The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2018-2019 academic year, including the Summer Semester 2018, the Fall Semester 2018 and the Winter Semester 2019. For your convenience the Undergraduate Calendar is available in PDF format. If you wish to link to the Undergraduate Calendar please refer to the Linking Guidelines.

The University is a full member of:

- Universities Canada

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Revision Information:

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The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2018-2019 academic year, including the Summer Semester 2018, the Fall Semester 2018 and the Winter Semester 2019.

The University reserves the right to change without notice any information contained in this calendar, including fees, any rule or regulation pertaining to the standards for admission to, the requirements for the continuation of study in, and the requirements for the granting of degrees or diplomas in any or all of its programs. The publication of information in this calendar does not bind the University to the provision of courses, programs, schedules of studies, or facilities as listed herein.

The University will not be liable for any interruption in, or cancellation of, any academic activities as set forth in this calendar and related information where such interruption is caused by fire, strike, lock-out, inability to procure materials or trades, restrictive laws or governmental regulations, actions taken by faculty, staff or students of the University or by others, civil unrest or disobedience, public health emergencies, or any other cause of any kind beyond the reasonable control of the University.

In the event of a discrepancy between a print version (downloaded) and the Web version, the Web version will apply.

Published by: Enrolment Services
Introduction

Collection, Use and Disclosure of Personal Information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) http://www.e-laws.gov.on.ca/index.html. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes. Certain personal information is disclosed to external agencies, including the Ontario Universities Application Centre, the Ministry of Advanced Education and Skills Development, and Statistics Canada, for statistical and planning purposes, and is disclosed to other individuals or organizations in accordance with the Office of Registrarial Services Departmental Policy on the Release of Student Information. For details on the use and disclosure of this information call the Office of Registrarial Services at the University at (519) 824-4120 or see http://www.uoguelph.ca/registrar/registrar/index.cfm?index.

Disclosure of Personal Information to the Ontario Ministry of Advanced Education and Skills Development

The University of Guelph is required to disclose personal information such as characteristics and educational outcomes to the Minister of Advanced Education and Skills Development under s. 15 of the Ministry of Advanced Education and Skills Development Act, R.S.O. 1990, Chapter M.19, as amended. The Ministry collects this data for purposes including but not limited to planning, allocating and administering public funding to colleges, universities and other post-secondary educational and training institutions.

Amendments made to the Ministry of Advanced Education and Skills Development Act, authorizing the collection and use of personal information from colleges and universities by the Ministry of Advanced Education and Skills Development, which were set out in Schedule 5 of the Childcare Modernization Act, 2014, came into force on March 31, 2015. The amendments strengthen the ability of the Minister to directly or indirectly collect and use personal information about students as required to conduct research and analysis, including longitudinal studies, and statistical activities conducted by or on behalf of the Ministry for purposes that relate to post-secondary education and training, including,

i. understanding the transition of students from secondary school to post-secondary education and training,
ii. understanding student participation and progress, mobility and learning and employment outcomes,
iii. understanding linkages among universities, colleges, secondary schools and other educational and training institutions prescribed by regulation,
iv. understanding trends in post-secondary education or training program choices made by students,
v. understanding sources and patterns of student financial resources, including financial assistance and supports provided by government and post-secondary educational and training institutions,
vi. planning to enhance the affordability and accessibility of post-secondary education and training and the quality and effectiveness of the post-secondary sector,
vii. identifying conditions or barriers that inhibit student participation, progress, completion and transition to employment or future post-secondary educational or training opportunities, and
viii. developing key performance indicators.

Information that the University is required to provide includes but is not limited to: first, middle and last name, Ontario Educational Number, citizenship, date of birth, gender, first three digits of a student’s postal code, mother tongue, degree program and major(s) in which the student is enrolled, year of study and whether the student has transferred from another institution.

Further information on the collection and use of student-level enrolment-related data can be obtained from the Ministry of Advanced Education and Skills Development website: https://www.ontario.ca/page/advanced-education-and-skills-development (English) or https://www.ontario.ca/fr/page/ministere-de-lenseignement-supérieur-et-de-la-formation-professionnelle (French) or by writing to the Director, Postsecondary Finance and Information Management Branch, Postsecondary Education Division, 7th Floor, Mowat Block, 900 Bay Street, Toronto, ON M7A 1L2.


Frequently Asked Questions related to the Ministry's enrolment and OEN data activities are also posted at: http://www.tcu.gov.on.ca/pepa/publications/NoticeOfCollection.pdf

Authority to Disclose Personal Information to Statistics Canada

The Ministry of Advanced Education and Skills Development discloses student-level enrolment-related data it collects from the colleges and universities as required by Statistics Canada in accordance with Section 13 of the Federal Statistics Act. This gives Ministry of Advanced Education and Skills Development Act authority to disclose personal information in accordance with s. 42(1) (e) of FIPPA

Notification of Disclosure of Personal Information to Statistics Canada

For further information, please see the Statistics Canada's web site at http://www.statcan.ca and Section XIV Statistics Canada.

Address for University Communication

Depending on the nature and timing of the communication, the University may use one of these addresses to communicate with students. Students are, therefore, responsible for checking all of the following on a regular basis:

Email Address

The University issued email address is considered an official means of communication with the student and will be used for correspondence from the University. Students are responsible for monitoring their University-issued email account regularly. See Section I--Statement of Students' Academic Responsibilities for more information.

Home Address

Students are responsible for maintaining a current mailing address with the University. Address changes can be made, in writing, through Enrolment Services.

Name Changes

The University of Guelph is committed to the integrity of its student records, therefore, each student is required to provide either on application for admission or on personal data forms required for registration, his/her complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution or addition, must be accompanied by appropriate supporting documentation.

Student Confidentiality and Release of Student Information Policy Excerpt

The University undertakes to protect the privacy of each student and the confidentiality of his or her record. To this end the University shall refuse to disclose personal information to any person other than the individual to whom the information relates where disclosure would constitute an unjustified invasion of the personal privacy of that person or of any other individual. All members of the University community must respect the confidential nature of the student information which they acquire in the course of their work.

Learning Outcomes
On December 5, 2012, the University of Guelph Senate approved five University-wide Learning Outcomes as the basis from which to guide the development of undergraduate degree programs, specializations and courses:

1. Critical and Creative Thinking
2. Literacy
3. Global Understanding
4. Communicating
5. Professional and Ethical Behaviour

These learning outcomes are also intended to serve as a framework through which our educational expectations are clear to students and the broader public; and to inform the process of outcomes assessment through the quality assurance process (regular reviews) of programs and departments.

An on-line guide to the learning outcomes, links to the associated skills, and detailed rubrics designed to support the development and assessment of additional program and discipline-specific outcomes, are available for reference on the Learning Outcomes website.

1. Critical and Creative Thinking
Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome show evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome.

In addition, Critical and Creative Thinking includes, but is not limited to, the following outcomes: Inquiry and Analysis; Problem Solving; Creativity; and Depth and Breadth of Understanding.

2. Literacy
Literacy is the ability to extract information from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.

In addition, Literacy includes, but is not limited to, the following outcomes: Information Literacy, Quantitative Literacy, Technological Literacy, and Visual Literacy.

3. Global Understanding:
Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.

In addition, Global Understanding includes, but is not limited to, the following outcomes: Global Understanding, Sense of Historical Development, Civic Knowledge and Engagement, and Intercultural Competence.

4. Communicating
Communicating is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communicating also comprises attentiveness and listening, as well as reading comprehension. It includes the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.

In addition, Communicating includes, but is not limited to, the following outcomes: Oral Communication, Written Communication, Reading Comprehension, and Integrative Communication.

5. Professional and Ethical Behaviour
Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organizational and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome.

In addition, Professional and Ethical Behaviour includes, but is not limited to, the following outcomes: Teamwork, Ethical Reasoning, Leadership, and Personal Organization and Time Management
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Bachelor of Science in Agriculture [B.Sc.(Agr.)]
The B.Sc.(Agr.) degree program is a 4 year honours science program designed to provide a fundamental education in the science of agriculture. The curriculum includes courses in the agricultural sciences, the physical, biological and social sciences, and in the arts.

Program Information
Agricultural scientists must be effective communicators and problem solvers, self-directed in their learning, and have a global perspective of the agrifood systems. Students will be involved in co-operative group learning activities and will experience courses that are multidisciplinary and integrate the teaching activities of many faculty and departments.

Students will have the option of completing a broad agricultural program (honours agricultural science) or another major in which they take courses towards a more focused subject area. The curriculum provides opportunities for students to select courses that will help them prepare for professional careers as entrepreneurs, scientists, marketing specialists, financial managers, technical advisors, or communication specialists. Students will have a comprehensive understanding of the food system when they graduate. They will be able to integrate their knowledge of production agriculture, environmental management, resource allocation and business management as it applies to the food system nationally and globally.

Students will be encouraged to integrate their academic program with a well-planned series of employment activities in the summer months and to develop their leadership and interpersonal skills in on-campus and community activities.

Graduates meet the educational requirements for membership in the Ontario Institute of Agrologists. The Ontario Institute of Agrologists is the professional organization in agriculture in the Province of Ontario. Professional institutes in the various provinces in Canada and the scientific societies in agriculture collectively comprise the Agricultural Institute of Canada. The program received full accreditation from the Agricultural Institute of Canada in April 2007.

B.Sc.(Agr.) Majors:
- Animal Science
- Crop, Horticulture and Turfgrass Science
- Honours Agricultural Science

Declaration of a Major
All students are admitted into an undeclared major upon entry. Students will be required to select a major by semester 3 through consultation with the Program Counsellor and Faculty Advisors. The course requirements are listed for each major in the following section.

Students may, with appropriate approvals, elect to complete Minors associated with other degree programs as listed in the undergraduate calendar.

Honours Minor
A minor is a group of courses which provides for exposure to and mastery of the fundamental principles of a subject. A minor consists of a minimum of 5.00 credits (normally 10 courses). It may also require certain other courses from other areas to be taken along with the specified courses of the minor. A minor is taken in conjunction with a major.

A maximum of 2.50 credits required in a major program may be applied to meet the requirements of a minor.

Students should seek advice from the B.Sc.(Agr.) Program Counsellor about the addition of a minor. Students in the B.Sc.(Agr.) are not eligible for a minor in Agriculture.

Study Abroad
The B.Sc.(Agr.) degree program is similar in many respects to programs offered at faculties of agricultural science in other provinces in Canada. Students are strongly encouraged to consider studying for 1 or 2 semesters in other faculties of agricultural science in Canada and in selected countries around the world.

Students interested in studying at another institution should consult the B.Sc.(Agr.) Program Counsellor to discuss their plans, and refer to the scholarship section for financial support.

For more specific information on these opportunities refer to Section V--International Study in this calendar, or contact the OAC Dean's Office.

Doctor of Veterinary Medicine
Students in the B.Sc.(Agr.) program may apply for admission to the D.V.M. program after semester 4 or later. Applications must be submitted to the Admissions Services, Office of Registrarial Services. Students should consult the D.V.M. Section of the calendar. Students who do not gain admission to the D.V.M. program are eligible to continue in the B.Sc.(Agr.) program through to graduation.

Students planning to enter the D.V.M. program are advised to include 12U biology, 12U chemistry, and 12U physics in addition to calculus in secondary school.

Continuation of Study
Students are advised to consult the regulations for continuation of study within the program which are outlined in detail in Section VIII--Undergraduate Degree Regulations & Procedures.

Conditions of Graduation
To qualify for the degree Bachelor of Science (Agriculture), the student must successfully complete a minimum of 20.00 credits as set out in the Schedule of Studies listed below. In addition, students must meet the continuation of study requirements at the time of graduation and have a minimum of 60% cumulative average.

Honours Agriculture (AGRS)
Departments of Plant Agriculture and Animal Biosciences

The Honours Agriculture major combines a core curriculum of agricultural science courses with a wide range of electives focusing on agri-food business, animal and plant production, land stewardship and sustainability. This major allows students to create a curriculum uniquely tailored to their career goals and provides diverse opportunities to explore international agriculture and leading edge agricultural research in animal production, plant biotechnology and pest management. The flexibility provided in semesters 5 and 6 permits students to participate in international exchanges and semesters abroad. Students can also incorporate a variety of field trips, experiential learning in the workplace and independent study into their program of studies. The combination of a solid understanding of life science and current agricultural practice with specialized skills and experience provided by this program is greatly valued by prospective employers in this essential sector of Canada's economy.

Semester 1
- AGR*1110 [1.00] Introduction to the Agri-Food Systems
- BIOL*1050 [0.50] Biology of Plants & Animals in Managed Ecosystems
- CHEM*1040 [0.50] General Chemistry I
- MATH*1080 [0.50] Elements of Calculus I

Semester 2
- AGR*2050 [0.50] Agroecology
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
- CHEM*1050 [0.50] General Chemistry II
- FARE*1400 [1.00] Economics of the Agri-Food System

Semester 3
- AGR*2320 [0.50] Soils in Agroecosystems
- AGR*2350 [0.50] Animal Production Systems, Health and Industry
- AGR*2470 [0.50] Introduction to Plant Agriculture
- FARE*2700 [0.50] Survey of Natural Resource Economics
- MBOG*2400 [0.50] Fundamentals of Plant and Animal Genetics

Semester 4
- ANSC*2340 [0.50] Agroecology
- ENVIS*2340 [0.50] Current Issues in Agriculture and Landscape Management
- STAT*2040 [0.50] Statistics I

1.00 electives or restricted electives

Semester 5 to 8
Students must choose either Option A (Production and Management) or B (Research).

Option A - Production and Management

Semester 5
- FOOD*3090 [0.50] Food Science and Human Nutrition

2.00 electives or restricted electives

Semester 6
- 2.50 electives or restricted electives

Semester 7
- 2.50 electives or restricted electives

Semester 8
- AGR*4600 [1.00] Agriculture and Food Issues Problem Solving

1.50 electives or restricted electives

Restricted Electives - Option A
Students should note that some restricted electives require other courses not included among the required courses for the major as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

• A minimum of 1.00 credits from the list of restricted electives below:

  - AGR*2500 [0.50] Field Course in International Agriculture
  - AGR*3010 [0.50] Special Studies in Agricultural Science I
  - AGR*3450 [0.50] Research Methods in Agricultural Science
  - AGR*3500 [0.50] Experiential Education I
  - ANSC*4010 [0.50] Animal Welfare and Evaluation
  - ANSC*4230 [0.50] Challenges and Opportunities in Dairy Cattle Production
  - ANSC*4610 [0.50] Critical Analysis in Animal Science
  - CROP*4260 [0.50] Crop Science Field Trip
  - EDRD*2020 [0.50] Interpersonal Communication
  - EDRD*3050 [0.50] Agricultural Communication I
  - EDRD*3140 [0.50] Organizational Communication
  - FARE*3310 [0.50] Operations Management

2018-2019 Undergraduate Calendar  
Last Revision: July 18, 2018
A minimum of 2.00 credits from the following list:

- CROP*3300 [0.50] Grain Crops
- CROP*3310 [0.50] Protein and Oilseed Crops
- CROP*3340 [0.50] Managed Grasslands
- ENVS*4090 [0.50] Soil Management
- ENVS*4160 [0.50] Soil and Nutrient Management
- HORT*2450 [0.50] Introduction to Turfgrass Science
- HORT*3150 [0.50] Principles and Applications of Plant Propagation
- HORT*4380 [0.50] Tropical and Sub-Tropical Crops
- PBIO*3110 [0.50] Crop Physiology
- PBIO*3750 [0.50] Plant Tissue Culture

A minimum of 0.50 credits from the following list:

- CROP*2420 [0.50] Weed Science
- ENV*2040 [0.50] Plant Health and the Environment
- ENV*3020 [0.50] Pesticides and the Environment
- ENV*3210 [0.50] Plant Pathology
- ENV*3230 [0.50] Agroforestry Systems

A minimum of 0.50 credits from the following list:

- ACCT*1220 [0.50] Introductory Financial Accounting
- ECON*1050 [0.50] Introductory Microeconomics
- ECON*1100 [0.50] Introductory Macroeconomics
- ECON*2310 [0.50] Intermediate Microeconomics
- FARE*2410 [0.50] Agrifood Markets and Policy
- FARE*3170 [0.50] Cost-Benefit Analysis

Students may also take any of the following courses as restricted electives:

- BIOC*2580 [0.50] Introduction to Biochemistry
- BOT*2100 [0.50] Life Strategies of Plants
- MBG*2040 [0.50] Foundations in Molecular Biology and Genetics
- MBG*3060 [0.50] Quantitative Genetics
- OAGR*2070 [1.00] Introduction to Organic Agriculture

• A minimum of 7.00 credits must be at the 3000 level or higher, of which 5.00 credits must be in agricultural science and of which 3.50 credits must be at the 4000 level.

2. A minimum of 7.00 credits must be at the 3000 level or higher, of which 5.00 credits must be in agricultural science and of which 3.50 credits must be at the 4000 level.

Refer to Program Counsellor for list of agricultural science courses.

3. A humanities or social science courses (0.50 credits) at the 1000-level or above. See Program Counsellor for acceptable list of courses.

### Agriculture (AGR)

#### OAC Dean’s Office

#### Minor (Honours Program)

The requirement of 5.00 credits for the minor is divided into three groups of courses: required courses and two lists of restricted electives. Students should ensure that they obtain the necessary prerequisites for required and restricted elective courses. Students should seek academic counselling from the B.Sc.(Agr) Program Counsellor early in their program. This minor is not open to students in the B.Sc.(Agr) Program.

#### Minor

A minimum of 5.00 credits is required including:

- **AGR**1110 [1.00] Introduction to the Agri-Food Systems

1.50 credits from the following Restricted Elective list:

- **AGR**2050 [0.50] Agroecology
- **AGR**2320 [0.50] Soils in Agroecosystems
- **AGR**2350 [0.50] Animal Production Systems, Health and Industry
- **AGR**2470 [0.50] Introduction to Plant Agriculture
- **AGR**2500 [0.50] Field Course in International Agriculture
- **EDRD**3400 [0.50] Sustainable Communities
- **FARE**1400 [1.00] Economics of the Agri-Food System
- **FOOD**3090 [0.50] Food Science and Human Nutrition

2.50 credits from the following Restricted Elective list, without regard to group:

**Note:** At least 0.50 credits from the following list must be at the 4000 level and 1.00 credits at the 3000 level or higher.

**Agronomy:**

- CROP*3300 [0.50] Grain Crops
- CROP*3310 [0.50] Protein and Oilseed Crops
- CROP*3340 [0.50] Managed Grasslands
- CROP*4220 [0.50] Cropping Systems
- CROP*4240 [0.50] Weed Science
- HORT*4380 [0.50] Tropical and Sub-Tropical Crops
- PBIO*3110 [0.50] Crop Physiology
- PBIO*3750 [0.50] Plant Tissue Culture

**Animal Science:**

- ANSC*1210 [1.00] Principles of Animal Care and Welfare
- ANSC*2330 [0.50] Horse Management Science
- ANSC*2340 [0.50] Structure of Farm Animals
- ANSC*3080 [0.50] Agricultural Animal Physiology
- MBG*2400 [0.50] Fundamentals of Plant and Animal Genetics
- MBG*3060 [0.50] Quantitative Genetics

**Environmental Biology:**

- ENV*2040 [0.50] Plant Health and the Environment
- ENV*3020 [0.50] Pesticides and the Environment
- ENV*3040 [0.50] Natural Chemicals in the Environment
- ENV*3210 [0.50] Plant Pathology
- ENV*4100 [0.50] Integrated Management of Invasive Insect Pests

**Horticultural Science:**

- HORT*3150 [0.50] Principles and Applications of Plant Propagation
- HORT*3280 [0.50] Greenhouse Production
- HORT*4300 [0.50] Postharvest Physiology
- PBIO*3110 [0.50] Crop Physiology
- PBIO*3750 [0.50] Plant Tissue Culture

**Resource Management:**

- ENV*2120 [0.50] Introduction to Environmental Stewardship
- ENV*2030 [0.50] Meteorology and Climatology
- ENV*2340 [0.50] Current Issues in Agriculture and Landscape Management

**Research Methods in Agricultural Science:**

- FARE*1400 [1.00] Economics of the Agri-Food System
- FARE*2410 [0.50] Crop Physiology
- FARE*3170 [0.50] Cost-Benefit Analysis
- FARE*4160 [0.50] Principles of Animal Care and Welfare
- FARE*4350 [0.50] Animal Production Systems, Health and Industry
- FARE*4380 [0.50] Tropical and Sub-Tropical Crops

**Grain Crops**

- CROP*3300 [0.50] Grain Crops
- CROP*3310 [0.50] Protein and Oilseed Crops
- CROP*3340 [0.50] Managed Grasslands
- CROP*4220 [0.50] Cropping Systems
- CROP*4240 [0.50] Weed Science
- HORT*4380 [0.50] Tropical and Sub-Tropical Crops
- PBIO*3110 [0.50] Crop Physiology
- PBIO*3750 [0.50] Plant Tissue Culture

**Protein and Oilseed Crops**

- CROP*3300 [0.50] Grain Crops
- CROP*3310 [0.50] Protein and Oilseed Crops
- CROP*3340 [0.50] Managed Grasslands
- CROP*4220 [0.50] Cropping Systems
- CROP*4240 [0.50] Weed Science
- HORT*4380 [0.50] Tropical and Sub-Tropical Crops
- PBIO*3110 [0.50] Crop Physiology
- PBIO*3750 [0.50] Plant Tissue Culture

**Tropical and Sub-Tropical Crops**

- CROP*3300 [0.50] Grain Crops
- CROP*3310 [0.50] Protein and Oilseed Crops
- CROP*3340 [0.50] Managed Grasslands
- CROP*4220 [0.50] Cropping Systems
- CROP*4240 [0.50] Weed Science
- HORT*4380 [0.50] Tropical and Sub-Tropical Crops
- PBIO*3110 [0.50] Crop Physiology
- PBIO*3750 [0.50] Plant Tissue Culture

**Weed Science**

- CROP*3300 [0.50] Grain Crops
- CROP*3310 [0.50] Protein and Oilseed Crops
- CROP*3340 [0.50] Managed Grasslands
- CROP*4220 [0.50] Cropping Systems
- CROP*4240 [0.50] Weed Science
- HORT*4380 [0.50] Tropical and Sub-Tropical Crops
- PBIO*3110 [0.50] Crop Physiology
- PBIO*3750 [0.50] Plant Tissue Culture
Students may also count the following courses as restricted electives:

- **A ERP*4600** [1.00] Agriculture and Food Issues Problem Solving
- **FA RE*4000** [0.50] Agricultural and Food Policy
- **FA RE*4220** [0.50] Advanced Agribusiness Management

### Animal Science (ANSC)

#### Department of Animal Biosciences

The animal science curriculum is designed to provide a broad opportunity to study animal physiology, nutrition, genetics, behaviour and welfare across a range of large and small domestic animal species. The program is designed around an option to follow a Production and Management focus or a Research focus in semesters 5-8 with additional flexibility to allow for a semester of study abroad.

#### Semester 1

- **AGR*1110** [1.00] Introduction to the Agri-Food Systems
- **B IOL*1050** [0.50] Biology of Plants & Animals in Managed Ecosystems
- **CHE M*1040** [0.50] General Chemistry I
- **MAT H*1080** [0.50] Elements of Calculus I

#### Semester 2

- **AGR*2050** [0.50] Agroecology
- **B IOL*1090** [0.50] Introduction to Molecular and Cellular Biology
- **CHE M*2050** [0.50] General Chemistry II
- **FA RE*1400** [1.00] Economics of the Agri-Food System

#### Semester 3

- **AGR*2320** [0.50] Soils in Agroecosystems
- **AGR*2350** [0.50] Animal Production Systems, Health and Industry
- **AGR*2470** [0.50] Introduction to Plant Agriculture
- **MBG*2400** [0.50] Fundamentals of Plant and Animal Genetics

One of:

- **FA RE*2700** [0.50] Survey of Natural Resource Economics
- **MBG*2040** [0.50] Foundations in Molecular Biology and Genetics

#### Semester 4

- **ANSC*1210** [1.00] Principles of Animal Care and Welfare
- **ANSC*2340** [0.50] Structure of Farm Animals
- **BI OC*2580** [0.50] Introduction to Biochemistry
- **STAT*2040** [0.50] Statistics I

#### Semester 5 to 8

Students must choose either Option A (Production and Management) or B (Research).

#### Option A - Production and Management

#### Semester 5

- **ANSC*3080** [0.50] Agricultural Animal Physiology
- **ANSC*3120** [0.50] Introduction to Animal Nutrition
- **N UTR*3210** [0.50] Fundamentals of Nutrition

1.00 electives or restricted electives

#### Semester 6

- **ANSC*3040** [0.50] Animal Reproduction
- **ANSC*3270** [0.50] Animal Disorders
- **MBG*3060** [0.50] Quantitative Genetics

1.00 electives or restricted electives

#### Semester 7

2.50 electives or restricted electives

#### Semester 8

- **AGR*4600** [1.00] Agriculture and Food Issues Problem Solving

1.50 electives or restricted electives

#### Restricted Electives - Option A

Students should note that some restricted electives require other courses not included among the required courses for the major as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

1. A minimum of 1.00 credits from the list:

- **AGR*2500** [0.50] Field Course in International Agriculture
- **AGR*3010** [0.50] Special Studies in Agricultural Science I
- **AGR*3450** [0.50] Research Methods in Agricultural Science
- **AGR*3500** [0.50] Experiential Education I
- **ANSC*4010** [0.50] Animal Welfare Judging and Evaluation
- **ANSC*4230** [0.50] Challenges and Opportunities in Dairy Cattle Production
- **ANSC*4610** [0.50] Critical Analysis in Animal Science
- **CROP*4260** [0.50] Crop Science Field Trip
- **EDRD*2020** [0.50] Interpersonal Communication
- **EDRD*3050** [0.50] Agricultural Communication I
- **EDRD*3140** [0.50] Organizational Communication
- **FA RE*3310** [0.50] Operations Management
- **FA RE*4220** [0.50] Advanced Agribusiness Management
- **FA RE*4310** [0.50] Resource Economics
- **FA RE*4360** [0.50] Marketing Research
- **FA RE*4550** [0.50] Independent Studies I

2. A minimum of 3.00 credits is required from the following list:

- **ANSC*3170** [0.50] Nutrition of Fish and Crustacea
- **ANSC*3180** [0.50] Wildlife Nutrition
- **ANSC*4260** [0.50] Beef Cattle Nutrition
- **ANSC*4270** [0.50] Dairy Cattle Nutrition
- **ANSC*4280** [0.50] Poultry Nutrition
- **ANSC*4290** [0.50] Swine Nutrition
- **ANSC*4470** [0.50] Animal Metabolism
- **ANSC*4560** [0.50] Pet Nutrition
- **EQN*4020** [0.50] Advanced Equine Nutrition
- **ANSC*4650** [0.50] Comparative Immunology
- **EQN*3050** [0.50] Equine Exercise Physiology

3. A minimum of 7.00 credits must be at the 3000 level or higher, of which 5.00 credits must be in agricultural science and of which 3.50 credits must be at the 4000 level. Refer to Program Counsellor for list of agricultural science courses.

4. A humanities or social science courses (0.50 credits) at the 1000-level or above. See Program Counsellor for acceptable list of courses.

#### Option B - Research

#### Semester 5

- **AGR*3450** [0.50] Research Methods in Agricultural Science
- **ANSC*3080** [0.50] Agricultural Animal Physiology
- **ANSC*3120** [0.50] Introduction to Animal Nutrition
- **N UTR*3210** [0.50] Fundamentals of Nutrition

0.50 electives or restricted electives

#### Semester 6

- **ANSC*3040** [0.50] Animal Reproduction
- **ANSC*3270** [0.50] Animal Disorders
- **MBG*3060** [0.50] Quantitative Genetics

1.00 electives or restricted electives

#### Semester 7

2.50 electives or restricted electives

#### Semester 8

2.50 electives or restricted electives

#### Restricted Electives - Option B

Students should note that some restricted electives require other courses not included among the required courses for the major as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

1. A minimum of 1.00 credits from the following list (normally to be taken during semesters 7 and 8):

- **ANSC*4350** [0.50] Experiments in Animal Biology
- **ANSC*4610** [0.50] Critical Analysis in Animal Science
- **ANSC*4700** [0.50] Research in Animal Biology I
- **ANSC*4710** [0.50] Research in Animal Biology II

2. A minimum of 3.00 credits is required from the following list:

- **ANSC*4050** [0.50] Biotechnology in Animal Science
- **MBG*4020** [0.50] Genetics of Companion Animals
- **MBG*4030** [0.50] Animal Breeding Methods and Applications

A minimum of 1.00 credits from the following list:

- **ANSC*3170** [0.50] Nutrition of Fish and Crustacea
- **ANSC*3180** [0.50] Wildlife Nutrition
- **ANSC*4260** [0.50] Beef Cattle Nutrition
- **ANSC*4270** [0.50] Dairy Cattle Nutrition
- **ANSC*4280** [0.50] Poultry Nutrition
- **ANSC*4290** [0.50] Swine Nutrition
- **ANSC*4470** [0.50] Animal Metabolism
- **ANSC*4560** [0.50] Pet Nutrition
- **EQN*4020** [0.50] Advanced Equine Nutrition
- **ANSC*4650** [0.50] Comparative Immunology
- **EQN*3050** [0.50] Equine Exercise Physiology

2018-2019 Undergraduate Calendar  Last Revision: July 18, 2018
A minimum of 1.00 credits from the following list:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSC*4090</td>
<td>Applied Animal Behaviour</td>
</tr>
<tr>
<td>ANSC*4100</td>
<td>Applied Environmental Physiology and Animal Housing</td>
</tr>
<tr>
<td>ANSC*4499</td>
<td>Applied Endocrinology</td>
</tr>
<tr>
<td>ANSC*4650</td>
<td>Comparative Immunology</td>
</tr>
<tr>
<td>EQN*3050</td>
<td>Equine Exercise Physiology</td>
</tr>
</tbody>
</table>

3. A minimum of 7.00 credits must be at the 3000 level or higher, of which 5.00 credits must be in agricultural science and of which 3.50 credits must be at the 4000 level.

Refer to Program Counsellor for list of agricultural science courses.

4. A humanities or social science courses (0.50 credits) at the 1000-level or above from the College of Arts or College of Social and Applied Human Sciences. See Program Counsellor for acceptable list of courses.

Crop, Horticulture and Turfgrass Sciences (CHAT)

Department of Plant Agriculture

The Crop, Horticultural and Turfgrass Sciences major is for students who want to apply the latest advancements in the biological sciences to contemporary problems in the plant production industries. This major is appropriate for students with a focus on the production of field crops for food, fuel or biomaterials, management of today’s advanced commercial greenhouses, horticultural production, breeding improved crop varieties, or using turfgrass and other plant species to enhance urban environments. The flexibility provided in semester 6 permits students to participate in international exchanges and semesters abroad. Students can also incorporate a variety of field trips, experiential learning in the workplace and independent study into their program of studies.

**Semester 1**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR*1110</td>
<td>Introduction to the Agri-Food Systems</td>
</tr>
<tr>
<td>BIOL*1050</td>
<td>Biology of Plants &amp; Animals in Managed Ecosystems</td>
</tr>
<tr>
<td>CHEM*1040</td>
<td>General Chemistry I</td>
</tr>
<tr>
<td>MATH*1080</td>
<td>Elements of Calculus I</td>
</tr>
</tbody>
</table>

**Semester 2**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR*2050</td>
<td>Agroecology</td>
</tr>
<tr>
<td>BIOL*1090</td>
<td>Introduction to Molecular and Cellular Biology</td>
</tr>
<tr>
<td>CHEM*1050</td>
<td>General Chemistry II</td>
</tr>
<tr>
<td>FARE*1400</td>
<td>Economics of the Agri-Food System</td>
</tr>
</tbody>
</table>

**Semester 3**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR*2320</td>
<td>Soils in Agroecosystems</td>
</tr>
<tr>
<td>AGR*2350</td>
<td>Animal Production Systems, Health and Industry</td>
</tr>
<tr>
<td>AGR*2470</td>
<td>Introduction to Plant Agriculture</td>
</tr>
<tr>
<td>FARE*2700</td>
<td>Survey of Natural Resource Economics</td>
</tr>
<tr>
<td>MBG*2400</td>
<td>Fundamentals of Plant and Animal Genetics</td>
</tr>
</tbody>
</table>

**Semester 4**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC*2580</td>
<td>Introduction to Biochemistry</td>
</tr>
<tr>
<td>BOT*2100</td>
<td>Life Strategies of Plants</td>
</tr>
<tr>
<td>ENVS*2040</td>
<td>Plant Health and the Environment</td>
</tr>
<tr>
<td>STAT*2040</td>
<td>Statistics I</td>
</tr>
</tbody>
</table>

Note: Students who wish to add business courses to their program are advised to take ACCT*1220 in semester 4 and ACCT*2230 in semester 5.

**Semester 5 to 8**

Students must choose either Option A (Production and Management) or B (Research).

**Option A - Production and Management**

**Semester 5**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOOD*3090</td>
<td>Food Science and Human Nutrition</td>
</tr>
</tbody>
</table>

2.00 electives or restricted electives

**Semester 6**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBO*3110</td>
<td>Crop Physiology</td>
</tr>
</tbody>
</table>

2.00 electives or restricted electives

**Semester 7**

One of:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVS*4090</td>
<td>Soil Management</td>
</tr>
<tr>
<td>ENVS*4160</td>
<td>Soil and Nutrient Management</td>
</tr>
</tbody>
</table>

2.00 electives or restricted electives

**Semester 8**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR*4600</td>
<td>Agriculture and Food Issues Problem Solving</td>
</tr>
</tbody>
</table>

1.50 electives or restricted electives

**Restricted Electives - Option A**

Students should note that some restricted electives require other courses not included among the required courses for the major as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

1. A minimum of 1.00 credits from the following list:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR*3010</td>
<td>Special Studies in Agricultural Science I</td>
</tr>
<tr>
<td>AGR*3450</td>
<td>Research Methods in Agricultural Science</td>
</tr>
<tr>
<td>AGR*3500</td>
<td>Experiential Education I</td>
</tr>
<tr>
<td>CROP*4260</td>
<td>Crop Science Field Trip</td>
</tr>
<tr>
<td>EDRD*3050</td>
<td>Agricultural Communication I</td>
</tr>
<tr>
<td>EDRD*3140</td>
<td>Organizational Communication</td>
</tr>
<tr>
<td>FARE*3310</td>
<td>Operations Management</td>
</tr>
<tr>
<td>FARE*4220</td>
<td>Advanced Agribusiness Management</td>
</tr>
<tr>
<td>FARE*4310</td>
<td>Resource Economics</td>
</tr>
<tr>
<td>FARE*4550</td>
<td>Independent Studies I</td>
</tr>
<tr>
<td>MBG*2040</td>
<td>Foundations in Molecular Biology and Genetics</td>
</tr>
<tr>
<td>MBG*3100</td>
<td>Plant Genetics</td>
</tr>
<tr>
<td>MBG*4160</td>
<td>Plant Breeding</td>
</tr>
<tr>
<td>OAGR*2070</td>
<td>Introduction to Organic Agriculture</td>
</tr>
<tr>
<td>OAGR*4050</td>
<td>Design of Organic Production Systems</td>
</tr>
<tr>
<td>PBO*3750</td>
<td>Plant Tissue Culture</td>
</tr>
<tr>
<td>PBO*4070</td>
<td>Biological and Cultural Control of Plant Diseases</td>
</tr>
<tr>
<td>PBO*4750</td>
<td>Genetic Engineering of Plants</td>
</tr>
</tbody>
</table>

**Crop Science:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR*2500</td>
<td>Field Course in International Agriculture</td>
</tr>
<tr>
<td>CROP*3300</td>
<td>Grain Crops</td>
</tr>
<tr>
<td>CROP*3310</td>
<td>Protein and Oilseed Crops</td>
</tr>
<tr>
<td>CROP*3340</td>
<td>Managed Grasslands</td>
</tr>
<tr>
<td>CROP*4220</td>
<td>Cropping Systems</td>
</tr>
<tr>
<td>CROP*4240</td>
<td>Weed Science</td>
</tr>
<tr>
<td>ENVS*2340</td>
<td>Current Issues in Agriculture and Landscape Management</td>
</tr>
<tr>
<td>ENVS*3080</td>
<td>Soil and Water Conservation</td>
</tr>
<tr>
<td>ENVS*3210</td>
<td>Plant Pathology</td>
</tr>
<tr>
<td>ENVS*4100</td>
<td>Integrated Management of Invasive Insect Pests</td>
</tr>
<tr>
<td>HORT*4380</td>
<td>Tropical and Sub-Tropical Crops</td>
</tr>
<tr>
<td>MBG*2040</td>
<td>Foundations in Molecular Biology and Genetics</td>
</tr>
<tr>
<td>MBG*3100</td>
<td>Plant Genetics</td>
</tr>
<tr>
<td>MBG*4160</td>
<td>Plant Breeding</td>
</tr>
<tr>
<td>OAGR*2070</td>
<td>Introduction to Organic Agriculture</td>
</tr>
<tr>
<td>OAGR*4050</td>
<td>Design of Organic Production Systems</td>
</tr>
<tr>
<td>PBO*3750</td>
<td>Plant Tissue Culture</td>
</tr>
<tr>
<td>PBO*4070</td>
<td>Biological and Cultural Control of Plant Diseases</td>
</tr>
<tr>
<td>PBO*4750</td>
<td>Genetic Engineering of Plants</td>
</tr>
</tbody>
</table>

**Horticultural Science:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROP*4240</td>
<td>Weed Science</td>
</tr>
<tr>
<td>ENVS*3210</td>
<td>Plant Pathology</td>
</tr>
<tr>
<td>ENVS*4100</td>
<td>Integrated Management of Invasive Insect Pests</td>
</tr>
<tr>
<td>HORT*2450</td>
<td>Introduction to Turfgrass Science</td>
</tr>
<tr>
<td>HORT*3010</td>
<td>Annual, Perennial and Indoor Plants - Identification and Use</td>
</tr>
<tr>
<td>HORT*3150</td>
<td>Principles and Applications of Plant Propagation</td>
</tr>
<tr>
<td>HORT*3270</td>
<td>Medicinal Plants</td>
</tr>
<tr>
<td>HORT*3310</td>
<td>Greenhouse Production</td>
</tr>
<tr>
<td>HORT*3510</td>
<td>Vegetable Production</td>
</tr>
<tr>
<td>HORT*4300</td>
<td>Postharvest Physiology</td>
</tr>
<tr>
<td>HORT*4420</td>
<td>Fruit Crops</td>
</tr>
<tr>
<td>MBG*2040</td>
<td>Foundations in Molecular Biology and Genetics</td>
</tr>
<tr>
<td>MBG*3100</td>
<td>Plant Genetics</td>
</tr>
<tr>
<td>MBG*4160</td>
<td>Plant Breeding</td>
</tr>
<tr>
<td>PBO*3750</td>
<td>Plant Tissue Culture</td>
</tr>
<tr>
<td>PBO*4070</td>
<td>Biological and Cultural Control of Plant Diseases</td>
</tr>
<tr>
<td>PBO*4750</td>
<td>Genetic Engineering of Plants</td>
</tr>
</tbody>
</table>

**Turfgrass Science:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROP*4240</td>
<td>Weed Science</td>
</tr>
<tr>
<td>ENVS*3020</td>
<td>Pesticides and the Environment</td>
</tr>
<tr>
<td>ENVS*3140</td>
<td>Management of Turfgrass Diseases</td>
</tr>
<tr>
<td>HORT*2450</td>
<td>Introduction to Turfgrass Science</td>
</tr>
<tr>
<td>HORT*3050</td>
<td>Management of Turfgrass Insect Pests and Weeds</td>
</tr>
<tr>
<td>HORT*4200</td>
<td>Plants, the Environment and Society</td>
</tr>
<tr>
<td>HORT*4450</td>
<td>Advanced Turfgrass Science</td>
</tr>
</tbody>
</table>

3. A minimum of 7.00 credits must be at the 3000 level or higher, of which 5.00 credits must be in agricultural science and of which 3.50 credits must be at the 4000 level.

Refer to Program Counsellor for list of agricultural

4. A humanities or social science courses (0.50 credits) at the 1000-level or above from the College of Arts or College of Social and Applied Human Sciences. See Program Counsellor for acceptable list of courses.

**Option B - Research**

**Semester 5**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR*3450</td>
<td>Research Methods in Agricultural Science</td>
</tr>
<tr>
<td>FOOD*3090</td>
<td>Food Science and Human Nutrition</td>
</tr>
</tbody>
</table>

1.50 electives or restricted electives

**Semester 6**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBO*3110</td>
<td>Crop Physiology</td>
</tr>
</tbody>
</table>

2.00 electives or restricted electives
Semester 7

AGR*4450 [1.00] Research Project I

One of:
- ENVS*4090 [0.50] Soil Management
- ENVS*4160 [0.50] Soil and Nutrient Management

1.00 electives or restricted electives

Semester 8

AGR*4460 [1.00] Research Project II

1.50 electives or restricted electives

Restricted Electives - Option B

Students should note that some restricted electives require other courses not included among the required courses for the major as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

1. During semesters 4-8 students must select a minimum of 3.00 credits from the lists of restricted electives below, without regard to group. Courses are organized into three subject areas only to provide guidance to students who wish to concentrate in a particular area of plant agriculture.

Crop Science:
- AGR*2500 [0.50] Field Course in International Agriculture
- CROP*3300 [0.50] Grain Crops
- CROP*3310 [0.50] Protein and Oilseed Crops
- CROP*3340 [0.50] Managed Grasslands
- CROP*4220 [0.50] Cropping Systems
- CROP*4240 [0.50] Weed Science
- ENVS*3240 [0.50] Current Issues in Agriculture and Landscape Management
- ENVS*3080 [0.50] Soil and Water Conservation
- ENVS*3210 [0.50] Plant Pathology
- ENVS*4100 [0.50] Integrated Management of Invasive Insect Pests
- HORT*4380 [0.50] Tropical and Sub-Tropical Crops
- MBG*2040 [0.50] Foundations in Molecular Biology and Genetics
- MBG*3100 [0.50] Plant Genetics
- MBG*4160 [0.50] Plant Breeding
- OAGR*2070 [1.00] Introduction to Organic Agriculture
- OAGR*4050 [1.00] Design of Organic Production Systems
- PBIO*3750 [0.50] Plant Tissue Culture
- PBIO*4070 [0.50] Biological and Cultural Control of Plant Diseases
- PBIO*4750 [0.50] Genetic Engineering of Plants

Horticultural Science:
- CROP*4240 [0.50] Weed Science
- ENVS*3210 [0.50] Plant Pathology
- ENVS*4100 [0.50] Integrated Management of Invasive Insect Pests
- HORT*2450 [0.50] Introduction to Turfgrass Science
- HORT*3010 [0.50] Annual, Perennial and Indoor Plants - Identification and Use
- HORT*3150 [0.50] Principles and Applications of Plant Propagation
- HORT*3270 [0.50] Medicinal Plants
- HORT*3280 [0.50] Greenhouse Production
- HORT*3310 [0.50] Plants, Food and Health
- HORT*3510 [0.50] Vegetable Production
- HORT*4300 [0.50] Postharvest Physiology
- HORT*4420 [0.50] Fruit Crops
- MBG*2040 [0.50] Foundations in Molecular Biology and Genetics
- MBG*3100 [0.50] Plant Genetics
- MBG*4160 [0.50] Plant Breeding
- PBIO*3750 [0.50] Plant Tissue Culture
- PBIO*4070 [0.50] Biological and Cultural Control of Plant Diseases
- PBIO*4750 [0.50] Genetic Engineering of Plants

Turfgrass Science:
- CROP*4240 [0.50] Weed Science
- ENVS*3020 [0.50] Pesticides and the Environment
- ENVS*3140 [0.50] Management of Turfgrass Diseases
- HORT*2450 [0.50] Introduction to Turfgrass Science
- HORT*3050 [0.50] Management of Turfgrass Insect Pests and Weeds
- HORT*4200 [0.50] Plants, the Environment and Society
- HORT*4450 [0.50] Advanced Turfgrass Science

2. A minimum of 7.00 credits must be at the 3000 level or higher, of which 5.00 credits must be in agricultural science and of which 3.50 credits must be at the 4000 level. Refer to the Program Counsellor for the list of agricultural science courses.

3. A humanities or social science courses (0.50 credits) at the 1000-level or above from the College of Arts or College of Social and Applied Human Sciences. See Program Counsellor for acceptable list of courses.

Business Electives:

Students in either Option A or Option B who wish to add business courses to their program are advised to select courses from the following list:

- FARE*3310 [0.50] Operations Management
- FARE*4220 [0.50] Advanced Agribusiness Management
- FARE*4240 [0.50] Futures and Options Markets
- FARE*4370 [0.50] Food & Agri Marketing Management
- MGMT*3320 [0.50] Financial Management

2018-2019 Undergraduate Calendar  
Last Revision: July 18, 2018