# College of Agricultural, Food, and Environmental Sciences

This is the College of Agricultural, Food, and Environmental Sciences section of the 1999-2000 Undergraduate Catalog of the University of Minnesota.

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Since the 1880s, thousands of students have come to study at the College of Agricultural, Food, and Environmental Sciences (COAFES). The stature of the college and its programs has attracted an excellent faculty and student body. It is consistently ranked among the top colleges of agriculture in the United States. In 1997-98, more than 850 students were enrolled in COAFES undergraduate programs. The student body has a near equal split of women and men. The college’s majors represent a broad spectrum of programs in the applied sciences of soil, plant, animal, food and environment, education, communication, business, and the social sciences.

COAFES is located on the St. Paul campus. The Minnesota Agricultural Experiment Station borders the campus and supports a comprehensive agricultural research program. The experiment station provides a sizable teaching laboratory for undergraduate and graduate education.

The goal of COAFES is to provide students with varied educational experiences and an environment that promotes professional competence, the capacity to attain career success in agriculture (including food or related professions), and a sense of social responsibility.

**Admission**

Requirements for admission to COAFES for high school graduates, adult special students, and transfer students are explained below. For more information, call Prospective Student Services, (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 requirements 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. Transfer applicants who graduated from high school during 1987 or later must have

- passed intermediate algebra with a grade of “C” or better;
- at least a “C” average in transfer coursework;
- demonstrated a solid foundation in math and science;
- completed at the high school level the following coursework:
  - four years of English
  - three years of science, including one year each of biological and physical science
  - two years of a single second language
  - two years of social studies, including U.S. history

**Change of College Within the University**—To transfer to COAFES from another college within the University, students must meet COAFES entrance requirements. Students must complete an Application for Change of College or Status 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 regular University admission deadlines.

**Adult Special Students**—The adult special category of admission in COAFES is primarily for (1) students who are pursuing coursework in COAFES departments, but who are not degree-seeking students, or (2) students who are preparing for application to graduate programs offered by COAFES departments, but who still have some prerequisites to satisfy. Admission may be processed at any time before the first day of class. The adult special category is also open to (3) staff members in COAFES departments taking courses through the Regents Scholarship Program and (4) COAFES graduates returning for coursework to improve their skills.

Students who enter COAFES as adult special students with the intention of transferring later to the Graduate School should be aware of restrictions on the number of adult-special credits that may be transferred to a graduate program. See the Graduate School 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 requirements. 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 have

- passed intermediate algebra with a grade of “C” or better;
- have at least a “C” average in transfer coursework;
- demonstrated a solid foundation in math and science.

After a transfer applicant has been accepted as a student, the Office of Admissions and COAFES evaluates 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.

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Degrees/Majors

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

In a limited number of programs, COAFES also offers a master of agriculture; a professional, non-research oriented degree designed for those who seek post baccalaureate education to further advance their professional competence. For more information, contact COAFES Student Services, 120 Biosystems and Agricultural Engineering, 1390 Eckles Avenue, St. Paul, MN 55108.

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.

Majors

COAFES offers the following 12 interdisciplinary majors and areas of emphasis. Detailed information about each follows in the Degree Programs section. A matrix lists general interests and occupations with corresponding majors and primary COAFES departments on the next page.

Agricultural and Food Business Management
  Business Management
  Financial Management
  Food Processing, Wholesaling, and Retailing
  Marketing and Sales Management

Agricultural Education
  Agricultural Development
  Agricultural Education
  Natural and Managed Environmental Systems

Agricultural Industries and Marketing
  Animal Industries
  Crops/Soils Industries
  Food Industries
  Horticultural Industries

Animal Production Systems
  Beef
  Dairy
  Equine
  Poultry
  Sheep
  Swine

Applied Economics
  Management and Finance
  Marketing
  Food Retailing
  Regional and Public Economics
  Resources and Environment
  Trade and Development

Crops and Soils Resources Management

Environmental Horticulture
  Greenhouse Production and Retail Floriculture
  Turfgrass Management
  Landscape Design, Implementation, and Management
  Nursery Production and Garden Center Management

Environmental Science
  Environmental Education
  Environmental Management
  Land and Water Resources

Food Science
  Nutrition
  Coordinated Program in Dietetics
  Nutrition Science

Nutrition

Science in Agriculture
  Animal Science
  Food Science
  Nutrition
  Plant Sciences
  Science in Agriculture/Doctor of Veterinary Medicine Joint Degree
  Soil Science

Scientific and Technical Communication

Students may prepare in COAFES for the following upper division/professional programs.
  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 form before completing the required coursework for the second major.

Minors

To receive a minor, students must have a GPA of 2.00 or higher 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 for all COAFES students who qualify and accept the challenge of broadening, deepening, and enriching 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 3101). The honors experience course is student-designed and is supervised by COAFES faculty. The honors program 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;
  • earn a coefficient of completion of .75 or greater in all coursework.
### Finding your way around the college

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<th>COAFES majors</th>
<th>Occupations</th>
<th>Primary COA departments</th>
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<td>Animals</td>
<td>APS, BAE, ScAg</td>
<td>Animal breeder, Designer of animal housing, Animal nutritionist, Dairy inspector, Equipment designer</td>
<td>Animal Science; Biosystems and Agricultural Engineering</td>
</tr>
<tr>
<td>Animal production (beef, dairy, poultry, swine)</td>
<td>AIM, APS, ScAg, AgEd</td>
<td>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; Agricultural Education</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>BAE, FdSc, ES, ScAg</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>
</tr>
<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; Soils, Water, and Climate</td>
</tr>
<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</td>
<td>Agricultural Education; Biosystems and Agricultural Engineering; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Field crop production (corn, soybeans, wheat, oats, barley, sunflowers, hay, flax)</td>
<td>AIM, ApEc, ScAg, AgEd</td>
<td>Seed producer/conditioner, Agronomist, Crop consultant, Farmer, Elevator/Co-op manager, Regulatory agent, Plant protection representative, Horticulturist, Crop production specialist, Seed technologist, Machinery and systems designer</td>
<td>Biosystems and Agricultural Engineering; Agronomy &amp; Plant Genetics; Entomology; Plant Pathology; Soils, Water, and Climate</td>
</tr>
<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>
</tr>
<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>
</tr>
<tr>
<td>Horticultural food crops (fruits, vegetables)</td>
<td>AIM, ApEc, ScAg</td>
<td>Vegetable grower, Orchard manager, Greenhouse or garden center worker, Nursery stock producer, Plant breeder, Arboretum 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>
</tr>
<tr>
<td>Insects</td>
<td>AIM, ApEc, EH, ScAg</td>
<td>Crop/environment consultant, Research biologist, Biological control specialist, Technical/sales representative, Public health inspector, Commercial honey producer, Plant health care specialist</td>
<td>Entomology; Plant Pathology</td>
</tr>
<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>Applied Economics; Agricultural Education; Food Science and Nutrition</td>
</tr>
<tr>
<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>
</tr>
<tr>
<td>Plants</td>
<td>CSRM, EH, ScAg</td>
<td>Plant breeder, Nursery/greenhouse manager, Plant health care specialist</td>
<td>Agronomy &amp; Plant Genetics; Entomology; Horticultural Science; Plant Pathology; Soils, Water, and Climate</td>
</tr>
<tr>
<td>Sales and marketing</td>
<td>AgBu, AgEc, 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, CSRM, ES, ScAg</td>
<td>Pollution control agent, Land/water use planner, Waste manager, Fertilizer sales representative, Landscape designer, Irrigation and drainage system designer, Conservationist, Soil scientist</td>
<td>Applied Economics; Agricultural Education; Biosystems and Agricultural Engineering; Soil, Water, and Climate</td>
</tr>
<tr>
<td>Teaching</td>
<td>AgEd</td>
<td>Middle, high school or adult agriscience/agribusiness teacher, Natural resources, horticulture, agrimarketing teacher, Extension educator, Peace Corps volunteer, International development agent, FFA and 4H advisor, 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; Soils, Water, and Climate</td>
</tr>
<tr>
<td>Veterinary medicine</td>
<td>ScAg</td>
<td>Veterinarian</td>
<td>Animal Science</td>
</tr>
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### Key to Majors

- **AgBu**: Agricultural and Food Business Management
- **AIM**: Agricultural Education
- **ApEc**: Applied Economics
- **BAE**: Biosystems and Agricultural Engineering
- **CSRM**: Crops and Soils Resources 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
Advising

The faculty of COAFES is committed to providing quality advising for students. To accomplish that goal, almost all advising is handled 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 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. Advisers also inform students about other resources at the University.

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 students’ majors and have a working knowledge of most of the required courses. Most advisers also know some of the basic requirements of other 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 APAS reports and updated transcripts from the COAFES Student Services office.

Advisers often write letters of recommendation for scholarship, job, or graduate school applications.

Petition Procedures
To request permission to depart from usual procedures, students must complete a petition form available at the COAFES Student Services Office, 120 Biosystems and Agricultural Engineering, or at the Office of the Registrar–St. Paul, 130 Coffey Hall. All submitted petitions must be signed by an adviser. Some majors also 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 Undergraduate Research Opportunities Program 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 Career Services Office, 120 Biosystems and Agricultural Engineering (612/624-2710).

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 4 credits for satisfactory completion of a PEP program. Students may enroll in two different PEP programs, for a total of 8 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, 120 Biosystems and Agricultural Engineering (612/624-2710).

Scholarships
COAFES has an extensive scholarship program for freshmen, transfer students, and continuing students. Scholarship brochures and applications are usually available in December. Students can pick them up in 120 Biosystems and Agricultural Engineering. Deadlines for applications are published in the applications and brochures.

International Programs
Two types of study abroad that can especially enhance degree work in COAFES are field study and integrated classroom study. Students may also seek internship credit from COAFES for academic projects arranged as a part of a MAST Experience Abroad (see page 39). For details, consult with Career Services.
Some scholarships are available through COAFES to help defray costs of overseas study-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, 120 Biosystems and Agricultural Engineering (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, see “Study Abroad” in the General Information section of this catalog.

### Career Information

To help students secure employment after graduation, the Career Services Office, 120 Biosystems and Agricultural Engineering, 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>.

### 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. Through the board, students participate in matters such as consideration of proposed curricula, questions related to instruction, improvement of educational facilities, development of administrative policy, and establishment of the goals 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. Further information related to the board and its operation may be obtained in 120 Biosystems and Agricultural Engineering.

**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 brings questions from the student bodies to the administration of the colleges and discusses problems and reaches decisions on matters of general interest. The board cooperates with the Minnesota Student Association and the Assembly Committee on Student Affairs (ACSA). COAFES students may file for election to this board. For more information, inquire at the Office for Student Affairs, 130 Coffey Hall.

**Student Center Board of Governors**—The St. Paul Student Center Board of Governors, composed of students elected to represent the academic units on the St. Paul campus, formulates policies for operation of the student center and establishes its budget. Information about the St. Paul Student Center, its operation, and opportunities to serve on its various planning and programming committees, is available at the information desk on the first floor of the student center.

**Agricultural Ambassadors**—Selected COAFES undergraduates volunteer their time to serve as goodwill ambassadors for the college. They foster communications among the college, prospective students, and the community at large. Each ambassador gains experience in public relations and recruitment and develops communications skills through public speaking engagements and small group discussions with prospective students. Agricultural ambassadors develop leadership and management skills by participating on the executive board and special committees. For more information, students should contact the COAFES Student Services Office, 120 Biosystems and Agricultural Engineering.

**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. All-University committees publish announcements in *The Minnesota Daily* and on bulletin boards around campus.

**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, 120 Biosystems and Agricultural Engineering.

Other clubs affiliated with COAFES include:
- Agricultural Education Club
- Alpha Zeta Fraternity (an honor and service fraternity)
- Block and Bridle
- Gopher Dairy Club
- Gopher Crops and Soils
- Food Science Club
- Horticulture Club
- National AgriMarketing Association, Student Chapter (NAMA)
- Minnesota Collegiate Agri-Women
- National Society for Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS)
- Environmental Studies Club
- Student Organization of Nutrition and Dietetics (SOND)
- American Society of Agricultural Engineers, Student Branch
- Rhetoric’s Association of Student Technical Communicators (R.A.S.T.E.C.)
- Students in Honors
- Frenatar: Entomology Student Association
- Pre-Vet Med Club
- The Sheep and Goat Club
- Alpha Epsilon Delta (Pre-Med and Pre-Vet)
- American Association of Bovine and Swine
Minnesota. income per year in added farmer generate $55 million barley varieties alone 

Affiliated majors
• Agricultural Industries and Marketing
• Crops and Soils Resources Management
• Science in Agriculture

Animal Science
Abel Ponce de León, head 122 Peters Hall 1404 Gortner Avenue St. Paul, MN 55108 624-1205

Affiliated majors
• Agricultural Industries and Marketing
• Animal Production Systems
• Science in Agriculture

Applied Economics
Vernon Eidman, head 231 Classroom Office Building 1994 Buford Avenue St. Paul, MN 55108 625-0231

Affiliated majors
• Agricultural Industries and Marketing
• Applied Economics
• Agricultural and Food Business Management

Biosystems and Agricultural Engineering
R. Vance Morey, head 213 Agricultural Engineering 1390 Eckles Avenue St. Paul, MN 55108 625-7733

Affiliated majors
• Biosystems and Agricultural Engineering (IT)
• Environmental Science
• Food Science

Entomology
Mark Ascerno, head 219 Hodson Hall 1980 Folwell Avenue St. Paul, MN 55108 624-3278

Affiliated majors
• Agricultural Industries and Marketing
• Crops and Soils Resources Management
• Environmental Horticulture
• Science in Agriculture

Food Science and Nutrition
Joseph Warthesen, head 225 Food Science and Nutrition 1334 Eckles Avenue St. Paul, MN 55108 624-3086

Affiliated majors
• Agricultural Industries and Marketing
• Food Science
• Nutrition

Horticultural Science
Gary Gardner, head 305 Alderman Hall 1970 Folwell Avenue St. Paul, MN 55108 624-3606

Affiliated majors
• Agricultural Industries and Marketing
• Environmental Horticulture
• Science in Agriculture
COAFES views each of its majors as a four-year program that integrates liberal education courses, preparation or foundation courses, and professional courses in areas of special expertise. The following section details the requirements for each major. Several courses listed under the designation of foundation and professional courses in each major will also meet the liberal education requirements. Students need to consult with their adviser and a copy of the Class Schedule to determine what University courses have been approved to meet the liberal education core and designated theme requirements.

Students who were enrolled in a degree program before 1994 at the University of Minnesota–Twin Cities and have been following the general education requirements designated as areas A-D, have the option of completing their COAFES degrees using those requirements. For a summary of the requirements and a complete list of courses to fulfill them, students should consult with their adviser or the COAFES Student Services Office.

All other transfer students will be held to the current liberal education requirements. The number of credits required for graduation is dictated by the liberal education program a student follows. Students in the environmental science major must complete the current liberal education requirements.

Program Requirements—Students are responsible for the program requirements that are in effect for their major the semester they enter the college. COAFES Student Services Office provides students with a current program sheet or Academic Progress Audit System (APAS) Report at orientation/registration.

Students can choose to move to newer program requirements as the program changes in subsequent years or semesters, but students must assume the new requirements in total. To move to a newer program, students file a Change of Major form, available in the COAFES Student Services Office. Upon processing the form, the Student Services Office provides students with an updated APAS report or program sheet. The student and his or her adviser should follow those requirements for graduation. The final degree clearance is processed using the student’s declared major.

Students who request a leave of absence, or who are not enrolled for more than two consecutive semesters but are without a leave of absence, should consult the Policies section of this catalog.

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 agricultural and food business management curriculum emphasizes the use of concepts and methods from economics and business management in the identification, analysis, and solution of 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 agribusiness. Examples of employment areas include finance and banking, management, input marketing, commodity marketing, food marketing, sales, administration, public and industrial relations, production management, economic and statistical analysis, managerial accounting, and transportation.

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

Admission Requirements—Students 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 to the agricultural and food business management major, students must meet the following 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:
  - Acct 2050 or ApEc 1251
  - ApEc 1101, 1102 or Econ 1101, 1102
  - BA 1550
  - Math 1142 or 1271
- Earn a GPA of at least 2.80 in all coursework.
- Earn a GPA of at least 2.50 in the tool courses and at least a C in each tool course.

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 can be obtained from the major coordinator for the agricultural and food business management program, 231 Classroom Office Building, or from the COAFES Student Services Office, 120 Biosystems and Agricultural Engineering.
Degree Requirements
To complete the degree, students must complete at least 120 credits, including at least 69 credits in the major. Frequently, courses in the foundation requirements also apply toward completion of the liberal education requirements.

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

Note: Students contemplating graduate work are encouraged to take both Math 1271 (4 cr) and Math 1272 (4 cr).

Complete at least 8 credits of physical and biological sciences from courses listed below. The courses taken should be selected to provide the science background for the agricultural science courses listed below.

Biol 1009—General Biology (4 cr)
Biol 2022—General Botany (3 cr)
Biol 2012—General Zoology (4 cr)
Chem 1011—General Principles of Chemistry (4 cr)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)

Professional Requirements
Applied Economics
Core courses and electives required of all majors:
ApEc 1001—Orientation (1 cr)
ApEc 1101—Principles of Microeconomics (4 cr)
ApEc 1102—Principles of Macroeconomics (4 cr)
ApEc 3001—Applied Microeconomics: Consumers and Markets (3 cr)
ApEc 3002—Applied Microeconomics: Managerial Economics (3 cr)
ApEc 3006—Applied Macroeconomics: Government and the Economy (3 cr)
ApEc 3007—Applied Macroeconomics: Policy, Trade, and Development (3 cr)
ApEc 3401—Markets, Marketing and Prices (2 cr)
ApEc 4501—Agribusiness Finance (3 cr)
ApEc 4821—Agribusiness Management (5 cr)

6-8 credits in applied economics in an area of emphasis. An internship or special project is encouraged.

Carlson School of Management
Core courses and electives required of all majors:
Acct 2050—Introduction to Financial Reporting (4 cr)
Acct 3001—Introduction to Management Accounting (2 cr)
BA 1550—Business Statistics: Data Sources, Presentation, and Analysis (4 cr)
Mgmt 3001—Fundamentals of Management (2 cr)
Mktg 3000—Principles of Marketing (2 cr)

6-8 credits from the Carlson School of Management in an area of emphasis.

Note: Elective courses in applied economics and from the Carlson School of Management are to be used to meet area of emphasis requirements.

Areas of Emphasis
12 credits in one of the following areas of emphasis:
Business Management
Acct 3201—Intermediate Management Accounting (2 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 5811—Cooperative Organizations (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
BLaw 3058—The Law of Contracts and Agency (4 cr)
Fina 4242—Corporate Investment Decisions (4 cr)
HRIR 3021—Human Resource Management and Industrial Relations (4 cr)
HRIR 3041—Individual in the Organization (2 cr)
Mgmt 4002—Managerial Psychology (4 cr)
Mgmt 4008—Entrepreneurial Management (4 cr)
OMS 3056—Production and Inventory Management (4 cr)
Marketing and Sales Management
ApEc 3411—Grain Marketing Economics (2 cr)
ApEc 3421—Livestock and Meat Marketing Economics (2 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 5401—Intermediate Market and Price Analysis (3 cr)
ApEc 5481—Futures and Options Markets (3 cr)
ApEc 5751—Agricultural Trade and Trade Policy: Issues and Analysis (3 cr)
Financial Management
Acct 3201—Intermediate Management Accounting (4 cr)
Acct 5160—Financial Statement Analysis (4 cr)
ApEc 4096—Professional Experience Program: Internship (1-3 cr)
ApEc 5481—Futures and Options Markets (3 cr)
ApEc 5811—Cooperative Organizations (3 cr)
Fina 4121—Financial Markets and Interest Rates (2 cr)
Fina 4122—Banking Institutions (2 cr)
Fina 4241—Corporate Financing Decisions (4 cr)
Fina 4322—Security Analysis (4 cr)
Fina 4641—International Finance and Risk Management (4 cr)
BLaw 3058—The Law of Contracts and Agency (4 cr)
Econ 4432—International Finance (3 cr)
Ins 5100—Corporate Risk Management (2 cr)
**Applications and Requirements**

**Admission Requirements**—Students preparing for career opportunities that emphasize skills such as communications, law, or information systems may use this alternative to design an area of emphasis. A program of study under this 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 do count toward the degree requirements.

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**Agricultural Education**

**Department of Work, Community, and Family Education**

**B.S.**

**Agricultural Science and Technology Education**

This undergraduate specialization is a collaborative partnership by College of Education and Human Development and the College of Agricultural, Food, and Environmental Sciences. It 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. In addition, graduates of this specialization also are qualified for a broad array of agriculturally related positions in sales, management, finance, and production aspects of agriculture. The specialization allows students to have an emphasis area that includes a broad agricultural science and technology background.

**Admission Requirements**—Students may be admitted to this program as freshmen or may transfer into the program any semester. They must maintain an overall GPA of 2.75 and complete the Praxis I: Preprofessional Skills Test (PPST).

**Degree Requirements**

To complete the degree, students must complete at least 128 credits, including required courses in the major. 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 student teaching experience.

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**Required Courses**

Students must meet the University’s liberal education requirements. In addition, students must meet the following requirements.

**Prerequisites (44-46 cr)**

Prerequisite courses may apply toward liberal education requirements—see adviser.

**Communications (10 cr)**

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

**Core Sciences (19-21 cr)**

Chem 101—General Principles of Chemistry (4 cr)
BioC 1012—General Principles of Biochemistry (3 cr)
Biol 1009—General Biology (4 cr)
or
Biol 1051—Introduction to Environmental Science (3 cr)
MicB 2022—General Microbiology (2 cr)

or
Phys 1101—Fundamental Physics I (4 cr)

ScAg 1501—Biotechnology, People, and the Environment (3 cr)

**Mathematics (3 cr)**

Math 1031—College Algebra and Probability (3 cr)

**Social Science (12 cr)**

HSci 1814—Introduction to History of Science: Ancient Study (4 cr)
HSci 1815—Introduction to History of Science: Modern Science (4 cr)

Psy 1001—Introduction to Psychology (4 cr)

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

**Plant Science (6 cr)**

Agro 3003—Introduction to Integrated Weed Management (1 cr)
Ent 3001—Insects and Insect Management (1 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)

**Horticulture (8 cr)**

Hort 1001—Plant Propagation (4 cr)
Hort 1002—Home Horticulture (3 cr)
Hort 1012—Woody Landscape Plants (4 cr)
Hort 1013—Interior Floral and Foliage Design (3 cr)
Hort 3002—Greenhouse Management (3 cr)

**Animal Science (6 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 1101—Introductory Animal Science (4 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2012—Livestock and Carcass Evaluation (3 cr)
AnSc 2301—Systemic Physiology (4 cr)

**AnSc/Agro 3203—Environment, Global Food Production, and Citizens (3 cr)**

AnSc 3221—Animal Breeding (4 cr)

**Natural Resources (6 cr)**

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

**Plus 3 credits from the following:**

Agro/AnSc 3203—Environment, Global Food Production, and Citizens (3 cr)
EEB 3001—Ecology and Society (3 cr)
ES 1011—Issues in the Environment (3 cr)
NRES 2012—Conservation 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)
ApEc 3821—Retail Center Management (3 cr)
The agricultural sciences program is consistently ranked as one of the top five programs of its kind in the country.

### Agricultural Mechanization (6 cr)
- AgEE 2051—Career Planning for Agricultural Professionals (1 cr)
- AgEE 1001—Introduction to Agricultural Education (1 cr)
- AgEE 1002—Career Planning for Agricultural Professionals (1 cr)
- AgEE 2096—Professional Practicum: Early Experience (1 cr)
- AgEE 5111—Agricultural Education Methods of Teaching (4 cr)
- AgEE 5112—Agricultural Education Program Organization and Curriculum for Youth (4 cr)
- AgEE 5113—Agricultural Education Adult Program Development and Technology (3 cr)
- AgEE 5114—Agricultural Education Seminar (1 cr)
- WCFE 5301—Philosophy and Practice of Vocational Education (2 cr)
- WCFE 5697—Teaching Internships: School and Classroom Settings (2 cr)
- WCFE 5698—Teaching Internship (6 cr)

### B.S. Agricultural Leadership, Training, and Development Specialization
The specialization provides a unique, futuristic educational opportunity combining agricultural science, communication, leadership, education, business and industry, training, and development. It provides a general background in agriculture, with agribusiness and industry associations.

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.

#### Degree Requirements
To complete the degree, students must complete at least 124 credits, including required courses in the major. The degree requirements for this program require the completion of the courses and business experience. Students must maintain an overall GPA of 2.00.

#### Required Courses
Students must meet the University’s liberal education requirements. In addition, students must meet the following requirements.

**Prerequisites (35 cr)**
Prerequisite courses may apply toward liberal education requirements—see adviser.

**Communications (10 cr)**
- Rhet 1101—Writing to Inform, Convince and Persuade (4 cr)
- Rhet 3562—Technical and Professional Writing (3 cr)
- Rhet 1223—Oral Presentations in Professional Settings (3 cr)

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

**Physical and Biological Sciences (14 cr)**
- Agro 1103—Crops, Environment and Society (4 cr)
- Chem 1009—General Biology (4 cr)
- BioC 1012—General Principles of Biochemistry I (3 cr)
- Chem 1011—General Principles of Chemistry (4 cr)
- ScaG 1501—Biotechnology: People and the Environment (3 cr)

**Social Science (8 cr)**
- Phil 1003—Introduction to Ethics (4 cr)
- Psy 1001—Introduction to Psychology (4 cr)

**Agricultural Sciences and Economics (52 cr)**

**Plant Science (9 cr)**
- Agro 3003—Introduction to Integrated Weed Management (1 cr)
- Ent 3001—Insects and Insect Management (1 credit)
- PlPa 3001—Plant Disease Biology and Management (1 cr)

**Plus at least 6 credits from the following:**
- Agro 1101—Biology of Plant Food Systems (3 cr)
- Agro 2501—Weed Biology and Systematics (2 cr)
- Agro 3005—Applied Crop Physiology and Development (2 cr)
- AnSc 3203—Environment, Global Food Production and Citizens (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 (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 3212—Livestock and Carrcass Evaluation (3 cr)
- AnSc 3203—Environment, Global Food Production and Citizens (3 cr)

**Soils (7 cr)**
- Soil 1125—The Soil Resource (4 cr)
- Soil 2125—Basic Soil Science (4 cr)

**Plus 3 credits from the following:**
- Soil 1425—The Atmosphere (3 cr)
- Soil 3221—Soil Conservation and Land-Use Management (3 cr)
- Soil 3416—Plant Nutrients in the Environment (3 cr)

**Applied Economics and Agribusiness (12 cr)**
- ApEc 1101—Principles of Microeconomics (3 cr)
- ApEc 1251—Principles of Accounting (3 cr)
- ApEc 3451—Food and Agricultural Sales (3 cr)

**Plus 2-3 credits from the following:**
- ApEc 3401—Markets, Marketing and Prices (2 cr)
- ApEc 3811—Principles of Farm Management (3 cr)
- ApEc 3821—Retail Center Management (3 cr)

**Agricultural Mechanization (3 cr)**
- AgEE 2051—Current Technical Competencies (3 cr)

**Emphasis Area**
Students must select 10 credits in one of the following three emphasis areas:

**Agricultural Science (10 cr)**
- Agro 2103—Grain Grading and Crop Utilization (1 credit)
- Agro 2105—Seed Technology (1 credit)
- Agro 2501—Weed Biology and Systematics (2 cr)
- Agro 3203—Environment, Global Food Production, and the Citizen (3 cr)
- Agro 3005—Applied Crop Physiology and Development (2 cr)
- AnSc 1511—Food Animal Products for Consumers (3 cr)
- AnSc 2012—Livestock and Carrcass Evaluation (3 cr)
- AnSc 3211—Biometrics for Livestock (3 cr)
- AnSc 3201—Systemic Physiology (4 cr)
- SoSc 3111—Food: Safety, Risks, and Technology (3 cr)
- PlPa 3002—Diseases of Field Crops (3 cr)
- PlPa 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 1152—Writing on Issues of Science and Technology (3 cr)
Rhet 3221—Theories of Human Communications (3 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 Leadership and Development (6 cr)
AgEE 3221—Rural Leadership Development (3 cr)
AgEE 5361—World Development Problems (3 cr)

Experiential Education (3 cr)
AgEE 3906—Experiential Learning: Production and Business (3 cr)

Agricultural Education and Extension (9 cr)
AgEE 1001—Introduction to Agricultural Education (1 cr)
AgEE 1002—Career Planning for Agricultural Professionals (1 cr)
AgEE 5111—Agricultural Education Methods of Teaching (4 cr)
AgEE 5311—History, Philosophy, and Systems of Agricultural Extension Systems (3 cr)

Human Resource Development/Adult Education (15 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)
Plus (three) elective credits in HRD courses.

AdEd 5102—Perspectives of Adult Learning and Development (3 cr)

B.S. Natural and Managed Environmental Education Specialization

The 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. They must maintain an overall GPA of 2.75 and complete the Praxis I: Preprofessional Skills Test (PPST).

Degree Requirements

To complete the degree, students must complete at least 128 credits, including required courses in the major. The specialization requires a broad study in agriculture focused on the natural and managed environmental education areas. Areas of study include 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 student teaching experience.

Required Courses

Students must meet the University’s liberal education requirements. In addition, students must meet the following requirements.

Prerequisites (39-41 cr)
Prerequisite courses may apply toward liberal education requirements—see adviser.

Communications (9-10 cr)
Rom 1011—Writing to Inform, Convince, and Persuade (4 cr)
Rom 1223—Oral Presentations in Professional Settings (3 cr)
Rom 3562—Technical and Professional Writing (3 cr)

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

Physical and Biological Science (19-20 cr)
BioC 1012—General Principles of Biochemistry (3 cr)
Biol 1009—General Biology (4 cr)
or
Biol 1051—Introduction to Environmental Science (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
McB 2022—General Microbiology (2 cr)

or
Phys 1101—Fundamental Physics I (4 cr)
SciAg 1501—Biotechnology, People, and the Environment (3 cr)

Social Science (8 cr)

Plus 2-3 credits from the following:

EEB 3001—Ecology and Society (3 cr)
Fr 2104—Forest Measurement Techniques (3 cr)
Fr 3104—Forest Ecology (4 cr)
Fr 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)

El 1002—Wildlife: Ecology, Values, and Human Impact (3 cr)
El 3003—Wildlife in Agricultural Land (2 cr)

Land, Water, Atmosphere (7 cr)
Soil 2125—Basic Soil Science (4 cr)

Plus 3-4 credits from the following:

NRES 1201—Conservation of Natural Resources (3 cr)
Soil 1425—The Atmosphere (3 cr)
Soil 3221—Soil Conservation and Land-Use Management (3 cr)
Soil 3416—Plant Nutrients in the Environment (4 cr)

Applied Economics and Agribusiness (3 cr)
AgEc 1101—Principles of Microeconomics (3 cr)
or
AgEc 3451—Food and Agricultural Sales (3 cr)

Plant Science (6 cr)
Pip 3001—Plant Disease Biology and Management (1 cr)
Ent 3001—Insects and Insect Management (1 cr)
Agro 3003—Introduction to Integrated Weed Management (1 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 2001—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 3203—Environment, Global Food Production, and Citizens (3 cr)

Agricultural Mechanization (6 cr)

Select 6 credits from the following:
AgEE 2051—Current Technical Competencies (3 cr)
AgEE/BIE 3112—Technical Drawing and Production Technologies (3 cr)
AgEE/BIE 3120—Communication, Energy, Power, and Machinery Technology (3 cr)

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

Professional Education (40 cr)

Foundations (15 cr)
EdHD 5001—Learning, Cognition and Assessment in the Schools (3 cr)
EdHD 5003—Developmental and Individual Differences (3 cr)
EdHD 5005—School and Society (2 cr)
EdHD 5007—Technology for Teaching and Learning (1.5 cr)
EdHD 5009—Human Relations (1 cr)

EdPa 5341—The American Middle School (3 cr)

PubH 5003—Fundamentals of Alcohol and Drug Abuse (1.5 cr)

Agricultural Education (15 cr)
AgEE 1001—Introduction to Agricultural Education (1 cr)
AgEE 1002—Career Planning for Agricultural Professionals (1 cr)
AgEE 2096—Professional Practicum: Early Experience (1 cr)
AgEE 5112—Agricultural Education Program Organization and Management (3 cr)
AgEE 5361—World Development Problems (3 cr)

Environmental Science (40 cr)

Environmental (8-9 cr)

ES 1011—Issues in Environment (3 cr)

Plus 2-3 credits from the following:

EEB 3001—Ecology and Society (3 cr)
Fr 2104—Forest Measurement Techniques (3 cr)
Fr 3104—Forest Ecology (4 cr)
Fr 3251—Role of Renewable Natural Resources in Developing Countries (1 cr)

El 1002—Wildlife: Ecology, Values, and Human Impact (3 cr)
El 3003—Wildlife in Agricultural Land (2 cr)

Land, Water, Atmosphere (7 cr)
Soil 2125—Basic Soil Science (4 cr)

Plus 3-4 credits from the following:

NRES 1201—Conservation of Natural Resources (3 cr)
Soil 1425—The Atmosphere (3 cr)
Soil 3221—Soil Conservation and Land-Use Management (3 cr)
Soil 3416—Plant Nutrients in the Environment (4 cr)

Applied Economics and Agribusiness (3 cr)
AgEc 1101—Principles of Microeconomics (3 cr)
or
AgEc 3451—Food and Agricultural Sales (3 cr)

Plant Science (6 cr)
Pip 3001—Plant Disease Biology and Management (1 cr)
Ent 3001—Insects and Insect Management (1 cr)
Agro 3003—Introduction to Integrated Weed Management (1 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 2001—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 3203—Environment, Global Food Production, and Citizens (3 cr)

Agricultural Mechanization (6 cr)

Select 6 credits from the following:
AgEE 2051—Current Technical Competencies (3 cr)
AgEE/BIE 3112—Technical Drawing and Production Technologies (3 cr)
AgEE/BIE 3120—Communication, Energy, Power, and Machinery Technology (3 cr)

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

Professional Education (40 cr)

Foundations (15 cr)
EdHD 5001—Learning, Cognition and Assessment in the Schools (3 cr)
EdHD 5003—Developmental and Individual Differences (3 cr)
EdHD 5005—School and Society (2 cr)
EdHD 5007—Technology for Teaching and Learning (1.5 cr)
EdHD 5009—Human Relations (1 cr)

EdPa 5341—The American Middle School (3 cr)

PubH 5003—Fundamentals of Alcohol and Drug Abuse (1.5 cr)

Agricultural Education (15 cr)
AgEE 1001—Introduction to Agricultural Education (1 cr)
AgEE 1002—Career Planning for Agricultural Professionals (1 cr)
AgEE 2096—Professional Practicum: Early Experience (1 cr)
AgEE 5112—Agricultural Education Program Organization and Management (3 cr)
AgEE 5361—World Development Problems (3 cr)
Agricultural Industries and Marketing

B.S.

Industries related to modern agriculture include the manufacturers and distributors of farm production inputs (such as equipment, structures, animal feed, health products, seeds, fertilizers, and crop protection products); the assemblers, processors, manufacturers, and distributors of products originating from farms (products such as meat, milk, eggs, wool, grains, fruits, vegetables, nursery crops, flowers, and turf); and the finance and insurance industries providing agricultural credit. “Agribusinesses” such as these regularly search for individuals who have a broad education in the scientific (and technical) aspects of agriculture, effective work and communication skills, and the ability to competently apply 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 five areas of emphasis: animal industries, horticultural industries, crops and soils industries, food industries, or individualized emphasis.

Admission Requirements—Admission to COAFES.

Degree Requirements

To complete the degree, students must complete at least 120 credits, 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 (calculus, accounting, and statistics) and science (biology and chemistry) and (2) professional courses with three major clusters (communications, business, and agricultural sciences). Students must complete at least 13 credits in their area of emphasis. Finally, students must complete an internship or a student project.

Required Courses

Foundation Requirements

Quantitative Foundations Math 1142—Short Calculus (3 cr)
or Math 1271 Calculus I (4 cr)
ApEc 1251—Principles of Accounting (3 cr)

Plus one of the following:
Stat 3011—Introduction to Statistical Analysis (4 cr)
Agro 4101—Experimental Design/Plot Techniques (3 cr)
AnSc 2211—Biometrics for Livestock (3 cr)

Science Foundations
Biol 1009—General Biology (4 cr)
or Agro 1101—Biology of Plant Food Systems (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
BioC 1012—General Principles of Biochemistry (3 cr)

Professional Requirements

Experiential
AgEE 1002—Principles of Career Planning for Agricultural Professionals (1 cr)
xxxx 4096—Professional Experience Program (3 cr)
or AIM 4011—Student Project/Field Investigation (3 cr)

One of the following:
WCFE 3061—Professional Internship (3 cr)
ApEc 3451—Food and Agricultural Sales (3 cr)

Communications
Rhet 1101—Writing to Inform, Convince and Persuade (4 cr)
Rhet 1102—Writing on Issues in Science and Technology (3 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (3 cr)
Rhet 3257—Scientific and Technical Presentations (3 cr)

Plus one of the following:
Rhet 3266—Group Process, Team Building, and Leadership (3 cr)
Rhet 3258—Information Gathering Techniques in Scientific and Technical Communications (3 cr)

Business
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
ApEc 3402—Markets, Marketing and Prices (2 cr)

One of the following:
ApEc 3411—Grain Marketing Economics (2 cr)
ApEc 3421—Livestock and Meat Marketing Economics (2 cr)
ApEc 3821—Retail Center Management (3 cr)
ApEc 4451—Food Marketing Economics (3 cr)

Plus one of the following: ApEc 4501, ApEc 5481, Jour 3201, Rhet 4165, Spch 3441

Agriculture
AnSc 1011—Domestic Animals and Society (3 cr)
AgET 3213—Engineering Principles and Applications (3 cr)
or FScN 1102—Food: Safety, Risks, and Technology (3 cr)
Agro 1103—Crops, Environment, and Society (4 cr)
or Hort 1101—Plant Propagation (4 cr)
Soil 2125—Basic Soil Science (4 cr)
or FScN 1112—Principles of Nutrition (3 cr)

Emphasis Areas

Animal Industries
AnSc 1101—Introductory Animal Science (4 cr)

Plus three of the following:
AnSc 2301—Systematic Physiology (4 cr)
AnSc 2401—Animal Nutrition (3 cr)
AnSc 3221—Animal Breeding (4 cr)
AnSc 3511—Animal Growth and Development (3 cr)

Crops and Soils Industries*
Agro 3005—Applied Crop Physiology and Development (2 cr)
Biol 3002—Plant Biology: Function (2 cr)
Soil 3416—Plant Nutrients in the Environment (3 cr)
Agro 3003—Introduction to Integrated Weed Management (1 cr)
Ent 3001—Insects and Insect Management (1 cr)
PPlA 3001—Plant Disease Biology and Management (1 cr)
Plus at least 4 credits from the following: Agro 2103, Agro 3203, Agro 4305, Agro 4401, Agro 4505, Agro 4603, Agro 4605, Ent 4005, PPlA 2002, Soil 3221, Soil 3612, Soil 4511

*The emphasis in crops and soils industries is also offered at Southwest State University in Marshall, Minnesota, through a joint agreement. Students can contact Southwest State University or COAFES for more information.
Animal Production Systems

B.S.
The animal production systems major prepares students for work as managers and technical advisers for animal production systems and sales, for various careers in animal industries, or for graduate study in animal related specializations. The curriculum emphasizes applied principles and includes courses in agriculture, science, mathematics, business, and social science. Areas of emphasis include dairy, beef, equine swine, sheep, and poultry. An individualized course of study may also be pursued.

Degree Requirements
To complete the degree, students must complete at least 120 credits, including 59 credits in the major. Frequently, courses in the foundation requirements also apply toward completion of liberal education requirements.

Required Courses

Foundation Requirements
ApEc 1101—Principles of Microeconomics (3 cr)
Biol 1009—General Biology (4 cr)
BioC 1012—General Principles of Biochemistry (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (3 cr)
Math 1031—College Algebra and Probability (3 cr)

Professional Requirements
AgEE 1002—Principles of Career Planning in Agriculture (1 cr)
AgET 3213—Engineering Principles and Applications (3 cr)
Agro 1105—Plant and Crop Science (4 cr)
AnSc 1011—Domestic Animals and Society (3 cr)
AnSc 1101—Introductory Animal Science (4 cr)
AnSc 1511—Food Animal Products for Consumers (3 cr)
AnSc 2211—Biometrics for Livestock (3 cr)
AnSc 2301—Systemic Physiology (4 cr)
AnSc 2401—Animal Nutrition (3 cr)
Soil 2125—Basic Soil Science (4 cr)
AnSc 3203—Environment, Global Food Production, and the Citizen (3 cr)
AnSc 3221—Animal Breeding (4 cr)
AnSc 4609—Livestock Systems Analysis (2 cr)
AnSc 4096—Professional Experience Program: Internship (3 cr)
CAPS 3502—Animal Health and Disease (3 cr)
orVPB 3105—General Microbiology (4 cr)

Emphasis Areas

Beef
AnSc 4403—Ruminant Nutrition (3 cr)
AnSc 4603—Beef Production Systems Management (4 cr)
AnSc 4613—Advanced Beef Production Systems Management (2 cr)

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

Equine
AnSc 4012—Horse Production (ITV from Crookston) (2 cr)
AnSc 3102—Equine Management (ITV from Crookston) (2 cr)
Students must complete at least 5 credits of selected equine lab courses offered during summer sessions at Crookston.

Sheep
AnSc 4403—Ruminant Nutrition (3 cr)
AnSc 4602—Sheep Production Systems Management (4 cr)

Swine
AnSc 4403—Ruminant Nutrition (3 cr)
AnSc 4601—Pork Production Systems Management (4 cr)
AnSc 4611—Advanced Pork Production Systems Management (2 cr)

Poultry*
AnSc 4405—Poultry Nutrition (3 cr)
AnSc 4602—Poultry Production Systems Management (4 cr)

*Students interested in poultry study should inquire about courses available through the Midwest Poultry Consortium

Individualized Emphasis (12 cr min)
Courses may be selected according to students’ interest in consultation with an adviser and with the approval of the Animal Production Systems Committee.
Animal Science

Minor Only
For students who want to include animal science coursework to enhance or supplement their major program. Students have considerable flexibility in choosing courses to meet the minor requirements. To complete the minor, students must complete at least 10 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, agriculture, or graduate work. Students may choose one of six areas of emphasis: management and finance; marketing; food retailing; trade and development; natural resources and environment; or regional and public economics. Students may also consult with their adviser to develop an individualized area of emphasis. This curriculum emphasizes fundamental written and oral communication skills and a strong foundation in economic principles and their applications. Potential areas of employment for graduates include management, finance, marketing and international trade, domestic and international development, environmental impact assessment, resource management and use, and government-related work in planning, taxation, and development. Entry-level jobs are often in merchandising and sales, credit analysis, management, and other customer contact areas.

Admission Requirements—Admission to COAFES.

Degree Requirements
To complete the degree, students must complete at least 120 credits, including 80 credits in the major. Besides completing the liberal education requirements of the University, 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. According to their interests, students select the remainder of their courses from the categories of professional application (specialization), technical emphasis, and electives.

Required Courses

Foundation requirements

Writing Performance Courses
Rhett 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhett 1152—Writing on Issues of Science and Technology (3 cr)
Rhett 3562—Technical and Professional Writing (3 cr)

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

Social Science
Students in ApEc must complete 6 credits in Social Sciences beyond the 6 credits required for liberal education.
Math 1142—Short calculus
or
Math 1271—Calculus (4 cr)

Note: Students contemplating graduate study are encouraged to take Math 1271—Calculus I (4 cr) and Math 1272—Calculus II (4 cr).

Professional Requirements
ApEc 1001—Orientation to Applied Economics (1 cr)
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)

Note: Students in ApEc must complete 6 credits in social sciences beyond the 6 credits required for liberal education.
ApEc 1251—Principles of Accounting (3 cr)
or
Acct 2050—Introduction to Financial Reporting (4 cr)
BA 1550—Business Statistics (4 cr)
ApEc 3001—Applied Microeconomics: Consumers and Markets (3 cr)
ApEc 3002—Applied Microeconomics: Managerial Economics (3 cr)
ApEc 3006—Applied Macroeconomics: Government and the Economy (3 cr)
ApEc 3007—Applied Macroeconomics: Policy, Trade, and Development (3 cr)

A. Professional Application Cluster (12 cr min)
At least two ApEc courses plus one or two more courses from ApEc, Econ, or Carlson School of Mgmt. Students are encouraged to take 9 or more of these 12 credits in one of the following areas:

- Food Retailing: ApEc 4821, ApEc 4451, DHA 5241, DHA 5242, Mktg 5001, HRIR 3041
- Individualized Professional Cluster: To develop such a program, consult with adviser.

Technical Emphases (12 cr min)
With the help of an adviser, students select at least three courses from at least two departments. At least one course should be 3xxx or above.

Electives—Several courses in the Carlson School and in the Economics Department are optional in meeting the professional requirement and the professional application cluster chosen.

Internships
Internships are recommended for all students in the major.

Minor Requirements
For students who want to include a basic core of economics coursework to enhance or supplement their major program. Students have considerable flexibility in choosing courses to meet the minor requirements. To complete the minor, students must complete at least 16 credits.

Required Courses
ApEc 1101—Principles of Microeconomics (3 cr)
ApEc 1102—Principles of Macroeconomics (3 cr)
Electives (10 cr)
Crops and Soils Resources Management

B.S.
The crops and soils resources management major is for students who are interested in becoming proficient in 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 production as a part of managed ecosystems with local and global connections.

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 support staff. Quality performance in the major prepares students to pursue crops and environmental science related graduate degrees.

Admission Requirements—Admission to COAFES.

Degree Requirements
To complete the degree, students must complete at least 120 credits, including 66 credits in the major. Frequently, courses in the foundation requirements also apply toward completion of liberal education requirements.

Required Courses
Foundation Requirements
Communications
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1123—Oral Presentation in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (3 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
Biol 1009—General Biology (4 cr)
or Agro 1101—Biology of Plant Food Systems (3 cr)
Chem 1011—General Principles of Chemistry (4 cr)
BioC 1012—General Principles of Biochemistry (3 cr)
EEB 3001—Ecology and Society (3 cr)
Professional Requirements
AgEE 1002—Principles of Career Planning for Agricultural Professions (1 cr)
AgET 3213—Engineering Principles and Applications (3 cr)
Agro 1103—Crops, Environment, and Society (4 cr)
Agro 2501—Weed Biology, Ecology, and Systematics (2 cr)
Agro 3005—Applied Crop Physiology and Development (2 cr)
or Bio 3002—Plant Biology: Function (2 cr)
or Hort 3005—Applied Crop Physiology and Development (2 cr)
or Bio 3002—Plant Biology: Function (2 cr)
Agro 4305—Crop Harvest, Storage, Processing, Utilization (3 cr)
or FScN 5551—Grains: Introduction to Cereal Chemistry and Technology (2 cr)
Agro 4606—Professional Experience Program: Internship (3 cr)
Agro 4603—Field Crop Scouting and Problem Diagnosis (2 cr)

Environmental Horticulture

B.S.
The environmental horticulture program educates and trains students in all phases of horticulture: crop production; education (botanic gardens and arboreta); service oriented activities (landscaping); plant production; 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 the public about science and agriculture, bring together and improve community environments, and provide recreational and practical benefits to the public.

Electives
Final Project
Agro 4096—Professional Experience Program.
The program offers the following emphases: landscape design, implementation, and management; nursery production and garden center management; greenhouse production and retail floriculture; and turfgrass management. An individualized program of study can be arranged. The program offers a wide range of internship opportunities and requires all students engage in a professional experience.

**Degree Requirements**

To complete the degree, students must complete at least 120 credits, including 55 credits in the major. The program requires courses in algebra, chemistry, physics, and biology. Applied courses are in horticultural science, soil science, entomology, plant pathology, and applied economics. Courses vary depending on emphasis.

**Required Courses**

**Foundation Requirements**
- Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
- Rhet 1223—Oral Presentations in Professional Settings (3 cr)
- One other communications course (3 cr)
- Biol 1009—General Biology (4 cr)
- Biol 2022—General Botany (3 cr)
- Math 1031—College Algebra and Probability (3 cr)
- or Math 1142—Short Calculus (3 cr)
- Chem 1011—General Principles of Chemistry (4 cr)
- or Chem 1021—Principles of Chemistry I (4 cr)
- and Chem 1022—Principles of Chemistry II (4 cr)
- BioC 1012—General Principles of Biochemistry (3 cr)
- ApEc 1101—Microeconomics (3 cr)

**Professional Requirements (39 cr)**
- Hort 1001—Plant Propagation (4 cr)
- Hort 1012—Woody Landscape Plants (3 cr)
- Hort 1011—Herbaceous Landscape Plants (3 cr)
- PIPAs 2001—Introductory Plant Pathology for Horticulturists (3 cr)
- Soil 2125—Basic Soil Science (4 cr)
- Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
- and Biol 3002—Plant Biology: Function (2 cr)
- Ent 3001—Insects and Insect Management (1 cr)
- GC 1513—Principles of Small Business Management (3 cr)
- Hort 3002—Greenhouse Management (3 cr)
- Hort 4401—Plant Genetics and Breeding (4 cr)
- PIPAs 4000—Plant Pathology Practicum (choose 2-1 cr modules) (2 cr)
- Ent 4251—Forest and Shade Tree Entomology (2 cr)
- Hort 4096—Professional Experience Program (3 cr)
- One additional business course chosen in consultation with adviser.

**Emphasis Areas**

**Landscape Design, Implementation, and Management (21 cr min)**
- ApEc 1251—Principles of Accounting (3 cr)
- Hort 4021—Landscape Design, Implementation, and Management I (4 cr)
- Hort 4061—Turf and Landscape Management (4 cr)
- Hort 5021—Landscape Design II (4 cr)
- Hort 5024—Landscape Development (1 cr)
- At least two additional horticultural science courses (6-8 cr)

**Nursery Production and Garden Center Management (21 cr min)**
- ApEc 1251—Principles of Accounting (3 cr)
- Hort 4041—Nursery Production and Management I (4 cr)
- Hort 5041—Nursery Production and Management II (3 cr)
- Hort 5042—Nursery Operations (1 cr)
- ApEc 3821—Retail Center Management (3 cr)
- At least two additional horticultural science courses (7-8 cr)

**Greenhouse Production and Retail Floriculture (21 cr min)**
- ApEc 1251—Principles of Accounting (3 cr)
- Hort 4051—Floriculture Production and Management I (4 cr)
- Hort 5051—Floriculture Production and Management II (4 cr)

**ApEc 3820—Retail Center Management (3 cr)**
- At least two additional horticultural science courses (7-8 cr)

**Turfgrass Management (21 cr min)**
- Hort 4061—Turf and Landscape Management (4 cr)
- Hort 5061—Turfgrass Science (3 cr)
- Hort 4021—Landscape Design, Implementation, and Management I (4 cr)
- Soil 3416—Plant Nutrients in the Environment (3 cr)
- At least two additional horticultural science courses (7-8 cr)

**Individualized Program of Study (21 cr min)**
- Seven courses (21-23 cr) chosen in consultation with adviser. Students must submit a course of study to the Department of Horticultural Science Undergraduate Affairs Committee at least three semesters before graduation.

**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.

**Minor Requirements**
- Hort 1001—Plant Propagation (4 cr)
- Hort 3005—Environmental Effects on Horticultural Crops (2 cr)
- At least 12 credits of horticultural science electives of which one course from a related area may be used. A maximum of 3 credits of Hort 5090—Directed Studies may be applied to the minor.

**Environmental Science B.S.**

The environmental science curriculum 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 will become knowledgeable about the 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, and plant science.

Emphasis areas include land and water resources (land use management, soil resources, sustainable agriculture, water resources); environmental management (bioremediation, environmental measurement, waste management); and environmental education (natural and managed environmental systems).

**Admission Requirements**—Acceptance to COAFES.

**Degree Requirements**

To complete the degree, students must complete at least 120 credits, including 54 credits in the major. The program requires courses in calculus, chemistry, physics, biology, and geology. Applied science courses are in meteorology, soil science, hydrology, and plant science. Emphasis area courses vary by area.

**Required Courses**

**Foundation Requirements**
- ApEc 1101—Principles of Microeconomics (3 cr)
- ApEc 1102—Principles of Macroeconomics (3 cr)
- Biol 1001—Introductory Biology I: Evolutionary and Ecological Perspectives (4 cr)
- Biol 1002—Introductory Biology II: Molecular, Cellular, and Developmental Perspectives (4 cr)
- Chem 1021—Chemical Principles I (4 cr)
- Chem 1022—Chemical Principles II (4 cr)
- BioC 1012—General Principles Biochemistry (3 cr)
- or Chem 2301—Organic Chemistry I (3 cr)
Food Science

B.S.

Food scientists apply the principles of disciplines such as chemistry, physics, and microbiology to food processing, preservation, and product development. The food science program provides students with a basic foundation in calculus, chemistry, physics, communications, statistics, and biology. Professional courses center around food engineering/processing, food chemistry, food microbiology, and food quality.

Degree Requirements

To complete the degree, students must complete at least 120 credits, including 82 credits in the major. Students must also complete the University’s liberal education requirements and maintain an overall GPA of at least 2.00.

Required Courses

Foundation Courses

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

or

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)

or

Phys 1201—General Physics (5 cr)
and Phys 1202—General Physics (5 cr)

or

Math 1142—Short Calculus (3 cr)
and Math 1271—Calculus I (4 cr)

or

Agro 4101—Experimental Design/Plot Techniques (3 cr)
and Stat 3011—Introduction to Statistical Analysis (4 cr)

Rhet 1152—Writing on Issues of Science and Technology (3 cr)
Rhet 1122—Oral Presentations in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (3 cr)

Professional Requirements

ES 1011—Issues in the Environment (3 cr)

or

Agro 3203—Environment, Global Food Production, and the Citizen (3 cr)

or

ES 1051—Introduction to Environmental Science (3 cr)

or

ES 4096—Experience and Training in a Field Setting (1-4 cr)

or

NRES 3061—Water Quality Management (3 cr) or FR 4114—Hydrology (3 cr)

or

Geo 1001—Introduction to Geology (4 cr)

or

Agro 4201—Air Pollution, People, and Plants (3 cr) or Soil 1425—The Atmosphere (3 cr)

or

Soil 2125—Basic Soil Science (4 cr)

or

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

or

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

or

Soil 3612—Soil and Environmental Biology (3 cr)

or

Soil 4021—Environmental Impact Assessment (3 cr)

or

Soil 4601—Soils and Pollution (3 cr)

Choose one from the following:

NRES 3021—Plant Resource Management and the Environment (3 cr)
Agro 1101—Biological Plant Food Systems (4 cr)
Agro 1103—Crops, Environment, and Society (3 cr)

Area of emphasis (15 cr)

Final Project

Internship requirement: students must complete ES 4096.

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 how to select and apply efficient and 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

Ent 5211—Insect Pest Management (3 cr)
PipA 5204—Epidemiology and Plant Disease Resistance (4 cr)
Agro 2501—Weed Biology Systematics (2 cr)
Agro 4505—Integrated Weed Management (4 cr)

Choose one of the following management courses:

Agro 4605—Management Technologies for Crop Production (3 cr)
Hort 5031—Sustainable Fruit and Vegetable Production (4 cr)
Hort 4041—Nursery Production and Management I (3 cr)
Hort 4051—Floriculture Production and Management I (3 cr)
Hort 4061—Turf and Landscape Management (4 cr)
Soil 3222—Soil Conservation and Land Use Management (3 cr)

Choose one of the following applied courses:

Agro 4603—Field Crop Scouting and Problem Diagnosis (2 cr)
Agro 4888—Issues in Sustainable Agriculture (2 cr)
PipA 5202—Field Plant Pathology (2 cr)
Soil 3612—Soil and Environmental Biology (3 cr)
Pick one of the following lab courses: BioC 4025, Chem 2111, Chem 2311, FScN 4612
Pick one of the following microbiology courses: MicB 2032, MicB 3301, VPB 2032
Pick one of the following physics series: Phys 1101/1102, Phys 1201/1202, Phys 1301/1302

Note: Phys 1301 and 1302 are recommended.

Professional Courses

FScN 1102—Food: Safety, Risks, and Technology (3 cr)
FScN 1111—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—Lab in Microbiology and Fermentations (2 cr)
FScN 4131—Food Quality (3 cr)
FScN 4312—Food Analysis (4 cr)
FScN 4331—Principles of Food Engineering (4 cr)
FScN 4332—Food Processing Operations (3 cr)

One of the following courses with a Capstone component: FScN 4341, FScN 4342, FScN 4343, FScN 4344

Minor Requirements

Complete at least 20 credits from the following list:

FScN 1102, FScN 3102, FScN 4111, FScN 4121, FScN 4122, FScN 4312, FScN 4331, FScN 4332

Pick one of the following lab courses: BioC 4025, Chem 2111, Chem 2311, FScN 4612
Pick one of the following microbiology courses: MicB 2032, MicB 3301, VPB 2032
Pick one of the following physics series: Phys 1101/1102, Phys 1201/1202, Phys 1301/1302

Note: Phys 1301 and 1302 are recommended.

Professional Courses

FScN 1102—Food: Safety, Risks, and Technology (3 cr)
FScN 1111—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—Lab in Microbiology and Fermentations (2 cr)
FScN 4131—Food Quality (3 cr)
FScN 4312—Food Analysis (4 cr)
FScN 4331—Principles of Food Engineering (4 cr)
FScN 4332—Food Processing Operations (3 cr)

One of the following courses with a Capstone component: FScN 4341, FScN 4342, FScN 4343, FScN 4344

Minor Requirements

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

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 how to select and apply efficient and 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

Ent 5211—Insect Pest Management (3 cr)
PipA 5204—Epidemiology and Plant Disease Resistance (4 cr)
Agro 2501—Weed Biology Systematics (2 cr)
Agro 4505—Integrated Weed Management (4 cr)

Choose one of the following management courses:

Agro 4605—Management Technologies for Crop Production (3 cr)
Hort 5031—Sustainable Fruit and Vegetable Production (4 cr)
Hort 4041—Nursery Production and Management I (3 cr)
Hort 4051—Floriculture Production and Management I (3 cr)
Hort 4061—Turf and Landscape Management (4 cr)
Soil 3222—Soil Conservation and Land Use Management (3 cr)

Choose one of the following applied courses:

Agro 4603—Field Crop Scouting and Problem Diagnosis (2 cr)
Agro 4888—Issues in Sustainable Agriculture (2 cr)
PipA 5202—Field Plant Pathology (2 cr)
Soil 3612—Soil and Environmental Biology (3 cr)
International Agriculture

Minor Only
For COAFES students who want to add an international dimension to their degree, or for non-COAFES students who want to acquire experience and knowledge in international agriculture. The program gives students and advisers a high degree of flexibility in planning the minor. To complete the minor, students must complete at least 20 credits.

Required Courses
Agri 3000—International Seminar (1 cr)
4xxx internship, independent study, project, or extensive review of literature (4 cr, must be a COAFES course)
3xxx-4xxx electives in language or culture (6-8 cr)
Electives in agricultural science (9-12 cr)

Nutrition

B.S.
The nutrition major explores how nutrients and the foods from which they are derived aid the body in health, growth, and development. With the major national and international concern for how food and nutrition affect health and disease, there are many career opportunities for registered dietitians and nutritionists. 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 approval status and the Coordinated Program in Dietetics is currently granted accreditation status by the Commission on Accreditation/Approval for Dietetics Education of The American Dietetic Association, 216 W. Jackson Blvd., Chicago, IL 60606-6995, (312) 899-4876.

Degree Requirements
To complete the degree, students must complete at least 120 credits, including required credits in the major. Students must also complete the University’s liberal education requirements and maintain an overall GPA of at least 2.00.

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, Risk, 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 4612—Experimental Nutrition (2 cr)
FScN 5621—Nutrition and Metabolism (4 cr)
Phy 3051—Human Physiology (4 cr)
Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1223—Oral Presentations in Professional Settings (3 cr)
Rhet 3562—Technical and Professional Writing (3 cr)
VPB 2032—General Microbiology with Laboratory (4 cr)
or MicB 3022—General Microbiology with Laboratory (4 cr)
or MicB 3301—Biology of Microorganisms (5 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 who have a cumulative GPA of 3.00, strong work experience in nutrition, and demonstrated leadership skills, and who are highly recommended, may apply for a postbaccalaureate dietetic internship.

Additional Courses
FScN 3614—Nutrition Education (2 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 (2 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 (2 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 (2 cr)
FScN 4596—Field Experience in Community Nutrition (2 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 (4 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 (2 cr)
Math 1031—College Algebra and Probability (3 cr)
Mgmt 3001—Fundamentals of Management (2 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
Biol 2012—General Zoology (4 cr) or another advanced biology course
Chem 2302—Organic Chemistry II (3 cr)
Chem 2311—Organic Chemistry Lab (3 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 4009—Genetics (3 cr)
Math 1142—Short Calculus (3 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)

Minor Requirements
For those having completed Biol 1009; Chem 1021, 1022, and 2301; and BioC 3021:
FScN 1112—Principles of Nutrition (3 cr)
FScN 3612—Lifecycle Nutrition (3 cr)
FScN 4612—Human Nutrition (3 cr)
FScN 4613—Experimental Nutrition (2 cr)
FScN 5621—Nutrition and Metabolism (4 cr)

Science in Agriculture

B.S.
The science in agriculture major is an interdisciplinary program that provides a thorough grounding of biological/physical science and mathematics 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, animal science, entomology, food science and nutrition, horticultural science, plant pathology, and soil science) and related areas, as well as in veterinary or human medicine. Students considering veterinary medicine should consult the science in agriculture/doctor of veterinary medicine joint 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.

Admission Requirements—See COAFES policy.

Degree Requirements
To complete the degree, students must complete at least 120 credits, including required credits in the major.

Students must complete the liberal education diversifed core and designated themes. See the University’s liberal education statement in the Policies section of this catalog. Frequently, courses in the foundation requirements also apply toward completion of liberal education requirements.

Required Courses

Foundation Requirements

Rhet 1101—Writing to Inform, Convince, and Persuade (4 cr)
Rhet 1152—Writing on Issues of Science and Technology (3 cr)
Rhet 1223—Oral Presentation (3 cr)
Math 1142—Short Calculus (3 cr)
or
Math 1271—Calculus I (4 cr)
and Math 1272—Calculus 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)
Chem 1021—Chemical Principles I (4 cr)
Chem 1022—Chemical Principles II (4 cr)
University rhetoric students participated with nine other schools worldwide on an international team dealing with technology and community-building sponsored by Apple, Inc.

**Science in Agriculture**

- Chem 2301—Organic Chemistry I (3 cr)
- Chem 2302—Organic Chemistry II (3 cr)
- Chem 2311—Organic Chemistry Lab (3 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)
- 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)
- MicB 2105—Microbiology (4 cr)
- or  VPB 2105—Microbiology (4 cr)

**Professional Requirements**

- ScAg 1001—Orientation to Science in Agriculture (1 cr)
- ScAg 1501—Biotechnology, People, and the Environment (3 cr)
- ScAg 5009—Undergraduate Research Thesis (6 cr)

**Emphasis Areas**

**Animal Science (24 cr)**

- AnSc 1101—Introductory Animal Science (4 cr)
- AnSc 2301—Systemic Physiology (4 cr)
- AnSc 2401—Animal Nutrition (3 cr)
- AnSc 3221—Animal Breeding (4 cr)

**Biototechnology (22-25 cr)**

- ScAg 1502—Biotechnology Laboratory (2 cr)
- AnSc 2221—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)

**One of the following:**

- Agro 1102—Crops, Environment, and Society (4 cr)
- Soil 2125—Basic Soil Science (4 cr)
- FScN 1102—Food Safety, Risks, and Technology (3 cr)
- AnSc 1101—Introductory Animal Science (4 cr)

**One of the following:**

- PBio 5414—Plant Cell and Molecular Biology (3 cr)
- Soil 4601—Soils and Pollution (3 cr)
- FScN 4121—Food Microbiology and Fermentation (3 cr)
- AnSc 2301—Systemic Physiology (4 cr)

**Food Science (21 cr)**

- FScN 1112—Principles of Nutrition (3 cr)
- FScN 3102—Introduction to Food Science (3 cr)
- FScN 4121—Food Microbiology and Fermentation (4 cr)
- Plus at least 12 credits from FScN 4111, FScN 4122, FScN 4131, FScN 4312, FScN 4331, FScN 4332

**Nutrition (22 cr)**

- FScN 1112—Principles of Nutrition (3 cr)
- FScN 3612—Lifestyle Nutrition (3 cr)
- FScN 4612—Human Nutrition (3 cr)
- FScN 5621—Nutrition and Metabolism (4 cr)
- Plus at least 9 additional credits from FScN 2103, FScN 4103, FScN 4613, FScN 5622, FScN 5623, AnSc 4401, AnSc 4403, AnSc 4405

**Plant Science (26-27 cr)**

- Agro 1101—Biology of Plant Food Systems (3 cr)
- or  Hort 1001—Plant Propagation (4 cr)
- Agro 3005—Applied Crop Physiology and Development (2 cr)
- and Biol 3005—Plant Function Laboratory (2 cr) (concurrent registration required)
- 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)
- PIPa 2001—Introductory Plant Pathology for Horticulturalists (3 cr)
- or  PIPa 2002—Diseases of Field Crops (3 cr)
- Biol 2222—General Botany (3 cr)
- Agro 2501—Weed Biology and Systematics (2 cr)
- Soil 2125—Basic Soil Science (4 cr)
- Ent 3001—Insects and Insect Management (1 cr)
- Ent 3005—Insect Biology (concurrent with Ent 3001) (2 cr)

**Soil Science (20 cr)**

- Soil 2125—Basic Soils (4 cr)
- Soil 3221—Soil Conservation (3 cr)
- Soil 3416—Plant Nutrients (3 cr)
- Soil 3612—Soil and Environmental Biology (3 cr)
- Soil 4511—Field Study of Soils (2 cr)
- Plus at least 6 credits from Soil 4601, Soil 4121, Soil 5232, Soil 5515, Soil 5555, Soil 5211

**Individualized Area of Emphasis**

- Students wishing to design a program with an emphasis different from the above options should consult with their adviser. Individualized programs must be approved by the major coordinating committee and have at least 21 credits, plus electives to reach 120 credits required for graduation.

**Final Project**

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

**Science in Agriculture/Doctor of Veterinary Medicine Joint Degree**

The science in agriculture/doctor of veterinary medicine joint degree is a cooperative program between COAFES and the College of Veterinary Medicine (CVM). Students who satisfy the specified curriculum requirements earn a B.S. in science in agriculture and, later, a doctor of veterinary medicine from CVM.

New freshmen enrolling in the science in agriculture major may complete three years of undergraduate coursework and then apply to CVM. Upon being accepted into CVM and successfully completing the courses specified in the first semester of the veterinary medicine curriculum, students will earn the B.S. degree from COAFES.

The program gives highly qualified students the opportunity to earn both a B.S. degree and a D.V.M. degree in seven years. It also allows integration of a significant set of animal science courses in the student’s preparation for veterinary education.

The program is only available to students who enter COAFES with no previous coursework and start in fall semester. The science in agriculture/D.V.M. curriculum is very structured, and the COAFES portion must be completed in three academic years. COAFES students enrolled in this program must meet CVM application standards; admission is competitive. COAFES students applying under the agreement will receive special consideration because of the animal knowledge and experience gained in the animal science courses required in the curriculum. Application to CVM must be made in the junior year. Students not admitted to CVM are expected to complete the normal science in agriculture requirements for the B.S. degree. Students can also reapply to CVM or any other college of their choice at a later date.

- AnSc 1101—Introductory Animal Science (4 cr)
- AnSc 2301—Systemic Physiology (4 cr)
- AnSc 2401—Animal Nutrition (3 cr)
- AnSc 3305—Reproductive, Artificial Insemination, and Lactation (4 cr)
- AnSc 3221—Animal Breeding (4 cr)
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.

Admission Requirements—Students planning to major in scientific and technical communication enter COAFES with a pre-major status. After completing the prerequisite courses, students apply for full major status. To apply, students must complete 27 prerequisite credits (see below) and submit the application materials to the Admissions Committee. Application materials include an application form; college transcripts; letter of intent; portfolio that includes 3-5 writing samples, 1-2 other samples, and a profile letter; and the Pre-Major Checklist that shows a 2.50 GPA in the following:

- 3 credits in Rhet 3221—Theories of Human Communication
- 6 additional credits in rhetoric, English, or composition
- 6 credits in lab-based physical or biological science
- 6 credits in math, computer science, engineering, or technology
- 6 credits in social sciences, history, or humanities

Although a 2.00 GPA is required to be admitted to COAFES, a 2.50 GPA in the 27 prerequisite credits is required to be admitted to the scientific and technical communication major.

Degree Requirements

To complete the degree, students must complete at least 120 credits, including 81 credits in the major. Students must also complete the University’s liberal education requirements.

Required Courses

Equivalent transfer courses are accepted in all areas (except for specific required rhetoric courses as indicated). However, at least 30 credits in areas A, B, C, D, and E must be completed in the Department of Rhetoric, as follows.

Area A. Communication Design (27 cr)

A-1. Written Communication (12 cr)
Rhet 1152—Writing on Issues of Science and Technology (3 cr)
Rhet 3562—Technical and Professional Writing (3 cr)
Rhet 4561—Editing and Style for Technical Communicators (3 cr)
Rhet 5662—Advanced Technical Communication (3 cr)

A-2. Oral Communication (9 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)

A-3. Visual Communication (6 cr)
Rhet 4671—Principles and Application of Project Management and Design I (3 cr)
Rhet 4672—Principles and Application of Project Management and Design II (3 cr)

Area B. Communication Expertise (9 cr)

Students work with their adviser to select courses in one area of communication in which they would like to develop expertise. Possible areas include written communication, multimedia, training and development, public relations and management, information management systems, sales and marketing, oral communication, visual communication, business communication, and international communication.

Area C. Information Management and Theory (21 cr)

C-1 Information Management (9 cr)
Rhet 4501—Usability and Human Factors in Technical Communication (3 cr)
Plus at least 6 credits from Rhet 3401, Rhet 4165, Rhet 4573, Rhet 5111/5112, Rhet 5258, Rhet 5562

C-2 Theory (9 cr)
Rhet 3221—Theories of Human Communication (3 cr)
Rhet 3701—Rhetorical Theory and Scientific and Technical Communication (3 cr)
Rhet 5511—Research in and Scientific and Technical Communication (3 cr)

C-3 Internship (3 cr)
Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr)

Area D. Science, Technology, and Society (9 cr)
Rhet 1301—Science, Religion, and the Search for Human Nature (3 cr)
Rhet 3371—Technology, Society, and Self (3 cr)
Rhet 5101—Gender in Rhetoric of Science and Technology (3 cr)

Area E. Scientific or Technical Competency (15 cr)

Students develop expertise in a specific scientific or technical area, in consultation with their adviser. The courses are limited to science and technology fields. The courses may be from multiple departments but cannot be taken from the Department of Rhetoric. At least two courses in the area must be upper division.

Scientific areas include, but are not limited to, agricultural science (including plant science and horticulture), animal science, astronomy, biology, chemistry, climatology, ecology, environmental science, food science/nutrition, health science, natural resources, and physics.

Engineering and technical areas include aerospace engineering, biomedicine, civil engineering, cognitive psychology (including human factors and ergonomics), computer science, electrical engineering, mathematics, and mechanical engineering.

To discuss non-rhetoric courses required as part of the major, contact the Department of Rhetoric assistant major coordinator.

Electives—The program accepts equivalent courses in all areas (except for specific required rhetoric courses as indicated in the listed under Required Courses). The program also expects students to take courses outside of rhetoric in areas listed under Required Courses such as area B and area E.

Language Requirements

Scientific and technical communication majors are encouraged to take a foreign language. In addition, students may choose International Communication as their area of emphasis under Area B.
Final Project
All students must participate in an internship, under area C: Rhet 4196—Internship in Scientific and Technical Communication (3-6 cr).

Minor Requirements
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 compliment students’ career plans. For help in planning a minor, contact the major coordinator of the Scientific and Technical Communication program in the Department of Rhetoric. Students must complete at least 21 credits to complete the minor.

Prerequisite Courses
Rhet 1101 (or 1151), 1223, and 3562
(do not count toward credits required for the minor)

Required Courses
Rhet 3257—Scientific and Technical Presentations (3 cr)
Rhet 3401—Accessing Information Through Electronic Media (3 cr)
Rhet 4561—Editing and Style for Technical Communicators (3 cr)
Rhet 5662—Advanced Technical Communication (3 cr)
Three 3xxx or higher courses
Courses should be selected in consultation with the student’s academic adviser and the major coordinator of the Scientific and Technical Communication Program.

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

Required Courses (18 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)
Soil 3416—Plant Nutrients in the Environment (3 cr)
Soil 3612—Soil and Environmental Biology (3 cr)
Soil 4601—Soils and Pollution (3 cr)
Soil 4511—Field Study of Soils (2 cr)

Electives (2 cr)
Soil 4021—Environental Impact Statements (3 cr)
Soil 5515—Soil Genesis and Landscape Relations (3 cr)
Soil 5555—Wetland Soils (3 cr)
Soil 5711—Forest Soils (2 cr)

Sustainable Agriculture
Minor Only
Emphasizes a holistic perspective in understanding farming and food systems and solving problems in agriculture. The importance of yield and profitability are balanced by consideration of the environment and of the health and social well being of producers, consumers, and communities. The minor provides for flexibility and individuality through several elective options. Students should develop their courses of study in consultation with an adviser in one of the COAFES major programs. To complete the minor, students must complete at least 20 credits.

Required Courses
Agro 4888—Issues in Sustainable Agriculture (2 cr)
AnSc 3203 or Agro 3203—Environment, Global Food Production and the Citizen (3 cr)
Rhet 1315—The Land in American Experience (3 cr)

Electives
Courses to fulfill the remaining credit requirements of the minor may be selected from the following list; other courses may be substituted.
Agro 3003—Introduction to Integrated Weed Management (1 cr)
PPlPa 3001—Plant Disease Biology and Management (1 cr)
Ent 3001—Insects and Insect Management (1 cr)
Hort 4072—Growing Plants Organically: What It Means to Be Green (3 cr)
Hort 3031—Sustainable Fruit and Vegetable Production Systems (4 cr)
AgEt 5203—Environmental Impacts of Food Production (3 cr)
Soil 3221—Soil Conservation and Land-Use Management (3 cr)
Soil 3612—Soil and Environmental Biology (3 cr)
ApEc 3041—Economic Development of U.S. Agriculture (3 cr)
Agro 4103 or ApEc 4103—World Food Problems (3 cr)
FScn 3615—Socio-Cultural Aspects of Food, Nutrition, and Health (3 cr)
PPlPa 1001—Microbes, Plants, and People: The Social and Economic Impact of Plant Disease (3 cr)

Internship Opportunities
Students are encouraged to gain knowledge and practical experience in sustainable agriculture through enrollment in a professional experience course or, less formally, through an internship with a sustainable agriculture producer or organization.