center in 130 Coffey Hall.

COAFES students are expected to maintain an academic standing that will enable them to meet minimum requirements for graduation. COAFES monitors academic progress each semester using the standards spelled out in the Policies section of this catalog.

Students who wish to use excess credits earned as an undergraduate for credit in the Graduate School should consult the Graduate School Catalog for current policies or the Graduate School Office, University of Minnesota, 316 Johnston Hall, 101 Pleasant Street S.E., Minneapolis, MN 55455.

Appeal System—Decisions by an adviser or a department’s Scholastic Standing Committee may be appealed to the COAFES Scholastic Standing Committee, 190 Coffey Hall, whose decision in turn may be appealed to the COAFES dean.

Advising

The faculty of COAFES is committed to providing quality advising for students. To accomplish that goal, almost all advising is done by the regular faculty. All advisers have volunteered to advise undergraduates and have gone through training to familiarize themselves with the curriculum as well as with University policies and resources.

New freshmen take part in the Student Learning Communities program. Students enroll in up to three courses in common, which are in turn coupled with special first-year integrating seminars that reinforce cross-disciplinary connections among the courses and provide hands-on field-based experiences. This program also provides structure and guidance to first-year students to help them more fully use the resources and programs within COAFES and the University.

New students in COAFES are assigned an academic adviser. Advisers guide students through major curriculum requirements, help with course selection, provide references for scholarships and employment, supervise internships, provide advice and counsel, and listen to students’ questions and concerns.

Most students prefer to have an adviser whose specialty matches their interests. If a student’s interests or career goals change, the student may change advisers. For information or assistance in changing advisers, students should consult their major coordinator or the COAFES Student Services Office.

Advisers know the curriculum of majors and have a working knowledge of most of the required courses. Most advisers also know some of the basic requirements of other COAFES majors or programs and can help students consider other options if interests change.

Advisers help students with petitions when it is appropriate to request a variation from specific program requirements.

Advisers keep a record of students’ work. Most advisers have advising files for the students assigned to them. They get regular academic progress reports and updated transcripts from the COAFES Student Services office.

Petition Procedures

To request permission to depart from usual procedures, students must complete a petition form available at the COAFES Student Services Office, 190 Coffey Hall, or at the One Stop Student Services Center in St. Paul, 130 Coffey Hall. All submitted petitions must be signed by an adviser. Requests for exceptions to coursework in the major require the signature of the major coordinator as well. Students present petitions to the COAFES Student Services Office for review by the Scholastic Standing Committee. A copy of the decision may be picked up about one week later.

Special Learning Opportunities and Resources

Undergraduate Research Opportunities Program (UROP)—The University of Minnesota’s 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 COAFES Student Services Office, 190 Coffey Hall (612-624-9299).

Professional Experience Program (PEP)—COAFES juniors and seniors may participate in PEP, a program 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 a PEP program. Students may enroll in two different PEP programs, 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 COAFES Career Services Office, 190 Coffey Hall (612-624-2710).
Scholarships

COAFES has an extensive scholarship program for freshmen, transfer students, and continuing students. Scholarship information, applications, and deadlines are available online at [www.coafes.umn.edu/scholarships](http://www.coafes.umn.edu/scholarships).

International Programs

Several types of study abroad that can especially enhance degree work in COAFES are field study, enrollment in international institutions, and integrated classroom study. Students may also seek internship credit from COAFES for academic projects arranged as a part of a MAST Experience Abroad. For details, consult the International Agricultural Programs office in 190 Coffey Hall.

Some scholarships are available through COAFES to help defray costs of overseas study and travel. A written report is required. Preference is given to proposals from non-English speaking countries. Students must initiate and plan the project with the aid of a faculty adviser. For more information, contact the COAFES Career Services Office, 190 Coffey Hall (612-624-2710).

**MAST Experience Abroad**—The MAST Experience Abroad 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, 240 Vocational and Technical Education Building (612-624-3740).

**Other Study Abroad Opportunities**—COAFES encourages study abroad for language acquisition or cultural learning. The resulting credits can often be used as electives. The University and other institutions sponsor a broad range of intensive language programs and area studies programs. For more information, contact the Learning Abroad Center at 612-626-9000 or visit the Web site at [www.UMabroad.umn.edu](http://www.UMabroad.umn.edu).

Career Information

To help students secure employment after graduation, the Career Services Office, 190 Coffey Hall, announces job opportunities and helps arrange interviews with employers. The office manages the recruiting activity for both full-time and internship positions. Beginning their freshman year, students are encouraged to take advantage of the Career Services Office. A wide range of information is available at their Web site at [www.coafes.umn.edu/career](http://www.coafes.umn.edu/career).

Student Organizations

**COAFES Student Board**—The COAFES 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 COAFES. COAFES 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 190 Coffey Hall.

**Ambassadors**—The Ambassadors is a voluntary, honorary organization consisting of 30 COAFES undergraduates 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 COAFES Student Services Office in 190 Coffey Hall.

**St. Paul Campus Board of Colleges**—The St. Paul Campus 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: COAFES, Biological Sciences, Natural Resources, Human Ecology, and Veterinary Medicine. The board cooperates with the Minnesota Student Association and the Assembly Committee on Student Affairs (ACSA). For more information, inquire at the Office for Student Affairs in 130 Coffey Hall.

**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 COAFES committees and most all-University committees have student representatives. For college committees, selection is made by the COAFES Student Board.

**Other COAFES Student Organizations**—Many of the undergraduate programs sponsor student clubs. For more information, students should check with their adviser or the COAFES Student Services Office in 190 Coffey Hall. Other clubs affiliated with COAFES 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 Resources and Related Sciences (MANRRS)
- American Society of Agricultural Engineers, Student Branch
- Applied Economics Student Association
- Block and Bridle
- Collegiate Agri-Women
- Environmental Studies Club
- Frenatar: Entomology Student Association
- Food Science Club
- Gopher Crops and Soils
- Gopher Dairy Club
- Horticulture Club
- National Agri-Marketing Association (NAMA)
- National Society for Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS)
- Pre-Vet Med Club
- Rhetoric’s Association of Student Technical Communicators (R.A.S.T.E.C.)
- Student Organization of Nutrition and Dietetics (SOND)
- Students in Honors
- The Sheep and Goat Club
Following is a list of COAFES departments. Several departments and units also have formal affiliations or administrative links to other colleges: Agriculture and Food Business Management has links with the Carlson School of Management (CSOM); Agricultural Education has links with the College of Education and Human Development (CEHD); Biosystems and Agricultural Engineering has links with the Institute of Technology (IT); Food Science and Nutrition has links with the College of Human Ecology (CHE).

Each department offers courses, and most departments have ties with several of the undergraduate majors offered by COAFES.
College of Agricultural, Food and Environmental Sciences

Degree Programs and Minors

Agricultural and Food Business Management

B.S.
The agricultural and food business management major is offered jointly by COAFES 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.

Admission Requirements—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.

To be considered for admission, students must meet the following pre-program requirements:

- Complete or have in progress coursework to total 60 credits by the time of admission.
- Complete the following management “tool” courses on an A-F grading basis before entering the program:
  - Agro 1101, 1102 or Econ 1101, 1102
  - OMS 2550
  - Math 1142 or Math 1271
- Earn a GPA of at least 2.80 in all coursework.
- Earn a GPA of at least 2.50 in the tool courses with grades of C- or better.

COAFES students who plan to major in agricultural and food business management and have not completed the pre-agricultural and food business management program are assigned a faculty adviser, but retain pre-major status until they are accepted into the program.

Additional information about admission to the program and application materials are available in 217 Classroom Office Building, from the Department of Applied Economics Web site at www.apec.umn.edu, or from the COAFES Student Services Office in 190 Coffey Hall.

Degree Requirements

Students must complete at least 120 credits to graduate, including at least 64 credits in the major. Frequently, courses in the foundation requirements also apply toward completion of the liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses. Students may not major in both agricultural and food business management and applied economics.

University of Minnesota researchers have brought new life to northern areas with cold-tolerant apples, winter-hardy mums, and agricultural techniques suited for northern climates.

Required Courses

Foundation Requirements (at least 24 cr)
Math 1142—Short Calculus (4 cr)
or Math 1271—Calculus I (4 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1152—Writing on Issues of Science and Technology (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)

Note: Students contemplating graduate work in applied economics are encouraged to take both Math 1271 and 1272.

Choose 4 credits of physical sciences from the following:
Chem 1011—General Principles of Chemistry (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Geo 1001—The Dynamic Earth (4 cr)
Geog 1403W—Biogeography of the Global Garden (4 cr)
Geog 1425—Introduction to Meteorology (4 cr)
IoT 1101—Environmental Issues and Solutions (4 cr)
Phys 1001W—Energy and the Environment (4 cr)
Soil 1125—The Soil Resource (4 cr)

Choose 4 credits of biological sciences from the following:
Agro 1101—Biology of Plant Food Systems (4 cr)
Biol 1001—Introductory Biology I (4 cr)
Biol 1009—General Biology (4 cr)
FScN 1021—Introductory Microbiology (4 cr)
Hort 1001—Plant Propagation (4 cr)
PIPA 1005—Plants Get Sick Too (4 cr)

Ethics and Responsible Management of Agricultural, Food, and Environmental Systems (3 cr)

Student must take one course (3 cr) from the list below 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.

This course must be taken A-F and passed with grade of C- or better.

Agro 1103, 3203W, AnSc 1011, BAE 5212, Biol 1051, 4501, EEB 3001, EE 1701W, ES 1011, FScN 1102, Geo 3005, Geog 3401W, HSci 3211, 3331, ENR 3011W, 3061W, PBio 1212W, Phil 3303W, PIPa 1001, or ScAg 1501
Professional Requirements (46 cr)

Applied Economics
ApEc 1001—Orientation (1 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (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 (3 cr)
ApEc 3501—Agritourism and Tourism (3 cr)
ApEc 4821—Agritourism Management (5 cr)

Carlson School of Management
Acct 2050—Introduction to Financial Reporting (4 cr)
Acct 3001—Introduction to Management Accounting (3 cr)
Mgmt 3001—Fundamentals of Management (3 cr)
Mktg 3001—Principles of Marketing (3 cr)
OMS 2550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)

Areas of Emphasis (12 cr)

All Emphases
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 3245, 4241, or 4242 only. These requirements may be met by selecting courses in one of the following areas of emphasis.

Business Management
Acct 3201—Intermediate Management Accounting (2 cr)
Acct 5100—Corporate Financial Reporting (4 cr)
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 5711—U.S. Agricultural and Environmental Policy (3 cr)
ApEc 5811—Cooperative Organization (3 cr)
Blaw 3058—The Law of Contracts and Agency (4 cr)
Fina 4241—Corporate Financing Decisions (4 cr)
Fina 4242—Corporate Investment Decisions (4 cr)
Hrir 3021—Human Resource Management and Industrial Relations (3 cr)
Hrir 3032—Training and Development (2 cr)
Hrir 3034—The Individual and Organizational Performance (2 cr)
Mgmt 3011—Introduction to Entrepreneurship (4 cr)
Mgmt 4002—Managerial Psychology (4 cr)
Mgmt 4008—Entrepreneurial Management (4 cr)

Financial Management
Acct 5101—Asset Valuation and Income Determination (4 cr)
Acct 5125—Auditing Principles and Procedures (4 cr)
Acct 5160—Financial Statement Analysis (4 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4481—Futures and Options Markets (3 cr)
ApEc 4501—Financial Applications (3 cr)
ApEc 5341—Public Finance (3 cr)
ApEc 5751—Agricultural Trade and Trade Policy: Issues and Analysis (3 cr)
Blaw 3058—The Law of Contracts and Agency (4 cr)
Econ 3701 or 4721H—Money and Banking (3 cr)
Econ 4432W—International Finance (3 cr)
Econ 4751—Financial Economics (3 cr)
Fina 4241—Corporate Financing Decisions (4 cr)
Fina 4242—Corporate Investment Decisions (4 cr)
Fina 4243—Portfolio Management and Performance Evaluation (2 cr)
Fina 4322—Security Analysis (2 cr)
Fina 4641—International Finance and Risk Management (4 cr)
Ins 5100—Corporate Risk Management (2 cr)

Marketing, Sales, and Food Industry Management
ApEc 3411—Commodity Marketing (3 cr)
ApEc 3821—Retail Center Management (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 4103—World Food Problems (3 cr)
ApEc 4451W—Food Marketing Economics (3 cr)

Individualized Area of Emphasis
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.

Internships
Internships are recommended for all students in the major. Internship credits (ApEc 4096) do count toward the degree requirements.

Agricultural Education

Department of Work, Community, and Family Education

B.S.
The undergraduate agricultural education program is a collaborative partnership between CEHD and the College of Agricultural, Food and Environmental Sciences. Three specializations are available; the following two prepare students for Minnesota state teaching licensure:

- agricultural science and technology education
- natural and managed environmental education

The agricultural leadership, training, and development specialization prepares students for agricultural industry and leadership careers, focusing on development of interpersonal skills. It does not lead to teaching licensure.

Agricultural Science and Technology Education Specialization
This specialization serves students preparing to teach agriscience, agribusiness, agriculture, horticulture, food systems, agrimechanics, and natural resource management under the licensure field of agricultural education in public schools at the 5-12 level. The specialization’s broad agricultural science and technology background also prepares graduates for a wide range of agriculturally related positions in sales, management, finance, and production aspects of agriculture.

Admission Requirements—Students may be admitted to this program after completing at least 60 semester credits. A minimum GPA of 2.50 is recommended.

Degree Requirements
Students must 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. Major coursework (courses with AFEE, BIE, EdHD, HRD, and WCPE designators) must be completed with a minimum 2.00 GPA with no grade lower than C-. A minimum grade of C- is also required for general psychology.
Students must complete at least 128 credits to graduate, included required courses in the major. Students must also complete the University’s liberal education requirements, including approved writing intensive (W) courses. For more information, see the Liberal Education Requirements section in this catalog.

The specialization requires a broad study of agriculture, including plant science (horticulture, agronomy, plant pathology, and entomology), animal science, natural resources, soils, economics and agribusiness, agricultural mechanization, food science, foundations of education, foundations of agricultural education, and a full-year student teaching experience.

**Major Foundation Courses**

**Communications (11 cr)**
- Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
- or GC 1421—Writing Laboratory: Basic Writing (3 cr)
- and GC 1422—Writing Laboratory: Communicating in Society (3 cr), GC 1423—Writing Laboratory: Community Service Writing (3 cr), or GC 1424—Writing Laboratory: Communicating in a Diverse Society (3 cr)
- Rhet 1225—Oral Presentations in Professional Settings (3 cr)
- or GC 1461—Oral Communication in the Public Sphere (3 cr)
- Rhet 352W—Technical and Professional Writing (4 cr)

**Physical and Biological Sciences (19-21 cr)**
- Agro 1101—Biology of Plant Food Systems (4 cr)
- or Biol 1009—General Biology (4 cr)
- or Biol 1051—Introduction to Environmental Science (3 cr)
- or GC 1131—Principles of Biological Science (4 cr)
- BioC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
- Chem 1011—General Principles of Chemistry (4 cr)
- MicB 2022—General Microbiology (2 cr)
- Phys 1001W—Energy and the Environment (4 cr)
- or Phys 1101W—Introductory College Physics I (4 cr)
- ScAg 1501—Biotechnology, People, and the Environment (3 cr)
- or GC 1163—Physical Systems: Principles and Practices (4 cr)

**Mathematics (3 cr)**
- Math 1031—College Algebra and Probability (3 cr)

**Social Science (8 cr)**
- HSci 1714—Technology and Western Civilization: To the Industrial Revolution (4 cr)
- or HSci 1715—Technology and Western Civilization: Since the Industrial Revolution (4 cr)
- or HSci 1814—Introduction to History of Science: Ancient Science to the Scientific Revolution (4 cr)
- or HSci 1815—Introduction to History of Science: Modern Science (4 cr)
- or any history course that meets HP or IP liberal education requirements
- Psy 1001—Introduction to Psychology (4 cr)
- or GC 1281—General Psychology (4 cr)

**Agricultural Sciences and Applied Economics (40 cr)**

**Plant Science (6-7 cr)**
- Agri 3001—Pests and Crop Protection (3 cr)
- or Agri 3002—Greenhouse Management (3 cr)

**Plus 3-4 credits from the following:**
- Agro 1103—Crops, Environment, and Society (4 cr)
- Agro/Hort 4401—Plant Genetics and Breeding (4 cr)
- Hort 1001—Plant Propagation (4 cr)
- Hort 1002—Home Horticulture (3 cr)
- Hort 1012—Woody Landscape Plants (3 cr)
- Hort 1013—Floral Design (2 cr)
- AnSc 2301—Systemic Physiology (4 cr)
- AnSc/Agro 3203W—Environment, Global Food Production, and the Citizen (3 cr)
- AnSc 3221—Animal Breeding (4 cr)

**Natural Resources (6 cr)**
- At least 6 credits from the following:
  - Agro/AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)
  - EEB 3001—Ecology and Society (3 cr)
  - ES 1011—Issues in the Environment (3 cr)
  - ES 1051—Introduction to Environmental Science (3 cr)
  - FW 1002—Wildlife: Ecology, Values, and Human Impact (3 cr)
  - ENR 1201—Conservation and Management of Natural Resources (3 cr)

**Soils (4 cr)**
- Soil 1125—The Soil Resource (4 cr)
- or Soil 2125—Basic Soil Science (4 cr)

**Applied Economics and Agribusiness (8-9 cr)**
- ApEc 1101—Principles of Microeconomics (3 cr)
- ApEc 3451—Food and Agricultural Sales (3 cr)

**Plus 2-3 credits from the following:**
- ApEc 1251—Principles of Accounting (3 cr)
- ApEc 3401—Markets, Marketing, and Prices (2 cr)
- ApEc 3811—Principles of Farm Management (3 cr)

**Agricultural Mechanization (6 cr)**
- ApEE 1002—Food: Safety, Risks, and Technology (3 cr)

**Food Science (3 cr)**
- FScN 1102—Food: Safety, Risks, and Technology (3 cr)

**Professional Development Core (37.5-38.5 cr)**

**Foundations (14.5-15.5 cr)**
- EdHD 5001—Learning, Cognition, and Assessment in the Schools (3 cr)
- EdHD 5003—Developmental and Individual Differences in Educational Contexts (3 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)
- EdPA 5341—The American Middle School (3 cr)
- PubH 3003—Fundamentals of Alcohol and Drug Abuse (2 cr)
- or PubH 5003—Fundamentals of Alcohol and Drug Abuse (1 cr)

**Agricultural Education (15 cr)**
- AFEE 1001—Introduction to Agricultural Education and Extension (1 cr)
- AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
- AFEE 2096—Professional Practicum in Agricultural Education: Early Experience (1 cr)
- AFEE 2099—Professional Practicum in Agricultural Education: Early Experience (1 cr)
- AFEE 5124—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)

**Work, Community, and Family Education (8 cr)**
- WCFE 5697—Teaching Internships: School and Classroom Settings (2 cr)
- WCFE 5698—Teaching Internship (6 cr)

Completion of standard first aid and cardiopulmonary resuscitation (CPR) training is required for licensure.

**Natural and Managed Environmental Education Specialization**

This specialization serves students preparing to teach agriscience, agribusiness, agriculture, horticulture, food systems, agrimechanics, and natural resource management, all under the licensure field of agricultural education in public schools at the 5-12 level. In addition, graduates have an emphasis in natural resource management and education and are prepared for work in environmental learning centers.
Admission Requirements—Students may be admitted to this program as freshmen or may transfer into the program any semester with a minimum overall GPA of 2.50 and complete the Praxis I: Pre-Professional Skills Tests (PPST).

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

Students must complete at least 128 credits, including required courses in the major. Students also must complete the University’s liberal education requirements, including approved writing intensive (W) courses. For more information, see the Liberal Education Requirements section of this catalog.

The specialization requires a broad study in agriculture focused on the natural and managed environmental education areas. Areas of study include the environment, land, water, climate, economics, soil, plant science, animal science, and agricultural mechanization. It also includes foundations in education, foundations in agricultural education, and a full-year student teaching experience.

Required Courses
Communications (11 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562W—Technical and Professional Writing (4 cr)
Mathematics (3 cr)
Math 1031—College Algebra and Probability (3 cr)
Physical and Biological Science (19-20 cr)
BioC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
Biol 1009—General Biology (4 cr)
or
Biol 1051—Introduction to Environmental Science (3 cr)
or
Agro 1101—Biology of Plant Food Systems (4 cr)
Chem 1011—General Principles of Chemistry (4 cr)
MicB 2022—General Microbiology (2 cr)
Phys 1001W—Energy and the Environment (4 cr)
or
Phys 1101W—Introductory College Physics I (4 cr)
ScAg 1501—Biotechnology, People, and the Environment (3 cr)
Social Science (8 cr)
HSci 1714—Technology and Western Civilization: To the Industrial Revolution (4 cr)
or
HSci 1715—Technology and Western Civilization: Since the Industrial Revolution (4 cr)
or
HSci 1814—Introduction to History of Science: Ancient Science to the Scientific Revolution (4 cr)
or
HSci 1815—Introduction to History of Science: Modern Science (4 cr)
Psy 1001—Introduction to Psychology (4 cr)
or
GC 1281—General Psychology (4 cr)
Natural and Managed Environmental Science (40 cr)
Environmental (9 cr)
ES 1011—Issues in Environment (3 cr)

Plus at least 6 credits from the following:
EEB 3001—Ecology and Society (3 cr)
ES 1051—Introduction to Environmental Science (3 cr)
FR 2104—Forest Measurement Techniques (1 cr)
FR 3104—Forest Ecology (4 cr)
FR 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)
FW 1002—Wildlife: Ecology, Values, and Human Impact (3 cr)
FW 3003—Wildlife in Agricultural Land (2 cr)
Land, Water, Atmosphere (7-8 cr)
Soil 2125—Basic Soil Science (4 cr)

Plus 3-4 credits from the following:
ENR 1201—Conservation and Management of Natural Resources (3 cr)
ES 1425—The Atmosphere (4 cr)
ES 3221—Soil Conservation and Water Quality Impacts (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)
Applied Economics and Agribusiness (3 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
or
ApEc 3451—Food and Agricultural Sales (3 cr)
Plant Science (6 cr)
Agri 3001—Pests and Crop Protection (3 cr)

Plus 3-4 credits from the following:
Agro/Hort 4401—Plant Genetics and Breeding (4 cr)
Agro or Hort (Electives)
Animal Science (6 cr)
AnSc 2401—Animal Nutrition (3 cr)

Plus 3-4 credits from the following:
AnSc 1101—Introductory Animal Science (4 cr)
AnSc 1403—Companion Animal Nutrition and Care (2 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)
Agricultural Mechanization (6 cr)
AFEE/BIE 3112—Technical Drawing and Production Technologies (3 cr)

Select one of the following:
AFEE/BIE 3121—Technical Drawing and Production Technologies (3 cr)
AFEE/BIE 3121—Communication, Energy and Power, Transportation and Machinery Technologies (3 cr)
Food Science (3 cr)
FScN 1102—Food: Safety, Risks, and Technology (3 cr)
Professional Education (38 cr)
Foundations (14.5–15.5 cr)
EdHD 5001—Learning, Cognition, and Assessment in the Schools (3 cr)
EdHD 5003—Developmental and Individual Differences in Educational Contexts (3 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)
EdPA 5341—The American Middle School (3 cr)
PubH 3003—Fundamentals of Alcohol and Drug Abuse (2 cr)
or
PubH 5003—Fundamentals of Alcohol and Drug Abuse (1 cr)
Agricultural Education (15 cr)
AFEE 1001—Introduction to Agricultural Education and Extension (1 cr)
AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
AFEE 2096—Professional Practicum in Agricultural Education: Early Experience (1 cr)
AFEE 5111—Agricultural Education: Methods of Teaching (4 cr)
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)

Work, Community, and Family Education (8 cr)
WCFE 5697—Teaching Internship: School and Classroom Settings (2 cr)
WCFE 5698—Teaching Internship (6 cr)
Completion of standard first aid and cardiopulmonary resuscitation (CPR) training is required for licensure.

Agricultural Leadership, Training, and Development Specialization
This specialization provides a unique, futuristic educational opportunity combining agricultural science, management, communication, leadership, education, business and industry, training, and development. It provides a general background in agriculture, with agribusiness and industry associations. This specialization does not lead to teaching licensure.

The agricultural industry is faced with leadership and employee training and development challenges. This specialization provides students with opportunities and flexibility in employment ranging from human resource development, sales and marketing, extension, and communications in statewide, national, and international situations.

Admission Requirements—Students may be admitted to this program as freshmen or may transfer into the program any semester. They must have a GPA of 2.00 for admission.

Degree Requirements
Students must complete at least 128 credits, including required courses in the major. Students also must complete the University’s liberal education requirements, including approved writing intensive (W) courses. For more information, see the Liberal Education Requirements section in this catalog.

This specialization requires business experience as well as completion of courses. Students must maintain an overall GPA of 2.00.

Required Courses
Communications (11 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562W—Technical and Professional Writing (4 cr)

Mathematics (3 cr)
Math 1031—College Algebra and Probability (3 cr)

Physical and Biological Sciences (14 cr)
Agro 1101—Biology of Plant Food Systems (4 cr)
Biol 1009—General Biology (4 cr)
BioC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
ScAg 1501—Biotechnology: People and the Environment (3 cr)

Agricultural Sciences and Economics (49–50 cr)

Plant Science (9 cr)
Agro 3001—Pests and Crop Protection (3 cr)
Agro 3005—Applied Crop Physiology and Development (2 cr)
AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)
Hort 1001—Plant Propagation (4 cr)
Hort 1002—Home Horticulture (3 cr)
Hort 3005—Environmental Effects on Horticultural Crops (2 cr)

Animal Science (9–10 cr)
AnSc 1101—Introductory Animal Science (4 cr)
AnSc 1403—Companion Animal Nutrition and Care (2 cr)
or AnSc 2401—Animal Nutrition (3 cr)

Plus 3-4 credits from the following:
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
AnSc 3203W—Environment, Global Food Production, and the Citizen (3 cr)

Soils (4 cr)
Soil 1125—The Soil Resource (4 cr)
or Soil 2125—Basic Soil Science (4 cr)

Applied Economics and Agribusiness (9 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1251—Principles of Accounting (3 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
or BIE 3061—Professional Sales Management (3 cr)

Agricultural Mechanization (3 cr)
AFEE 2051—Current Technical Competencies (3 cr)

Agricultural Leadership and Development (6 cr)
AFEE 4221—Rural Leadership Development (3 cr)
AFEE 5361—World Development Problems (3 cr)

Experiential Education (3 cr)
AFEE 3096—Experiential Learning: Production and Business (1–3 cr)

Agricultural Education and Extension (6 cr)
AFEE 1001—Introduction to Agricultural Education and Extension (1 cr)
AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
AFEE 5111—Agricultural Education: Methods of Teaching (4 cr)

Human Resource Development (12 cr)
HRD 3001—Introduction to Human Resource Development (3 cr)
HRD 5105—Strategic Planning in Human Resource Development (3 cr)
HRD 5201—Personnel Training and Development (3 cr)
HRD 5301—Organization Development (3 cr)

Human Resource Development/AFEE Electives (9 cr)
Select a minimum of 9 credits from:
AFEE 5331—History, Philosophy, and Systems of Extension (3 cr)
AFEE 5341—Global Program Delivery Techniques and Technology of Extension (2 cr)
AFEE 5351—Methods for Change in Developing Countries (3 cr)
BIE 3061—Professional Sales Management (3 cr)
HRD 3629—Course Development for Business and Industry (3 cr)
HRD 5106—Evaluation in Human Resource Development (3 cr)
HRD 5202—Training on the Internet (3 cr)
HRD 5302—Managing Work Teams in Business and Industry (3 cr)
HRD 5624—Sales Training (3 cr)

Emphasis Areas
Students must select 10 credits in one of the following three areas:

Agricultural Science (10 cr)
Agro 2103—Grain Grading and Crop Utilization (1 cr)
Agro 2105— Seed Technology (1 cr)
Agro 2501—Weed Biology and Systematics (2 cr)
Agro 3203W—Environment, Global Food Production, and the Citizen (3 cr)
AnSc 3005—Applied Crop Physiology and Development (2 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
AnSc 2211—Biometrics for Livestock (3 cr)
AnSc 2301—Systemic Physiology (4 cr)
FScN 1102—Food: Safety, Risks, and Technology (3 cr)
Ppia 2002—Diseases of Field Crops (3 cr)
Ppia 3002—Air Pollution, People, and Plants: The Science and the Ethics (3 cr)

Agricultural Business and Management (10 cr)
ApEc 3041—Economic Development of U.S. Agriculture (3 cr)
ApEc 3401—Markets, Marketing, and Prices (2 cr)
ApEc 3411—Grain Marketing Economics (2 cr)
ApEc 3421—Livestock and Meat Marketing Economics (2 cr)
ApEc 3811—Principles of Farm Management (3 cr)
Communication (10 cr)
Rhet 1152W—Writing on Issues of Science and Technology (4 cr)
Rhet 3221W—Theories of Human Communication (4 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3266—Group Process, Team Building, Leadership (3 cr)
Rhet 3401—Accessing Information Through Electronic Media (3 cr)

Agricultural Industries and Marketing
B.S.
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, wood, 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 regularly search for 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.

All departments in COAFES contribute to and are represented by the agricultural industries and marketing (AIM) major. The major provides a broad-based educational program reflecting the academic strengths of COAFES and the University at large. It also prepares students for a challenging career in agricultural industries.

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 COAFES or university-wide minor. Only 6 credits in the AIM major may also be counted towards a minor. For the student interested in preparing for the Certified Crop Advisor (CCA) exam or the certified professional agronomist (CPAg) programs, the minor in agronomy is highly recommended.

Degree Requirements
Students must complete at least 120 credits to graduate, including 108 credits in the major. Besides completing the University’s liberal education requirements, all majors must complete 1) a common core of foundation courses in the areas of quantitative studies (mathematics, accounting, and statistics) and science (biology and chemistry) and 2) professional courses with three major clusters (communications, business, and agriculture). Students must complete at least 14 credits in their area of emphasis. Finally, students must complete an internship or a student project. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

Required Courses
Foundation Requirements
Quantitative Foundations
Math 1031—College Algebra (3 cr)

or
Math 1131—Finite Mathematics (3 cr)

or
Math 1142—Short Calculus (4 cr)

Plus one of the following:
Agro 4101—Agricultural Decision-Making and Experimentation (3 cr)
AnSc 2211—Biometrics for Livestock (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)

Science Foundations
Track A: For undergraduate students pursuing the Crops/Soils or the Individualized Emphasis.
Agro 1101—Biology of Plant Food Systems (4 cr)
or Biol 1001—Introductory Biology (4 cr)
or Biol 1009—General Biology (4 cr)
BioC 1001—Elementary Biochemistry (3 cr)
or BioC 2011—Biochemistry for the Agricultural and Health Sciences (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
Soil 2125—Basic Soil Science (4 cr)
Track B: For undergraduate students pursuing the Food Industries Emphasis.
Agro 1101—Biology of Plant Food Systems (4 cr)
or Biol 1001—Introductory Biology (4 cr)
or Biol 1009—General Biology (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)

Professional Requirements
A grade of at least C- is required in all professional courses and the area of emphasis.

Communications Core
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3266—Group Process, Team Building, and Leadership (3 cr)
Rhet 3502—Technical and Professional Writing (4 cr)
Rhet 4165—Managerial and Organizational Communication, Planning, and Change (3 cr)
or Rhet 5258—Information-Gathering Techniques in Scientific and Technical Communication (3 cr)

Business Management Core
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
ApEc 1251—Principles of Accounting (3 cr)
ApEc 3411—Commodity Marketing (3 cr)
or ApEc 4451W—Food Marketing Economics (3 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
or Mktg 4030—Selling and Sales Management (4 cr)
ApEc 3811—Principles of Farm Management (3 cr)
or ApEc 3821—Retail Center Management (3 cr)
or GC 1513—Small Business Management (3 cr)
or Mgmt 3001—Principles of Management (3 cr)
or Mktg 3001—Principles of Marketing (3 cr)

Agriculture
Track A: For undergraduate students pursuing the Crops/Soils or the Individualized Emphasis.
Agro 1660—First-Year Colloquium (2 cr)
Agro 1103—Crops, Environment, and Society (4 cr)
Agro 4660—Senior Capstone (2 cr)
Agro 4096—Professional Experience Program: Internship (3 cr)
or AIM 4011—Student Project/Field Investigation (3 cr)

Track B: For undergraduate students pursuing the Food Industries Emphasis.
FScN 1021—Introductory Microbiology (4 cr)
or VBE 2012—General Microbiology with Lab (4 cr)
FScN 1102—Food: Safety, Risks, and Technology (3 cr)
FScN 1112—Principles of Nutrition (3 cr)
FScN 4096—Professional Experience Program: Internship (3 cr)
or AIM 4011—Student Project/Field Investigation (3 cr)

Areas of Emphasis
Crops and Soils Industries
Agri 3001—Pests and Crop Protection (3 cr)
Agro 4005—Applied Crop Physiology and Development (4 cr)
or Biol 3002 Plant Biology and Biol 3005 Plant Function Lab. (4 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)
At least one course from the following group:
Agro 3203, Agro 4401, Agro 4505, Agro 4603, Agro 4605, ES 3221

Food Industries
FScN 3102—Introduction to Food Science (3 cr)
FScN 3731—Food Service Operations Management Lab (2 cr)
FScN 3732—Food Service Operations Management (3 cr)
FScN 4131—Food Quality (3 cr)

Select one course from the following group:
FScN 1511, FScN 3612, FScN 3615, FScN 4614, Mktg 3010

Individualized Emphasis
At least 14 cr 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.

Agronomy

Minor Only
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.

Required Courses
Agro 4005—Applied Crop Physiology and Development (4 cr)
Agro 4660—Senior Capstone (2 cr)
Agri 3001—Pests and Crop Protection (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

Electives
5 credits of Agro 2xxx or higher courses selected from the following list in consultation with the minor adviser:
Agro 2104—Grain and Seed Technology (2 cr)
Agro 2501—Plant Identification in 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—Integrated Weed Management (3 cr)
Agro 4603—Field Crop Scouting and Problem Diagnosis (2 cr)
Agro 4605—Management Strategies for Crop Production (4 cr)

Animal Science

B.S.
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 the following options of study: biotechnology, dairy, beef, sheep, swine, equine, companion animal, or poultry.

Animal Science/Doctor of Veterinary Medicine Joint Degree
The animal science /doctor of veterinary medicine joint degree is a cooperative program between COAFES and the College of Veterinary Medicine (CVM). Students who are accepted into CVM and successfully complete one year (two semesters) of the veterinary medicine curriculum can earn the B.S. degree from COAFES. This program is available to students who satisfy the COAFES residency requirements and complete the COAFES portion in three academic years.

Degree Requirements
Students must complete at least 120 credits to graduate. All required courses must be taken A-F, and a grade of C- is required in all professional courses and area of emphasis courses.

Required Courses

Foundation Requirements
ApEc 1101—Principles of Microeconomics (3 cr)
Biol 1009—General Biology (4 cr)
Math 1031—College Algebra and Probability (3 cr)
or Math 1142—Short Calculus (4 cr)
or Math 1271—Calculus I (4 cr)
or Math 1281—Calculus I (4 cr)

Note: one semester of calculus required for biotech option
Rhett 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhett 1223—Oral Presentations in Professional Settings (3 cr)
Rhett 3562—Technical and Professional Writing (4 cr)

Professional Requirements
AFEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
or AnSc 1001—Orientation for AnSc Pre-Vet (1 cr)
AnSc 1101—Introductory Animal Science (4 cr)
AnSc 2211—Biometrics for Livestock (3 cr)
AnSc 2301—Systemic Physiology (4 cr)
AnSc 2401—Animal Nutrition (3 cr)
AnSc 3221—Animal Breeding (4 cr)
AnSc 4096—Professional Experience Program: Internship (3 cr)
or ScAg 4009—Undergrad Research Thesis (6 cr)

COAFES’S Mentor Program matches students with alumni who are leaders in the student’s field of study and provides opportunities for students to learn, ask questions, and talk candidly with professionals.

Areas of Emphasis
Choose one of three areas of emphasis: industry, production or science/pre-vet.

Industry
ApEc 1102—Principles of Macroeconomics (3 cr)
ApEc 1251—Principles of Accounting (3 cr)
BioC 2011—Biochemistry for Agriculture and Health Science (3 cr)
Chem 1031—General Principles of Chemistry (4 cr)
Rhett 1152—Writing on Issues of Science and Technology (4 cr)
or Rhett 3527—Scientific and Technical Presentations (3 cr)
Rhett 3266—Group Process, Team Building, and Leadership (3 cr)

Choose three courses from the following:
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 3811—Principles of Farm Management (3 cr)
ApEc 3821—Retail Center Management (3 cr)
ApEc 4451—Food Marketing Economics (3 cr)
ApEc 4821—Agribusiness Management (5 cr)

Choose one course from the following:
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 3501—Agribusiness Finance (3 cr)
BIE 3061—Professional Sales Management (3 cr)

Choose 12 credits from the following:
Agro 1103—Crops, Environment, and Society (4 cr)
AnSc 1011—Domestic Animals and Society (3 cr)
AnSc 1501—Biotechnology, People, and the Environment (3 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
College of Agricultural, Food and Environmental Sciences

AnSc 3203W—Environment, Global Food Production, and the Citizen (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 4401—Dairy Cattle Breeding (3 cr)
AnSc 4403—Ruminant Nutrition (4 cr)
AnSc 4401—Pork Production Systems Management (4 cr)
AnSc 4403—Beef Production Systems Management (4 cr)
AnSc 4601—Pork Production Systems Management (4 cr)
AnSc 4601—Advanced Pork Production Systems Management (2 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
AnSc 2102—Horse Production (3 cr)
AnSc 4102—Equine Management (3 cr)
AnSc 3051—Equine Nutrition (3 cr)
AnSc 3052—Equine Anatomy and Physiology (3 cr)

Companion Animal
AnSc 1403—Companion Animal Nutrition and Care (3 cr)
SACS 3211—Animal Behavior (3 cr)
SACS 4606—Small Animal Management (3 cr)
Plus 3 credits to be determined in consultation with an adviser.

Poultry
AnSc 4605—Poultry Production Systems Management (4 cr)
At least three poultry courses from the Midwest Poultry Consortium Summer Program at Madison, Wisconsin. Courses cannot count for requirements in this section and professional requirements.

Individualized Option (12 Cr Min)
Courses may be selected according to the students’ interests in consultation with the students’ adviser and with approval of the Animal Production Systems Committee.

Science/Pre-Vet
Students in the science/pre-vet emphasis must choose either the basic science or 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)
GCD 3022—Genetics (3 cr)
Phys 1101W—Introductory College Physics I (4 cr)
Phys 1102W—Introductory College Physics II (4 cr)
or Phys 1201W—Introductory Physics for Biology and Pre-medicine I (5 cr)
and Phys 1202W—Introductory Physics for Biology and Pre-medicine II (5 cr)

VPB 2032—Microbiology With Laboratory (4 cr)

Basic Science Option:
Choose 12 credits from the following (at least 6 credits must be 3xxx or higher):

AnSc 1011—Domestic Animals and Society (3 cr)
AnSc 1403—Companion Animal Nutrition and Care (3 cr)
AnSc 1501—Biotechnology, People, and the Environment (3 cr)
AnSc 1501—Biotechnology, People, and the Environment (3 cr)
AnSc 3203W—Environment, Global Food Production, and the Citizen (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 4401—Dairy Cattle Breeding (3 cr)
AnSc 4403—Ruminant Nutrition (4 cr)
CAPS 3502—Animal Health and Disease (3 cr)
Ent 4281—Veterinary Entomology (3 cr)
Soil 2125—Basic Soil Science (4 cr)

Choose one of the following livestock production systems management options:

Dairy
AnSc 4011—Dairy Cattle Breeding (3 cr)
AnSc 4403—Ruminant Nutrition (4 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 (4 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 (4 cr)
AnSc 4602—Sheep Production Systems Management (4 cr)
Biotechnology Option:
AnSc 1501—Biotechnology, People, and the Environment (3 cr)
AnSc 3509—Animal Biotechnology (3 cr)
Biol 4003—Genetics (3 cr)

Choose 11 credits from the following (at least 2 credits of a laboratory):
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 (2 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—Biolog y of Microorganisms (5 cr)
MicB 4131—Immunology (3 cr)
MicB 4141W—Biology, Genetics, and Pathogenesis of Viruses: Writing Intensive (3 cr)
MicB 4151—Molecular and Genetic Bases for Microbial Diseases (3 cr)
MicB 4235—Advanced Laboratory: Virology, Immunology, and Genetics (3 cr)

Animal Science Minor
The 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. To complete the minor, students must complete at least 20 credits with an AnSc designator.

Required Courses
At least 10 credits must be 3xxx or higher.

Applied Economics
B.S.
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, 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.

Degree Requirements
Students must complete at least 120 credits to graduate, including 52 credits in the major. Besides completing the University’s liberal education requirements, students must complete a core of foundational requirements (writing performance and speaking performance) and professional requirements, including basic economic principles, applied micro/macroeconomic theory, accounting, and statistics. Every student’s program is capped off with 12 credits of advanced-level coursework, called a professional application cluster, tailored to meet the student’s particular academic and career goals. All required courses must be taken A-F, and a grade of at least C-is required in all professional courses and in the professional application cluster courses. Students may not major in both applied economics and agricultural and food business management.

Required Courses
Foundation Requirements
Math 1142—Short Calculus
or Math 1271—Calculus (4 cr)

Note: Students considering graduate study in applied economics are encouraged to take Math 1271 and 1272.

Writing Performance Courses
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1152—Writing on Issues of Science and Technology (4 cr)
Rhet 3562—Technical and Professional Writing (4 cr)

Speech Performance Courses
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3266—Group Process, Team Building, and Leadership (3 cr)

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.

Ethics and Responsible Management of Agricultural, Food, and Environmental Systems
Students must take one course (3 cr) from the list below that fosters one or more of the following objectives:
• Responsible judgments about the management of natural resources and the environment;
• Responsible judgments 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.
This course must be taken A-F and passed with grade of C- or better.
Agro 1103, 3203W, AnSc 1011, BAE 5212, Biol 1051, 4501, EE 1701W, EEB 3001, ES 1011, FScN 1102, Geo 3005, Geog 3401W, HSci 3211, 3331, ENR 3011W, 3061W, PBio 1212W, Phil 3303W, PiPa 1001, ScAg 1501

COAFES awards about $750,000 in collegiate and departmental scholarships to approximately 230 students annually.

Professional Requirements
ApEc 1001—Orientation to Applied Economics (1 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
ApEc 1251—Principles of Accounting (3 cr)
or Acct 2050—Introduction to Financial Reporting (4 cr)
ApEc 3001—Applied Microeconomics: Consumers 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 (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
or OMS 2550—Business Statistics (4 cr)

Professional Application Cluster
At least two upper division ApEc courses (excluding 3991, 4096, 5891, 5991) must be chosen, 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.
Crop, Soil, and Pest Management

B.S.
The crop, soil, and pest management major is for students who are interested in becoming proficient in the principles and practices necessary for economically viable and environmentally sound management of the natural resource base upon which the food and fiber production system depends. Students follow a strong science-based curriculum that emphasizes crop, soil, and pest management in the context of global ecosystems.

The major prepares students for careers in the production and management of field and vegetable crops and for positions as technical representatives for seed, agricultural chemical, and crop protection companies; crop advisers/consultants; extension educators; state and federal regulatory professionals; farm managers; soil and water specialists/conservationists; research technicians; and research support staff. Quality performance in the major prepares students to pursue crop, soil, and environmental science related graduate degrees. The major provides the subject matter background needed for certified crop adviser (CCA) and certified professional agronomist (CPAg) programs. By selecting the soil science area of emphasis, students meet the minimum requirements for employment by NRCS as a soil conservationist and the initial requirements to become a certified professional soil scientist (CPSSc).

Admission Requirements—Admitted to COAFES.

Degree Requirements
Students must complete at least 120 credits to graduate, including 58 credits in the major. Typically 14 credits in the foundation and major requirements also apply toward completion of liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all professional and area of emphasis courses.

Required Courses

Foundation Requirements

Communications
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentation in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (4 cr)

Quantitative Foundations
Agro 4101—Experimental Design/Plot Techniques (3 cr)
or Stat 3011—Introduction to Statistical Analysis (4 cr)
Math 1031—College Algebra and Probability (3 cr)
or Math 1142—Short Calculus (3 cr)

Physical and Biological Sciences
Agro/Hort 4401—Plant Genetics and Breeding (4 cr)
or GCD 3022—Genetics (3 cr)
BioC 1001—Elementary Biochemistry (3 cr)
or BioC 2011 Biochemistry for the Agricultural and Health Sciences (3 cr)
Biol 1009—General Biology (4 cr)
or Agro 4101—Biology of Plant Food Systems (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
EEB 3001—Ecology and Society (3 cr)

Professional Requirements (58-61 cr)

General Core (11-13 cr)

AFAE 1002—Principles of Career Planning for Agricultural Professions (1 cr)
or Agro 1660—First Year Colloquium/Experience in Agroecosystems Analysis (2 cr)

BAE 5213—Engineering Principles and Applications (3 cr)
or BAE 5212—Safety and Health Issues in Agricultural Work Environment (2 cr)
or AnSc 1101—Introduction to Animal Science (4 cr)
or FScN 1102—Food: Safety, Risk, and Technology (3 cr)
Agro 4660—Senior Capstone: Leadership, Decision Making and Problem Solving (2 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
Xxxx 4096—Professional Experience Program: Internship (3 cr)
Crop Management Core (13-14 cr)
Agro 1103—Crops, Environment, and Society (4 cr)
or Hort 1101—Plant Propagation (4 cr)
Agro 2501—Plant Identification in Urban and Rural Landscapes (2 cr)
Agro 4005—Applied Crop Physiology and Development (4 cr)
or Biol 3002—Plant Biology; Function (2 cr)
and Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
or Biol 3005—Plant Function Laboratory (2 cr)
Agro 4605—Crop Management Strategies (4 cr)
or Hort 5032—Sustainable Commercial Vegetable Production Systems (3 cr)

Soil Management Core (10 cr)
Soil 2125—Basic Soil Science (4 cr)
ES 3221—Soil Conservation and Land-use (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

Pest Management core (12 cr)
Agro 4505—Integrated Weed Management (3 cr)
Agro 4603—Field Crop Scouting and Problem Diagnosis (3 cr)
Ent 3005—insect Biology (3 cr)
or Ent 4015—Ornamental and Turf Entomology (3 cr)
PPlP 2002—Diseases of Field Crops (3 cr)
or PPlP 2001—Introductory Plant Pathology for Horticulturists (3 cr)

Area of Emphasis (12 cr min)
Students must designate an area of emphasis within the major before completion of 60 credits of their program or upon admission to the program with advanced standing.

An area of emphasis consists of a group of courses (12 credits minimum) selected in consultation with the student’s adviser and approved by the major coordinator. One option for fulfilling the area of emphasis is to complete part or all of one of the 18 official minors in COAFES (see page 7 for listing). The second option is to design an individualized area of emphasis around a clearly evident theme or focus that serves the student’s professional interests, which might include crop science, precision agriculture, biotechnology, environmental studies, or a leadership minor. Students should consult with their advisers in constructing an individualized area of emphasis. This emphasis may include only one 1xxx course.

Entomology

Minor Only
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.

To complete the minor students must complete at least 12 credits.

Introductory Courses (3 cr min)
Choose 3 credits from the following:
Ent 3005—insect Biology (3 cr)
Ent 4015—Ornamental and Turf Entomology (3 cr)
Ent 4251—Forest and Shade Tree Entomology (3 cr)
Ent 4281—Veterinary Entomology (3 cr)
Agri 3001—Pests and Crop Protection (1 cr max)
It is strongly recommended that all students take Ent 3005.

Electives (9 cr min)
Ent 5910—Special Problems in Entomology (3 cr)
Ent 5920—Special Lectures in Entomology (3 cr)
Other 3xx—5xx courses in entomology
Workshop courses do not qualify as credits toward the minor. For a complete list of courses visit the Web site at www.entomology.umn.edu/department/gradprog/course.htm.

Environmental Horticulture

B.S.
The environmental horticulture major educates and prepares students in all phases of horticulture: crop and plant production; education (botanic gardens and arboreta); service oriented activities (landscaping and landscape maintenance); plant use and function (design, reclamation, and restoration); and recreation (golf courses and parks). Students gain experience in how plants can be used to alter environments, restore damaged landscapes, improve the health and well-being of individuals, educate people about science and agriculture, improve community environments, and provide recreational and practical benefits to the public.

Students have the opportunity to choose either a business or science option in the environmental horticulture major. Landscape design, a joint offering with the College of Architecture and Landscape Architecture (CALA), combines architecture and landscape architecture courses available in CALA with the plant-based design courses available in COAFES.

Contact the Department of Horticultural Science for recommended four-year plans for all programs.

Degree Requirements
Students must complete at least 120 credits to graduate, including 49 credits in the major. The major requires courses in algebra, chemistry, and biology. Applied courses in horticultural science, soil science, entomology, plant pathology, and applied economics vary depending on program. Required courses must be taken A-F, and a grade of at least C- is necessary in all professional and program areas.

Required Courses

Foundation Requirements
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
ApEc 1101—Microeconomics (3 cr)
Biol 1009—General Biology (4 cr)
Chem 1011—General Principles of Chemistry (4 cr)
or Chem 1021—Principles of Chemistry I (4 cr)
Math 1031—College Algebra and Probability (3 cr)
or Math 1142—Short Calculus (3 cr)

Choose two courses from the business option or all four of the courses from the science option:

Business Option
Acct 2050—Introduction to Financial Reporting (4 cr)
ApEc 1251—Principles of Accounting (3 cr)
GC 1513—Principles of Small Business Operations (3 cr)
OMS 2550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)

Science Option
BioC 3021—Biochemistry (3 cr)
Chem 1022—Chemical Principles II (4 cr)
Chem 2301—Organic Chemistry I (3 cr)
Phys 1101W—Introductory College Physics I (4 cr)

Professional Requirements
Ent 4251—Forest and Shade Tree Entomology (3 cr)
or Ent 3005—insect Biology (3 cr)
or Ent 4015—Ornamental and Turf Entomology (3 cr)
Hort 1001—Plant Propagation (4 cr)
Hort 1011—Herbaceous Landscape Plants (4 cr)
Hort 1012—Woody Landscape Plants (4 cr)
Hort 3002W—Greenhouse Management (3 cr)
Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
and Biol 3002—Plant Biology; Function (2 cr)
Hort 4096—Professional Experience Program (3 cr)
PPlP 2001—Introductory Plant Pathology for Horticulturists (3 cr)
Soil 2125—Basic Soil Science (4 cr)
College of Agricultural, Food and Environmental Sciences

Program Areas (21 cr min)

Landscape Design
Arch 3301—Drawing for Design in Architecture (3 cr)
Arch 3401W—Environmental Design and the Sociocultural Context (3 cr)
Arch 3411—Architectural History to 1750 (3 cr)
or Arch 3412—Architectural History Since 1750 (3 cr)
Hort 4021—Landscape Design and Implementation I (4 cr)
Hort 4061—Turf and Landscape Management (3 cr)
Hort 5021—Landscape Design and Implementation II (4 cr)
LA 1301—Introduction to Drawing in Architecture and Landscape Architecture (3 cr)
LA 3001—Understanding and Creating Landscape Space (3 cr)
LA 3204—Landscape Ecology (3 cr)
LA 3413—Introduction to Landscape Architectural History (3 cr)
LA 3501—Environmental Design and Its Biological and Physical Context (3 cr)
LA 3571—Landscape Construction: Site Systems and Engineering (3 cr)

Landscape Implementation and Management
Hort 4021—Landscape Design and Implementation I (4 cr)
Hort 4061—Turf and Landscape Management (3 cr)
Hort 4401—Plant Genetics and Breeding (4 cr)
or Hort 4071—Applications of Biotechnology to Plant Improvement (4 cr)
Hort 5009—Pesticides in Horticulture: Their Use and Abuse (3 cr)
Hort 5018—Landscape Operations and Management (3 cr)
PlPa 4000—Plant Pathology Practicum (1 cr)
At least one additional horticultural science course
or FR 3501—Arboriculture: Selection and Maintenance of Trees (3 cr)

Floriculture/Nursery Production and Retail Management
ApEc 3821—Retail Center Management (3 cr)
Hort 4401—Plant Genetics and Breeding (4 cr)
or Hort 4071—Applications of Biotechnology to Plant Improvement (4 cr)
Hort 5041W—Nursery Management (4 cr)
Hort 5051—Floriculture Crop Production (4 cr)
PlPa 4000—Plant Pathology Practicum (1 cr)
At least two additional horticultural science courses (6 cr min)

Turfgrass Science
Hort 4021—Landscape Design and Implementation I (4 cr)
Hort 4061—Turf and Landscape Management (3 cr)
Hort 4401—Plant Genetics and Breeding (4 cr)
or Hort 4071—Applications of Plant Biotechnology to Plant Improvement (4 cr)
Hort 5061—Turfgrass Science (3 cr)
PlPa 4000—Plant Pathology Practicum (1 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)
At least one additional horticultural science course (3 cr min)

Individualized Program of Study
Students choose courses in consultation with an adviser to fulfill credit requirements. Students must submit a course of study to the Department of Horticultural Science Undergraduate Studies Committee at least three semesters before graduation.

Hort 4401—Plant Genetics and Breeding (4 cr)
or Hort 4071—Applications of Biotechnology to Plant Improvement (4 cr)
PlPa 4000—Plant Pathology Practicum (1 cr)

Final Project
All students are required to do an internship. After arranging an internship and getting approval from an adviser, students register for Hort 4096.

Environmental Science

B.S.
This major is for students interested in an interdisciplinary science education that prepares them to deal with environmental problems. The basic natural resources of land, air, and water are studied in the context of protecting and sustaining the environment. Students become knowledgeable about environmental issues and the science behind policy decisions.

Students must complete coursework in math and science, economics, humanities, communication, and applied technical aspects of environmental problems. The environmental science core draws courses from atmospheric science, soil science, hydrology, plant science, and geology.

Tracks include soil and water sciences (soil science, wetland science, water quality, and soil and water conservation); environmental monitoring and analysis (land resource analysis, environmental monitoring, and measurement); environmental management (environmental remediation and waste management, land-use management, precision management and information technology); and land and atmospheric sciences (climatology, biochemical cycling).

Degree Requirements
Students must complete at least 120 credits to graduate, including 60 credits in the major. The major requires courses in calculus, chemistry, physics, biology, and geology. Applied science courses are in climatology, soil science, hydrology, and plant science. Upper division students select one of the four tracks in the major and an area of emphasis within that track. Students take 9 credits in their track and an additional 12 credits in their area of emphasis. All required courses must be taken A-F, and a grade of at least C- is required in all professional and area of emphasis courses.

Required Courses

Foundation Requirements
ApEc 1101—Principles of Microeconomics (3 cr)
or Econ 1101—Microeconomics (4 cr)
BioC 2011—Biochemistry for Agriculture and Health Sciences (3 cr)
or Chem 2301—Organic Chemistry I(3 cr)
Biol 1009—General Biology (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)
ES 3211—Environmental Physics (4 cr)
Math 1142—Short Calculus (3 cr)
or Math 1271—Calculus I (4 cr)
Phys 1101—Fundamental Physics I (4 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
Professional Requirements
Biol 2022—General Botany (3 cr)
ES 1011—Issues in the Environment (3 cr)
ES 1051—Introduction to Environmental Science (3 cr)
ES 1128—Environmental Science Orientation (1 cr)
ES 1425—The Atmosphere (4 cr)
ES 3128—Seminar in Environmental Science (1 cr)
ES 4021W—Environmental Impact Statements (3 cr)
ES 4096—Environmental Science Internship (1 cr)
ES 4128—Senior Seminar in Environmental Science (1 cr)
FR 3114—Hydrology and Watershed Management (3 cr)
FR 3131—Geographical Information Systems (GIS) for Natural Resources (4 cr)
or Geog 3561—Principles of Geographic Information Sciences (4 cr)
Geo 1001—Introduction to Geology (4 cr)
Soil 2125—Basic Soil Science (4 cr)
Choose two credits from the following:
ENR 3111—Hydrology and Water Quality Field Methods (3 cr)
Soil 3521—Soil Judging (1 cr)
Soil 4511—Field Study of Soils (2 cr)
Soil 8110—Colloquium in Soil Science: Field Tour of Minnesota Soils and Landscapes (1 cr)

Environmental Science Tracks (19-21 cr)

Soil and Water Sciences Track

Track Courses (8 cr)
ES 3221—Soil Conservation and Water Quality Impacts (3 cr)
ES 4216—Contaminant Hydrology (2 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

Area of Emphasis Courses (12 cr)

Soil Science

Students completing the soil science emphasis will be eligible to be licensed as a professional soil scientist.

Required courses:
ES 3612W—Soil and Environmental Biology (3 cr)
Soil 4511—Field Study of Soils (2 cr)
Recommended courses (select 6 cr):
ES 4601—Soils and Pollution (3 cr)
Geo 4703—Glacial Geology (4 cr)
Soil 3521—Soil Judging (1 cr)
Soil 5515—Soil Genesis and Landscape Relations (3 cr)
Soil 5555—Wetland Soils (3 cr)

Wetland Science

Required courses:
Hort 5071—Restoration and Reclamation Ecology (3 cr)
Soil 5555—Wetland Soils (3 cr)
Recommended courses (select 6 cr):
EEB 4601—Limnology (3 cr)
FR 5153—Forest and Wetland Hydrology (3 cr)
Soil 4511—Field Study of Soils (2 cr)
Soil 5515—Soil Genesis and Landscape Relations (3 cr)

Water Quality

Required courses:
EEB 4601—Limnology (3 cr)
ENR 4061W—Water Quality and Natural Resources (3 cr)
Recommended courses (select 6 cr):
Ent 5241—Ecological Risk Assessment (3 cr)
ES 4601—Soils and Pollution (3 cr)
FR 5153—Forest and Wetland Hydrology (3 cr)
Geo 5071—General Hydrogeology (3 cr)
Hort 5071—Restoration and Reclamation Ecology (3 cr)
PubH 5190—Environmental Chemistry (3 cr)
Soil 5555—Wetland Soils (3 cr)
WRS 5101—Water Resources: Individuals and Institutions (3 cr)

Soil and Water Conservation

Required courses:
ES 3612W—Environmental and Soil Biology (3 cr)
Soil 4511—Field Study of Soils (2 cr)
Recommended courses (select 6 cr):
ENR 4061W—Water Quality and Natural Resources (3 cr)
ES 4601—Soils and Pollution (3 cr)
Hort 5071—Restoration and Reclamation Ecology (3 cr)
Soil 5555—Wetland Soils (3 cr)

Environmental Monitoring and Analysis Track

Track Courses (8 cr)
ES 3401—Ecology (3 cr)
Ent 5241—Ecological Risk Assessment (3 cr)
Soil 4511—Field Study of Soils (2 cr)

Area of Emphasis Courses (12 cr)

Land Resource Analysis

Required courses for soils focus:
ES 4216—Contaminant Hydrology (2 cr)
ES 4601—Soils and Pollution (3 cr)
Required courses for water focus:
EEB 4601—Limnology (3 cr)
PubH 5190—Environmental Chemistry (3 cr)
Recommended courses (select 6 cr):
ES 3612W—Soil and Environmental Biology (3 cr)
FR 5146—Biological Implications of Global Change (3 cr)
Geo 3002—Climate Change and Human History (3 cr)
Geo 3531—Numerical Spatial Analysis (4 cr)
Geo 5565—Geographical Analysis of Environmental Systems and Global Change (3 cr)

Environmental Monitoring and Measurement

Required courses for soils focus:
ES 4216—Contaminant Hydrology (2 cr)
ES 4601—Soils and Pollution (3 cr)
Recommended courses (select 6 cr):
ES 4601—Soil and Environmental Biology (3 cr)
FR 5146—Biological Implications of Global Change (3 cr)
Geo 3002—Climate Change and Human History (3 cr)
Geo 3531—Numerical Spatial Analysis (4 cr)
PPl 3002—Air Pollution, People, and Plants (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)

Environmental Management Track

Track Courses (9 cr)
ES 3221—Soil Conservation and Water Quality Impacts (3 cr)
ES 3612W—Environmental and Soil Biology (3 cr)
ES 4601—Soils and Pollution (3 cr)

Area of Emphasis Courses (12 cr)

Environmental Remediation and Waste Management

Required courses (select 12 cr):
CE 3501—Environmental Engineering (3 cr)
Chem 2302—Organic Chemistry II (3 cr)
Ent 5241—Ecological Risk Assessment (3 cr)
ES 4216—Contaminant Hydrology (2 cr)
ES 5601—Principles of Waste Management (3 cr)
MicB 4121—Microbial Ecology and Applied Microbiology (3 cr)
PubH 5190—Environmental Chemistry (3 cr)

Land-Use Management

Recommended courses (select 12 cr):
FR 3262—Remote Sensing of Natural Resources and the Environment (4 cr)
Geo 3401—Geography of Environmental Systems (3 cr)
Geo 3531—Numerical Spatial Analysis (4 cr)
Geo 5565—Geographical Analysis of Environmental Systems and Global Change (3 cr)
Precision Management and Information Technology

**Recommended courses (select 12 cr):**
- Geog 5563—Advanced Geographic Information Science (3 cr)
- IDSc 3001—Information Systems for Business Process and Management (3 cr)
- IDSc 4102—Introduction to Information System Analysis (3 cr)
- Soil 3416—Plant Nutrients in the Environment (3 cr)
- Soil 4111—Introduction to Precision Agriculture (3 cr)

**Land and Atmospheric Sciences Track**

**Track Courses (9 cr)**
- Biol 3407—Soil Conservation and Water Quality Impacts (3 cr)
- ES 3612W—Environmental and Soil Biology (3 cr)
- PIPa 3002—Air Pollution, People, and Plants (3 cr)

**Area of Emphasis Courses (12 cr)**

**Climatology**

**Recommended courses (select 12 cr):**
- EEB 4611—Biogeochemical Processes (3 cr)
- FR 3262—Remote Sensing of Natural Resources and the Environment (3 cr)
- FR 5146—Biological Implications of Global Change (3 cr)
- Geo 3002—Climate Change and Human History (3 cr)
- Geog 3401—Geography of Environmental Systems (4 cr)
- Geog 5423—Climate Models/Modeling (3 cr)
- Geog 5426—Climate Variations (3 cr)

**Biogeochemical Cycling**

**Recommended courses (select 12 cr):**
- EEB 4609W—Ecosystem Ecology (3 cr)
- EEB 4611—Biogeochemical Processes (3 cr)
- ES 4121—Microbial Ecology and Applied Microbiology (3 cr)
- FR 5146—Biological Implications of Global Change (3 cr)
- Geog 3401—Geography of Environmental Systems (4 cr)

**Final Project**

Internship requirement: students must complete ES 4096.

## Food Science

**B.S.**

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 both the College of Agricultural, Food and Environmental Sciences and the College of Human Ecology.

**Degree Requirements**

Students must complete at least 120 credits, including the University’s liberal education requirements, and maintain an overall GPA of at least 2.00. All required courses must be taken A-F; and FScN courses must be completed with a grade of at least C-.  

**Required Courses**

**Foundation Courses**

- BioC 3021—Biochemistry (3 cr) 
  or BioC 4331—Biochemistry I (4 cr)
  and BioC 4332—Biochemistry II (4 cr)

- Biol 1009—General Biology (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)
- Math 1271—Calculus I (4 cr)
- Math 1272—Calculus II (4 cr)
- MicB 3301—Biology of Microorganisms (5 cr)
- Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
- Rhet 1223—Oral Presentations in Professional Settings (3 cr)
- Rhet 3562W—Technical and Professional Writing (4 cr)

Select one of the following physics series: Phys 1101/1102, Phys 1201/1202, Phys 1301/1302. **Note:** Phys 1301 and 1302 are recommended.

Select one of the following courses: BioC 4025, Chem 2111, Chem 2311, FScN 4613

**Professional Courses**

- FScN 1102—Food: Safety, Risks, and Technology (3 cr)
- FScN 1112—Principles of Nutrition (3 cr)
- FScN 3102—Introduction to Food Science (3 cr)
- FScN 4111—Food Chemistry (3 cr)
- FScN 4121—Food Microbiology and Fermentations (3 cr)
- FScN 4122—Laboratory Methods in Microbiology and Fermentations (2 cr)
- FScN 4131—Food Quality (3 cr)
- FScN 4312—Food Analysis (4 cr)
- FScN 4331—Food Process Engineering I (3 cr)
- FScN 4332—Food Process Engineering II (4 cr)

One of the following FScN courses with a capstone component: FScN 4341, 4342, 4343, 4344, 4345, 4346

**Food Science Minor**

Complete at least 20 FScN credits from the following list: FScN 1102, 3102, 4111, 4121, 4122, 4131, 4312, 4331, 4332

**Food Systems and the Environment**

**Minor Only**

This is a interdisciplinary minor based in COAFES. This minor 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.
- Understand the interdependence of rural and urban societies.
- Understand the environmental impact of consumer driven food systems choices.
- Manage natural resources used for food and fiber for the benefit of society.
- Make more responsible personal and public decisions impacting food systems and the environment.

This minor is limited to non-COAFES majors. Interested students should contact the minor adviser at 612-625-6754 or the COAFES Student Services Office at 612-625-7254.

In consultation with the minor adviser, students must complete five courses (15 credits minimum) from the following list. Students may only choose one course from each designator.

- Agri 3001—Pests and Crop Protection (3 cr)
- Agri 3500—Global Seminar (3 cr)
- Agri 1103—Crops, Environment, and Society (4 cr)
- Agro/AnSc 3203W—Environment, Global Food Production and the Citizen (3 cr)
- Agro 4103/ApEc 4103/FScN 4103—World Food Problems (3 cr)
- AnSc 1011—Domestic Animals and Society (3 cr)

**Recommended courses (select 12 cr):**
- BioC 4025, Chem 2111, Chem 2311, FScN 4613
- Phys 1101/1102, Phys 1201/1202, Phys 1301/1302. **Note:** Phys 1301 and 1302 are recommended.

**Area of Emphasis Courses (12 cr)**

**Climatology**

**Recommended courses (select 12 cr):**
- EEB 4611—Biogeochemical Processes (3 cr)
- FR 3262—Remote Sensing of Natural Resources and the Environment (3 cr)
- FR 5146—Biological Implications of Global Change (3 cr)
- Geo 3002—Climate Change and Human History (3 cr)
- Geog 3401—Geography of Environmental Systems (4 cr)
- Geog 5423—Climate Models/Modeling (3 cr)
- Geog 5426—Climate Variations (3 cr)

**Biogeochemical Cycling**

**Recommended courses (select 12 cr):**
- EEB 4609W—Ecosystem Ecology (3 cr)
- EEB 4611—Biogeochemical Processes (3 cr)
- ES 4121—Microbial Ecology and Applied Microbiology (3 cr)
- FR 5146—Biological Implications of Global Change (3 cr)
- Geog 3401—Geography of Environmental Systems (4 cr)

**Final Project**

Internship requirement: students must complete ES 4096.
AnSc 1101—Introductory Animal Science (4 cr)
ApEc 3041W—Economic Development of U.S. Agriculture (3 cr)
ApEc 4611—Resource Development and Environmental Economics (3 cr)
BAE 5203—Environmental Impacts of Food Production (3 cr)
Ent 4015—Ornamentals and Turf Entomology (3 cr)
FScN 1102—Food: Safety, Risks, and Technology (3 cr)
FScN 1112—Principles of Nutrition (3 cr)
PipA 1001—Microbes, Plants, and People: The Social and Economic Impact of Plant Disease (3 cr)
Rhet 1315—The Land in American Experience (3 cr)
Rhet 3383—In Search of Nature (3 cr)
ScAg 1501—Biotechnology, People, and the Environment (3 cr)
Soil 1125—The Soil Resource (4 cr)
Soil 3221—Soil Conservation and Land Use (3 cr)

Horticultural Science

**Minor Only**
The horticultural science minor requires completion of 18 credits. At least 10 credits of horticultural science, including one elective course, and at least two Hort courses at 4xxx or 5xxx. A maximum of 3 credits of Hort 5090—Directed Studies may be applied to the minor.

Students wishing to complete a minor in horticultural science should contact the Department of Horticultural Science, 305 Alderman Hall for assistance.

**Minor Requirements**
Biol 3002—Plant Biology: Function (2 cr)
Hort 1001—Plant Propagation (4 cr)
Hort 3006—Environmental Effects on Horticultural Crops (2 cr)

**Integrated Pest Management in Cropping Systems**

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

**Required Courses**
Agro 2501—Plant Identification for Urban and Rural Landscapes (2 cr)
Agro 4605—Applied Crop Physiology and Development (4 cr)
or Biol 3002—Plant Biology: Function (2 cr)
and Hort 3006—Environmental Effects on Horticultural Crops (2 cr)
Agro 4505—Biology, Ecology, and Management of Invasive Plants (4 cr)
Ent 3005—Insect Ecology (3 cr)
PipA 3002—Air Pollution, People, and Plants (3 cr)

Choose one of the following management courses:
Agro 4605—Management Strategies for Crop Production (3 cr)
Enter 5211—Insect Pest Management (3 cr)
ES 3222—Soil Conservation and Land Use Management (3 cr)
Hort 4061—Turf and Landscape Management (3 cr)
Hort 5032—Sustainable Commercial Vegetable Production (3 cr)
Hort 5041—Nursery Production and Management I (3 cr)
PipA 5204—Epidemiology and Plant Disease Resistance (4 cr)

Choose one of the following applied courses:
Agro 4603—Field Crop Scouting and Problem Diagnosis (3 cr)
Agro 4888—Issues in Sustainable Agriculture (2 cr)
PipA 5202—Field Plant Pathology (2 cr)
ES 3612W—Soil and Environmental Biology (3 cr)

**International Agriculture**

**Minor Only**
Due to the international nature of food and agricultural systems, and the interdependence of environmental systems, COAFES 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 the Office of International Agricultural Programs in the college. Students must complete 18 credits with a minimum GPA of 2.00.

**Required Courses**
Agro 3500—Directed Studies (2-4 cr)
Agri 3500—International Field Study Seminar (3 cr)
Agro/ApEc/CAPS/FScN 4103—World Food Problems (3 cr)
ApEc 3007—Applied Macroeconomics: Policy, Trade, and Development (3 cr)
ApEc 3071—Agriculture and Economic Growth in Developing Countries (3 cr)
ApEc 5751—Agricultural Trade and Trade Policy: Issues and Analysis (3 cr)
FScN 3615—Sociocultural Aspects of Food, Nutrition and Health (3 cr)
PipA 3001—Plant Disease Biology and Management I (1 cr)
PipA 3002—Air Pollution, People and Plants: The Science and Ethics (3 cr)
Rhet 3384—From Soil to Civilization: Agriculture and the Emergence of the Modern World (3 cr)
Rhet 3376—Terrorism (3 cr)

**International Opportunities**
The National Security Education Program (NSEP) in Ukraine is a package experience qualifying a student for the minor in international agriculture. The NSEP Ukraine program begins with an online course in Ukrainian culture and an orientation program. This is followed by a semester-long Ukrainian language experience during their academic degree program. Participation in this program is equivalent to 18 credits.

The Minnesota Studies in International Development program in International Agriculture provides an opportunity for students to learn about the international nature of food and agricultural systems and the interdependence of environmental systems. The program 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. Additional international practical or internship experiences may qualify for the minor. Arrangements can be made through MAST International or the COAFES Career Services office.

Travel grants for overseas experience are available through the Academic Enrichment Program. Students are also eligible for scholarships through the University’s Learning Abroad Center. See www.UMabroad.umn.edu.

For additional information, contact John R. Vreyens, Director, Office of International Agricultural Programs, 190 Coffey Hall, 612-624-3221.
Nutrition

B.S.
The nutrition program is a collaborative partnership between COAFES and the College of Human Ecology. 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 three options: nutrition, the Coordinated Program in Dietetics, or nutrition science.

Students expecting to apply to either the Coordinated Program in Dietetics, an internship, or a graduate school should maintain a GPA of at least 2.80. A cumulative GPA of at least 3.00 is highly recommended, and in the case of some graduate schools is required, for admission.

The Didactic Program in Dietetics (nutrition option) is currently granted initial accreditation and the Coordinated Program in Dietetics is currently granted accreditation status by the Commission on Accreditation for Dietetics Education of the American Dietetic Association, 216 W. Jackson Blvd., Chicago, IL 60606-6995 (312-899-5400).

Degree Requirements
Students must complete at least 120 credits, including the University’s liberal education requirements, and must maintain an overall GPA of at least 2.00. All required courses must be taken A-F, and FScN courses must be completed with a grade of at least C-.

Required Courses for All Options
BioC 3021—Biochemistry (3 cr)
Biol 1009—General Biology (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)
Chem 2301—Organic Chemistry I (3 cr)
FScN 1102—Food: Safety, Risks, and Technology (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—Human Nutrition (3 cr)
FScN 4613—Experimental Nutrition (2 cr)
FScN 5621—Nutrition and Metabolism (4 cr)
Phsl 3051—Human Physiology (4 cr)
or
AnSc 2301—Systemic Physiology (4 cr)
or
Biol 2005—Animal Diversity Laboratory (1 cr)
and Biol 3211—Animal Physiology (3 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562W—Technical and Professional Writing (4 cr)
VPB 2032—General Microbiology with Laboratory (4 cr)
or
MicB 2032—General Microbiology with Laboratory (4 cr)
or
MicB 3301—Bioremediation (3 cr)

Nutrition
The nutrition option (also referred to as the Didactic Program in Dietetics) offers preparation in the basic sciences and liberal education, a background in food science, and a focus on human needs related to nutrition. Students identify several areas of interest and develop a varied portfolio of competence. Work experience in nutrition, elective courses, and extracurricular activities develop communication and leadership skills. Graduates of the program take positions in various food-related fields, including nutrition, industry, and community programs. Students who plan to become registered dietitians must meet the American Dietetic Association requirements. Graduates with a cumulative GPA of 3.00, strong work experience in nutrition, demonstrated leadership skills, and are highly recommended, may apply for a postbaccalaureate dietetic internship.

Additional 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 Lab (2 cr)
FScN 3732—Food Service Operations Management (3 cr)
FScN 4614—Community Nutrition (3 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 (3 cr)
Mgmt 3001—Fundamentals of Management (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
Choose one of the following:
FScN 4111—Food Chemistry (3 cr)
FScN 4121—Food Microbiology and Fermentations (3 cr)

Coordinated Program in Dietetics
Students can apply, before their junior year, to the University’s Coordinated Program in Dietetics and complete both the academic and professional experience requirements within two years.

The basic curriculum is similar to that specified under Required Courses for All Options, but also includes field experience courses in which didactic and clinical phases of instruction are coordinated. A detailed plan of the program may be obtained from the Department of Food Science and Nutrition. A limited number of students are admitted to the program each year. Minnesota law requires each student admitted to a supervised practice in dietetics to have a criminal background check conducted by the state of Minnesota. The dietetic program director arranges for the background check. Failure to pass the background check results in dismissal from the program.

Additional Courses
(Nutrition Option plus field experiences)
FScN 3614—Nutrition Education and Counseling (3 cr)
FScN 3615—Sociocultural Aspects of Food, Nutrition, and Health (3 cr)
FScN 3662—Introduction to Dietetic Practice (2 cr)
FScN 3732—Food Service Operations Management (3 cr)
FScN 3796—Field Experience in Food Service Management (3 cr)
FScN 4596—Field Experience: Community Nutrition (3 cr)
FScN 4614—Community Nutrition (3 cr)
FScN 4665—Medical Nutrition Therapy I (3 cr)
FScN 4666—Medical Nutrition Therapy II (3 cr)
FScN 4696—Field Experience: Medical Nutrition Therapy I (6 cr)
FScN 4732—Food and Nutrition Management (3 cr)
FScN 4796—Field Experience in Food and Nutrition Management (3 cr)
FScN 4896—Field Experience: Medical Nutrition Therapy II (3 cr)
FScN 4996—Field Experience: Medical Nutrition Therapy III (3 cr)
Math 1031—College Algebra and Probability (3 cr)
Mgmt 3001—Fundamentals of Management (3 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
Choose one of the following:
FScN 4111—Food Chemistry (3 cr)
FScN 4121—Food Microbiology and Fermentations (3 cr)

Nutrition Science
The nutrition science option is for students planning to do graduate work in nutrition, related sciences, or professional programs such as medicine or dentistry.

Additional Courses
Chem 2302—Organic Chemistry II (3 cr)
Chem 2311—Organic Chemistry Lab (4 cr)
FScN 4111—Food Chemistry (3 cr) or an advanced chemistry course
FScN 5622—Vitamin and Mineral Biochemistry (3 cr)
FScN 5623—Regulation of Energy Balance (2 cr)
GCB 3022—Genetics (3 cr)
or
Biol 4003—Genetics (3 cr)
Math 1142—Short Calculus (4 cr)
or Math 1271—Calculus I (4 cr)
and Math 1272—Calculus II (4 cr)
Phys 1201—General Physics I (5 cr)
Phys 1202—General Physics II (5 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
or Stat 3021—Introduction to Probability and Statistics (3 cr)
or Stat 5021—Statistical Analysis (4 cr)

Nutrition Minor
For students having completed Biol 1009, Chem 1022, and Phys 3051:
FScN 1112—Principles of Nutrition (3 cr)
FScN 3612—Life Cycle Nutrition (3 cr)
FScN 4612—Human Nutrition (3 cr)
Select two courses from the following: FScN 3614, 3615, 4613, 4614, 5621

Science in Agriculture
B.S.
The science in agriculture major is an interdisciplinary program that provides a thorough grounding of biological/physical sciences and mathematical principles and their applications to food and agriculture. Students select an area of emphasis within the major or construct an individualized program. Students also complete an undergraduate research thesis under the guidance of a faculty member in one of the host departments.

The major is excellent preparation for employment in bachelor’s degree-level research positions as field or laboratory specialists in academia, government, or industry. The major also prepares students for graduate studies in the disciplines represented by the host departments (agronomy and plant genetics, entomology, food science and nutrition, horticultural science, plant pathology, and soil science) and related areas. Students considering veterinary medicine should consult the animal science degree option.

The host departments for the major offer opportunities and facilities for doing scientific research. Students may offset some educational costs and gain experience by working part-time as undergraduate technicians on research projects of the Minnesota Agricultural Experiment Station. Experience may also be gained by working on a University, government, or industry internship through the Professional Experience Program.

At the time this catalog went to press, final approval was pending for a new applied plant sciences major. When this major is approved, the science in agriculture major will no longer exist, and students interested in plants will apply to the new applied plant sciences major. For more information, please see the COAFES web site at www.coafes.umn.edu.

Degree Requirements
Students must complete at least 120 credits to graduate, including required credits in the major. Faculty academic advisers help students select electives, an undergraduate thesis topic, and a thesis mentor.

Students must complete the University’s liberal education requirements; for more information, see the General Information section of this catalog. Frequently, courses in the foundation requirements also apply toward completion of liberal education requirements. All required courses must be taken A-F, and a grade of at least C- is required in all professional courses and area of emphasis courses.

Required Courses
Foundation Requirements
BioC 3021—Biochemistry (3 cr)
Biol 1009—General Biology (4 cr)
Biol 4003—Genetics (3 cr)
or GCB 3002—Genetics (3 cr)
or Agro 4401—Plant Genetics and Breeding (4 cr)
or Hort 4401—Plant Genetics and Breeding (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 Chemistry Lab (3 cr)
Math 1142—Short Calculus (3 cr)
or Math 1271—Calculus I (4 cr)
and Math 1272—Calculus II (4 cr)
FScN 2011—General Microbiology (3 cr)
or VPB 2032—General Microbiology (4 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentation (3 cr)
Rhet 3562—Technical and Professional Writing (4 cr)
Phys 1101—Fundamental Physics I (4 cr)
or Phys 1301—Introductory Physics I (4 cr)
Phys 1102—Fundamental Physics II (4 cr)
or Phys 1302—Introductory Physics II (4 cr)
Stat 3011—Introduction to Statistical Analysis (4 cr)
or Stat 5021—Statistical Analysis (4 cr)
or AnSc 2211—Biometrics for Livestock (3 cr)
or Agro 4104—Experiment Design/Plot Techniques (3 cr)

Professional Requirements
Agro 1660—First-Year Colloquium/Experience in Agroecosystems Analysis (2 cr)
ScAg 1501—Biotechnology, People, and the Environment (3 cr)
ScAg 4009—Undergraduate Research Thesis (6 cr)

Areas of Emphasis
Biotechnology (22-25 cr)
AnSc 3509—Animal Biotechnology (4 cr)
BAE 3013—Engineering Principle of Molecular and Cellular Processes (3 cr)
Hort 4071—Applications of Biotechnology to Plant Improvement (4 cr)
Phil 3305—Medical Ethics (4 cr)
or Biol 4501—Social Uses of Biology (3 cr)
ScAg 1502—Biotechnology Laboratory (2 cr)
One of the following:
Agro 1102—Crops, Environment, and Society (4 cr)
AnSc 1101—Introductory Animal Science (4 cr)
FScN 1112—Principles of Nutrition (3 cr)
FScN 3102—Introduction to Food Science (3 cr)
FScN 4121—Food Microbiology and Fermentation (3 cr)
Plus at least 12 credits from FScN 4111, 4122, 4131, 4312, 4331, 4332

COAFES is attracting national attention for its work in the foods for health area. Plant breeders, nutritionists, and food scientists are working together to benefit society through safe and healthy foods.
College of Agricultural, Food and Environmental Sciences

Nutrition (22 cr)
FScN 1112—Principles of Nutrition (3 cr)
FScN 3612—Lifecyle Nutrition (3 cr)
FScN 4612—Human Nutrition (3 cr)
FScN 5621—Nutrition and Metabolism (4 cr)
Plus at least 9 additional credits from AnSc 4401, 4403, 4405, FScN 2103, 4103, 4613, 5622, 5625,

Plant Science (26–27 cr)
Agro 1101—Biology of Plant Food Systems (3 cr)
or  Hort 1001—Plant Propagation (4 cr)
Agro 2501—Plant Identification for Urban and Rural Landscapes (2 cr)
Agro 4005—Applied Crop Physiology and Development (4 cr)
or  Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
and  Biol 3005—Plant Function Laboratory (2 cr) (concurrent registration required)
Agro 4401—Plant Genetics and Breeding (4 cr)
or  Hort 4401—Plant Genetics and Breeding (4 cr)
Biol 2022—General Botany (3 cr)
Ent 3001—Insects and Insect Management (1 cr)
Ent 3005—Insect Biology (concurrent with Ent 3001) (2 cr)
PIPa 2001—Introductory Plant Pathology for Horticulturists (3 cr)
or  PIPa 2002—Diseases of Field Crops (3 cr)
Soil 2125—Basic Soil Science (4 cr)

Soil Science (20 cr)
Soil 2125—Basic Soils (4 cr)
ES 3221—Soil Conservation and Water Quality Impacts (3 cr)
ES 3612W—Soil and Environmental Biology (3 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)
Soil 4511—Field Study of Soils (2 cr)
Plus at least 6 credits from ES 4601, 4121, 5211 or Soil 5232, 5515, 5555.

Individualized Area of Emphasis
Students wishing to design a program with an individualized area of emphasis should consult with their adviser. Courses may be from multiple departments, but should combine to form a single, cohesive emphasis.

Final Project
Students must complete 6 credits of ScAg 5009—Undergraduate Research Thesis.

Scientific and Technical Communication

B.S.

Scientific and technical communicators apply modern techniques and technologies to the distribution of knowledge in industry, business, education, and government. They write and design information for audiences ranging from scientists to management to consumers of technical products and services. To accomplish their objectives, scientific and technical communicators apply principles of audience analysis, writing and editing, usability and testing, visual communication, communication technology, communication research and theory, and oral communication. The program offers an interdisciplinary curriculum that combines theory and practice in a program flexible enough to allow students to plan a course of study appropriate to their career goals. For more information, see the rhetoric Web site at www.rhetoric.umn.edu or call 612-624-9786.

Degree Requirements
Students must complete at least 120 credits to graduate, including 66 credits in the major. Students must also complete the University’s liberal education requirements. All required courses must be taken A-F, (except for the internship, which is taken S-N) and a grade of at least C- is required in all major degree requirements.

Required Courses

Equivalent transfer courses are accepted in all areas (except for required rhetoric courses). At least 30 credits must be completed in the Department of Rhetoric, as follows.

Entrance to Major (2 cr)
Rhet 1001—Introduction to Scientific and Technical Communication (2 cr)

Written Communication (10–11 cr)
Rhet 3562W—Technical and Professional Writing (4 cr)
Rhet 4561—Editing and Style for Technical Communicators (3 cr)

Choose one from the following:
Rhet 1152W—Writing on Issues of Science and Technology (4 cr)
Rhet 5664—Science Writing for Popular Audiences (3 cr)

Oral Communication (6 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)

Professional Practice (9 cr)
Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr)
Rhet 3266—Group Process, Team Building, and Leadership (3 cr)

Choose one from the following:
Rhet 4165—Managerial and Organizational Communication, Planning, and Change (3 cr)
Rhet 4573W—Writing Proposals and Grant Management (3 cr)
Rhet 5534—Designing Technical Training for Intercultural Audiences (3 cr)
Rhet 5562—Theory and Practice in International Business Communication (3 cr)

Research (6 cr)
Choose two from the following:
Rhet 4501—Usability and Human Factors in Technical Communication (3 cr)
Rhet 5258—Information-Gathering Techniques in Scientific and Technical Communication (3 cr)
Rhet 5511—Research in Scientific and Technical Communication (3 cr)

Theory (8 cr)
Rhet 3221W—Theories of Human Communication (4 cr)
Rhet 3701W—Rhetorical Theory and Scientific and Technical Communication (4 cr)

Science, Technology, and Society (9–10 cr)
Rhet 3371—Technology, Self, and Society (3 cr)

Choose two from the following:
Rhet 3108W—Gender and the Rhetoric of Science and Technology (4 cr)
Rhet 1302—Science, Religion, and the Search for Human Nature (3 cr)
Rhet 3577W—Rhetoric, Technology, and the Internet (3 cr)

Print and Media Design (10 cr)
Rhet 3671—Project Design and Development I (3 cr)
Rhet 3672—Project Design and Development II (3 cr)

Choose one from the following:
Rhet 4662W—Emerging Technologies in Scientific and Technical Communication (4 cr)
Rhet 4105W—Corporate Video for Technical Communicators (4 cr)

Scientific or Technical Emphasis (6 cr)
2xxx or above course in science or technology (3 cr)
3xxx or above course in science or technology (3 cr)
The scientific or technical emphasis area helps students develop familiarity with a science or technology in order to communicate with professionals in that field. Students must select courses in a scientific or technical area in consultation with their adviser. Courses may be from multiple departments, but should combine to form a single, cohesive emphasis.

Final Project
All students must participate in an internship, Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr), as a requirement for the professional practice area.
Department of Rhetoric Minors
The Department of Rhetoric offers four minors

- Designing documents with new and emerging technologies
- Internet, science, and society
- Land, nature, and environmental values
- Technical communication

A description of each minor is given below. Note that some of the required courses for these minors have prerequisite courses; for example, a prerequisite to taking Rhet 3257—Scientific and Technical Presentations is Rhet 1223—Oral Presentations in Professional Settings. Request a copy of the Minors Brochure from the Department of Rhetoric or contact the Department of Rhetoric program secretary at 612-624-3445 for more information.

Designing Documents With New and Emerging Technologies

Minor Only
The minor focuses on designing effective communication products using both traditional and emerging technologies. Students learn to design written messages using computer technologies; visual messages using photography, digital imaging, and video; and online and Web messages using multimedia, World Wide Web technologies, and streaming audio and video. Message design components include audience analysis and rigorous evaluation of document usability. This minor differs from the technical communication minor by its focus on emerging technologies.

For more information, contact the minor adviser for this area in the Department of Rhetoric.

Students must have a GPA of at least 2.00 in the required courses and a minimum of 16 credits to complete the minor.

Required Courses
Rhet 3671—Project Design and Development I (3 cr)
Rhet 3672—Project Design and Development II (3 cr)
Rhet 4501—Usability and Human Factors in Technical Communication (3 cr)
Rhet 4662W—Emerging Technologies in Scientific and Technical Communication (4 cr)

Plus one of the following:
Rhet 3101—Functional Photography (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3401—Internet Communication: Tools and Issues (3 cr)
Rhet 4105W—Corporate Video for Technical Communicators (4 cr)

Electives (3 cr)
Rhet 3371—Technology, Self, and Society (3 cr)
Rhet 3401—Internet Communication: Tools and Issues (3 cr)
Rhet 3577W—Rhetoric, Technology, and the Internet (3 cr)

Outside electives (6 cr)
Students should work with their minor adviser to select 6 credits of approved coursework outside the Department of Rhetoric. The selected courses should complement the minor.

Land, Nature, and Environmental Values

Minor Only
This multidisciplinary minor based in the humanities complements professional and scientific degree programs in COAFES and serves students from other colleges who have an interest in cultural issues relating to the environment. Students are introduced to the historical development, philosophical assumptions, and imaginative expression of the human relationship to nature and are asked to consider implications of issues involving our use of nature. Students write a senior integrative paper relating some aspect of their major field to social, cultural, or historical trends in the larger society.

For assistance in planning a minor in land, nature, and environmental values, see the humanities course coordinator in the Department of Rhetoric.

Students must complete at least 18 credits for the minor.

Required Courses
Rhet 3291—Independent Study (3 cr) (The integrative paper; see adviser for approval)

At least three of the following:
Rhet 1302—Science, Religion, and the Search for Human Nature (3 cr)
Rhet 1315—The Land in American Experience (3 cr)
Rhet 3371—Technology, Self, and Society (3 cr)
Rhet 3583—In Search of Nature (3 cr)

Outside electives (6 cr) courses should be chosen with an adviser.

Technical Communication

Minor Only
The minor provides theoretical and practical information about how to communicate complex technical information to various audiences. Students take required courses in oral and written communication and in communication technologies. Additional courses (e.g., visual communication, project management, international communication) are selected to complement students’ career plans. For help in planning the minor, contact the major coordinator of the Scientific and Technical Communication Program in the Department of Rhetoric.

Students must complete at least 16 credits for the minor.

Required Courses
Rhet 3562W—Technical and Professional Writing (4 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 4561—Editing and Style for Technical Communicators (3 cr)

Plus two additional Rhet courses in technical communication at 3xxx or higher. Independent study is not encouraged and, along with internships, may only be taken with the minor adviser’s approval.

Students must work with the minor adviser in Rhetoric.

Students must complete at least 18 credits for the minor.
Soil Science

Minor Only
The minor allows students to complete coursework required for the Professional Soil Science Examination for geoscientists. Students must complete at least 20 credits for the minor.

Required Courses (18 cr)
- ES 3221—Soil Conservation and Water Quality Impacts (3 cr)
- ES 3612W—Soil and Environmental Biology (3 cr)
- Soil 1125—The Soil Resource (4 cr)
- or Soil 2125—Basic Soil Science (4 cr)
- Soil 3416—Plant Nutrients in the Environment (3 cr)
- ES 4601—Soils and Pollution (3 cr)
- Soil 4511—Field Study of Soils (2 cr)

Electives (2 cr)
- ES 4021W—Environmental Impact Statements (3 cr)
- ES 4216—Contaminant Hydrology (2 cr)
- ES 5555—Wetland Soils (3 cr)
- Soil 5515—Soil Genesis and Landscape Relations (3 cr)

Sustainable Agriculture

Minor Only
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 in some aspect of sustainable agriculture (i.e., an internship, experiential learning opportunity, etc.). 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.

For more information, contact Dr. Craig Sheaffer, minor coordinator at 612-625-7224 or the Minnesota Institute for Sustainable Agriculture (MISA) at 612-625-2738 or misamail@umn.edu.

Required Courses (8-10 cr)
- Agro 4888—Issues in Sustainable Agriculture (2 cr)
- AnSc/Agro 3203—Environment, Global Food Production and the Citizen (3 cr)
- XXXX 4096—Internship/Professional Experience Program (1-3 cr)
- Agro 4660—Senior Capstone: Leadership, Decision Making and Problem Solving (2 cr) (To be taken concurrently with or after completion of XXXX 4096)

Foundational Course Clusters (9 cr min)
Select one course from each of the following clusters. Other courses may be substituted with approval of the minor adviser and coordinator.

Land and Public Policy
- Agro/ApEc/FScN 4103—World Food Problems (3 cr)
- ApEc 3041—Economic Development of U.S. Agriculture (3 cr)
- Geog 3361—Land Use, Landscapes, and the Law (3 cr)
- PA 5002—Introduction to Policy Analysis (1.5 cr)
- Rhet 1315—The Land in American Experience (3 cr)

Agriculture/Environment and Natural Resources
- Agri 3001—Pests and Crop Protection (3 cr)
- Agro 1103—Crops, Environment, and Society (4 cr)
- Agro 5999—Agroecosystems Analysis (summer field course) (3 cr)
- AnSc1101—Introductory Animal Science (4 cr)
- ENR 3021—Plant Resource Management and the Environment (3 cr)
- Geog 3355—Environmental Quality (3 cr)
- Hort 4072—Growing Plants Organically: What It Means to be Green (3 cr)
- Soil 1125—The Soil Resource (4 cr)
- or Soil 2125—Basic Soil Science (4 cr)
- Soil 3221—Soil Conservation and Land-Use Management (3 cr)

Citizens/Science and Society
- BAE 5212—Safety and Health Issues in Agricultural Work Environments (2 cr)
- Geog 3371—Introduction to Urban Geography (3 cr)
- PlPa 1001—Microbes, Plants, and People: Social and Economic Impact of Plant Disease (3 cr)
- Rhet 3371—Technology, Self, and Society (3 cr)
- ScAg 1501—Biotechnology, People, and the Environment (3 cr)
- Soc 3451—Urban Community (3 cr)

Water Science

Minor Only
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.

Required Courses
- EEB 4601—Limnology (3 cr)
- or Geo 5701—General Hydrogeology (4 cr)
- FR 3114—Hydrology and Watershed Management (3 cr)
- Soil 5232—Vadose Zone Hydrology (3 cr)
- or ES 5555—Wetland Soils (3 cr)

Electives
- CE 4541—Environmental Water Chemistry (4 cr)
- EEB 4605—Limnology Lab (1 cr)
- ENR 4061W—Water Quality and Natural Resources (3 cr)
- FR 5153—Forest and Wetland Hydrology (3 cr)
- or Geo 5701—General Hydrogeology (4 cr)
- ES 4216—Contaminant Hydrology (2 cr)
- ES 5555—Wetland Soils (3 cr)
- or Soil 5232—Vadose Zone Hydrology (3 cr)
- ES 5211—Environmental Biophysics and Ecology (3 cr)
- GeoE 4351—Ground Water Mechanics (3 cr)
- WRS 5001—Field Methods in Water Resources (3 cr)