

# College of Agricultural Sciences and Natural Resources

## College Administration

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The College of Agricultural Sciences and Natural Resources (CASNR) is the academic unit of the Division of Agricultural Sciences and Natural Resources, and offers outstanding undergraduate and graduate programs that are recognized at the state, regional, national and international levels. In collaboration with the Oklahoma Cooperative Extension Service (OCES) and the Oklahoma Agricultural Experiment Station (OAES), CASNR faculty provide great breadth and exceptional quality in teaching, advising, research, extension and service.

CASNR's academic programs prepare students to analyze information, communicate effectively, think critically, problem solve, and assume leadership roles in their respective fields of study. Students also receive a solid general education in communications, humanities and social sciences. In agriculture or natural resources, the graduate will have an opportunity for a rewarding career that will last as long as food is consumed, fiber is grown, and soil, water and wildlife resources are valued.

Career opportunities in Agricultural Sciences and Natural Resources are highly diverse. Majors are supported in traditional agricultural and natural resource areas such as animal science, agricultural business, soil science, range science, entomology and agricultural education, in addition to emerging areas such as plant and animal biotechnology, food science, natural resource management and agricultural communications. CASNR's programs also include many fields not commonly associated with agriculture such as landscape architecture, turf management, biochemistry, environmental science, leadership and pre-medical sciences. CASNR students come from both traditional agricultural roots and urban settings. This diversity adds strength to the college experience for all CASNR students. Active international programs, including study abroad opportunities, are available to students in every CASNR major and add a unique dimension to the college experience.

## Accreditation

Agricultural Sciences and Natural Resources include broad and diverse professions and do not have a single accrediting society as do some other professions. Programs in agricultural education, agricultural engineering, forestry, landscape architecture and landscape management are accredited by their professional organizations.

## Academic Programs

**Undergraduate Programs.** The Bachelor of Science in Agricultural Sciences and Natural Resources degree is offered in the following major fields of study: agribusiness, agricultural communications, agricultural economics, agricultural education, agricultural leadership, animal science, biochemistry and molecular biology, entomology, environmental science, food science, horticulture, landscape management, natural resource ecology and management, and plant and soil sciences. The Bachelor of Landscape Architecture is also offered in the College of Agricultural Sciences and Natural Resources. Most departments offer one or more minors. The requirements for the minors are available from the department offering the specified minor.

**Graduate Programs.** Graduate study is available in all CASNR academic departments and in the multidisciplinary international agriculture program. In addition to the Master of Agriculture and Master of Science degrees that may be obtained through several departments, the Doctor of Philosophy degree (PhD) may be earned in the following areas: agricultural economics, agricultural education, biosystems engineering, animal science, biochemistry and molecular biology, crop science, entomology, food science, plant pathology, soil science, natural resource ecology and management and in horticulture through interdisciplinary programs in crop science, environmental science, and plant science.

## High School Preparation and Admission Requirements

The high school preparation and admission requirements for the College are the same as the general University requirements.

## Transfer Students

Students who transfer from an accredited college or two-year college must meet the general University admission requirements. All transferred courses are recorded on the OSU transcript; however, a minimum of 60 credit hours must be earned at a senior college (baccalaureate degree-granting institution) to meet the College's degree requirements. Credits will be accepted by transfer from a community college to meet lower-division (i.e., 1000- and 2000-level courses) requirements only. Specific departmental requirements needed for graduation are determined by the department in which the student plans to earn his or her degree.

## Scholarships

Students enrolled and entering the College of Agricultural Sciences and Natural Resources are annually awarded over 1.4 million dollars in scholarships by the College and its departments. The following areas are considered in the awarding of scholarships: scholastic standing in high school or college; leadership qualities; financial need and sincere interest in the various agricultural disciplines.

Additional information may be obtained from the office of the associate dean, College of Agricultural Sciences and Natural Resources, Oklahoma State University, 136 Agriculture Hall, Stillwater, OK 74078. Applications are available at [casnr.okstate.edu](http://casnr.okstate.edu).

## Student Success Center

The College of Agricultural Sciences and Natural Resources Student Success Center (SSC) helps students with educational, career and personal goals. The SSC provides important services, programs and student support including Student Academic Mentors, Ambassadors, Career Liaisons, Freshmen in Transition, Success Coaches for Outstanding Transfer Students, Career Services, Prospective Student Services, assistance with tutoring or other services, and liaison to the OSU Writing Center, Mathematics Learning Resource Center and the Learning and Student Success Opportunity Center.

## Academic Advising

All students in the College have the advantage of being advised by a faculty member working in the individual student's academic discipline. Academic advisers are readily available to students and work closely with the students throughout their academic careers.

## Special Academic Programs

**Honors Program.** The Honors College through the College of Agricultural Sciences and Natural Resources is designed to provide outstanding students with opportunities to pursue new challenges and academic excellence. Honors courses, seminars, and special honors contracts provide for discussions and independent study by students who have the desire and ability to explore academic subjects beyond the normal class work material. Honors awards available in the College are:

1. General Education Honors.
2. Departmental Honors.
3. The bachelor's degree, with honors.

Awards (1) and (2) may each be earned independently of one another. Award (3) is earned by satisfying the requirements of both (1) and (2). The completion of each award is noted on the student's transcript. Students who complete all three receive the bachelor's degree with honors diploma.

For eligibility requirement information for new freshman, transfer, and current OSU students, please refer to the Honors College section of the catalog. Online information is available at <http://honors.okstate.edu>.

**Pre-Veterinary Medicine Curriculum.** Specific pre-veterinary science majors in agribusiness, animal science, biochemistry and molecular biology, entomology, and natural resources and ecology management as offered in the College of Agricultural Sciences and Natural Resources, include all courses required for admission to the Center for Veterinary Health Sciences.

Although the pre-veterinary course requirements may be completed within two years, most pre-veterinary medicine students complete at least three years of preparatory course work or a bachelor's degree. For more information on application requirements, refer to the "Center for Veterinary Health Sciences"

section in the *Catalog* and the current brochure, OSU Veterinary Medicine Admission Requirements.

### General Education Requirements

The College of Agricultural Sciences and Natural Resources is committed to providing graduates both a depth of knowledge in their chosen field of study as well as breadth of knowledge outside their major. General education requirements are the same as those of the general University. Specific course offerings are given in the respective plans of study.

### Graduation Requirements

General University requirements for graduation are stated elsewhere in the *Catalog*. In addition, specific requirements must be met for the Bachelor of Science in Agricultural Sciences and Natural Resources and Bachelor of Landscape Architecture degrees. For the BS degree, the required total semester credit hours vary by department, major and option. A minimum of 40 semester credit hours and 100 grade-points must be earned in courses numbered 3000 or above. The Bachelor of Landscape Architecture is a five-year program requiring 150 credit hours.

### College and Departmental Clubs, Organizations and Honor Societies

Agricultural Communicators of Tomorrow  
 Agricultural Economics Graduate Student Association  
 Aggie-X Club  
 Agronomy Club  
 Alpha Epsilon  
 Alpha Tau Alpha (Agricultural Education Honor Society)  
 Alpha Zeta (College Honor Society)  
 American Fisheries Society  
 American Society of Agricultural & Biological Engineers  
 American Society of Landscape Architects  
 Biochemistry Club  
 Biochemistry & Molecular Biology Graduate Student Association  
 Block and Bridle Club  
 CASNR Ambassadors  
 CASNR Career Liaisons  
 CASNR Student Council  
 Collegiate Farm Bureau  
 Collegiate 4-H  
 Collegiate FFA/ATA  
 Cowboy Motorsports  
 Cowboys for Christ  
 Dairy Science Club  
 Environmental Science Club  
 Food Industry Club  
 Freshmen in Transition  
 Horseman's Association  
 Horticulture Club  
 Landscape Management Club  
 Meat Science Association  
 Minorities in Agriculture, Natural Resources and Related Sciences  
 Oklahoma Collegiate Cattlemen  
 Oklahoma Collegiate Cattlewomen  
 Pi Alpha Xi  
 Plant and Soil Sciences Graduate Student Organization  
 Pre-Veterinary Science Club  
 Rodeo Association  
 Sanborn Entomology Club  
 Sigma Lambda Alpha (Landscape Architecture Honor Society)  
 Society of American Foresters/Forestry Club  
 Society for Range Management  
 Soil and Water Conservation Society  
 Student Organization for International Agriculture  
 Swine Club  
 Turf Club  
 Wildlife Society  
 Xi Sigma Pi (Forestry Honor Society)

### Agricultural Communications

Robert Terry, Jr., PhD—Professor and Head

Modern agriculture, with its diversity and specialization, requires accurate communication between industry leaders and the public. Education in agricultural communications prepares students to provide the necessary communications link mixing the most current media platforms with traditional principles.

By majoring in agricultural communications, students gain communications education with industry specific classes in advertising and public relations, Web design, magazine writing and production, radio and television broadcasting, photography, reporting and newswriting, or research report writing. Opportunities also are available for the student to develop a double-major program with other departments in the College of Agricultural Sciences and Natural Resources.

For the graduate with a bachelor's degree in agricultural communications, career opportunities are abundant in the agricultural production industry and in service organizations as well as with publishing firms, broadcast stations, trade publications or related media.

### Graduate Programs

The Master of Science degree in agricultural communications is designed to build mastery of knowledge in key areas such as communication theory, history, philosophy, technology, advanced communication skills and research and data analysis. The Master of Science degree in agricultural communications reflects the distinctive body of knowledge, research base, professional delivery and program focus of the discipline. In addition, the program introduces and requires students to apply research tools and methods.

The Master of Science program serves two primary purposes: (a) encouraging mastery of discipline-specific knowledge with an introduction to research and data analysis and (b) offering discipline-specific knowledge with professional application to the work setting.

The Master of Science program offers students two options for completion of the degree: thesis option and formal report option. The thesis option requires 30 approved credit hours of course work, which includes a six credit hour formal thesis following the graduate college format. The formal report option requires 32 approved semester credit hours of course work, which includes a two credit hour formal report.

Students applying for the Master of Science program without a background in the appropriate option will be expected to complete course work to bring their preparation to an acceptable level.

**Admission Requirements.** All students accepted into the agricultural communications Master of Science degree program will be expected to meet all University and Graduate College requirements and to have earned a degree in agricultural communications or related field from an accredited university. Applicants from outside agricultural communications will be required to complete prerequisite courses equivalent to the knowledge and competencies expected in the agricultural communications undergraduate program.

An undergraduate grade point average of 2.80 overall on a 4.00 scale or 3.00 in the last 30 hours is required. The applicant must complete the Graduate Record Examination, submit a statement of goals for pursuing the master's degree, and submit letters of reference from at least three people knowledgeable of the applicant's professional qualifications. These references should include statements relating to (a) the applicant's success in professional settings or commitment to professions allied with the disciplines in the College of Agricultural Sciences and Natural Resources, (b) the applicant's prior academic record as a reflection of ability to succeed in a Master of Science program, and (c) the applicant's potential for success in research, writing and course work at the Master of Science level. If such references are not available, the applicant should submit references from one or more faculty members familiar with the applicant's academic career. Other references should be from individuals capable of addressing the applicant's ability to successfully complete a Master of Science program.

**Review Process for Admission.** The Office of the Associate Dean of Graduate Studies manages all procedures and records pertinent to admission. The admission process is ongoing with admission recommendations rendered by the graduate faculty in the department. To be eligible for committee review, each applicant must submit an application for admission to the Graduate College, transcripts of all academic records, reference letters, goal statement and GRE scores.

### Agricultural Economics

Mike Woods, PhD—Professor and Head

The Department of Agricultural Economics at Oklahoma State University offers programs of study leading to the BS, MS, MAg and PhD degrees in Agricultural Economics and the BS and MAg degree in Agribusiness. Agricultural economics and agribusiness curricula study the economic relationships among individuals, firms and service agencies in agriculture and between the agricultural sector and other sectors of the economy. The department's courses emphasize the economic issues and concepts associated with producing, processing, marketing, and consuming agricultural goods and services and those used in the industry.

Undergraduate programs in Agricultural Economics and Agribusiness combine instruction in technical agricultural sciences with education in the application of economic and business management principles and tools. The agricultural economist or agribusiness person draws upon the physical and social sciences to outline, understand, and solve economic problems created by agriculture's dynamic operating environment. Curricula in the Department of Agricultural Economics emphasize the decision-making and problem-solving skills used in the management of agricultural production and marketing firms.

Study in agricultural economics or agribusiness prepares students to excel in many challenging careers. Many graduates work to improve food production and processing throughout the world. Other graduates work with government policies that affect the food and fiber sector. Others assist rural communities to adjust and thrive in the rapidly changing world. Graduates also help protect and maintain natural resources and the environment for the greatest benefit of

society. Many graduates choose career paths that lead them far from the farm; and others choose to return to family businesses.

**Agricultural Economics.** The Agricultural Economics BS degree trains students to analyze problems and make decisions using a solid framework of economic and business principles. Students may tailor study to a wide variety of career interests. The base Agricultural Economics degree plan offers specializations in Quantitative Studies, Environmental and Natural Resources, and Community and Regional Analysis. The Agricultural Economics BS degree student can also choose a double major with Accounting. Each of the study plans in Agricultural Economics equips students for a variety of employment opportunities at competitive salaries in private industry and government agencies.

**Agribusiness.** Like the Agricultural Economics degree, the Agribusiness BS degree trains students to analyze problems and make decisions using a solid framework of economic and business principles. In addition, the agribusiness degree targets the skills needed for careers in agribusiness firms, including all areas of food and fiber production, processing, and marketing. Students may choose from six degree options: Farm and Ranch Management, Crop and Soil Science, International, Pre-Law, Pre-Veterinary Business Management or a double major with Agricultural Communications. Agribusiness students also may develop a minor area of study or a double major by selecting various course electives. Employment opportunities for agribusiness graduates are widely diverse, including jobs with farms, agricultural advisers, processing firms, wholesalers and retailers of food and fiber products, farm input supply firms, banks and other financial services firms, utilities and educational institutions.

**Minor in Agricultural Economics and Agribusiness.** The minor helps students understand the basics of economics and business within the context of Agricultural Sciences and Natural Resources. Requirements of the minor include an introduction to Agricultural Economics or Microeconomics and Financial Accounting or Agribusiness Accounting and Taxation plus 15 hours controlled electives of upper division Agricultural Economics courses.

**Minor in Environmental Economics, Politics and Policy.** This minor offered in cooperation with Political Science helps students understand economic, politics and policy issues related to environmental issues. Requirements of the minor include an introduction to Agricultural Economics or Microeconomics, a 3000 level environmental economics course, Environmental Economics and Resource Development and 12 hours controlled electives from related upper division courses.

#### Graduate Programs

The department offers graduate work leading to the Master of Science, the Master of Agriculture and the Doctor of Philosophy degrees. Both thesis and non-thesis options are available at the MS level. PhD students complete a teaching practicum in addition to the research thesis as a part of the degree requirements.

The graduate program stresses development of superior professional competence, suited to the demands of the modern business, academic, government and research environments. Advanced courses concentrate on economic analysis applied to problems of production, distribution and consumption of agricultural products. Courses in economic theory, econometrics, mathematical programming, and statistics are an integral part of the program. Primary data analysis, natural resource use, international trade, planning, policy, and development are also important topics included in graduate courses.

The faculty provide direction and individual guidance to student research in marketing, production, management of agricultural enterprises, demand and price analysis, land and water use and development, non-market valuation, rural development and planning, agricultural finance, international trade, farm appraisal, agricultural policy, econometrics, and experimental economics. Students specialize through course electives and research topics. In addition, an advisory committee guides each student in preparing the program of study to ensure that the student's background, graduate course work, and research program together lead to the desired depth and breadth of proficiency.

**Admission Requirements.** Prerequisites to advanced training in agricultural economics are (1) the desire to understand and solve the complex and changing economic problems faced by agriculture and rural society, and (2) the desire and ability to learn methods of rigorous logical analysis.

In addition, differential calculus, statistics, and intermediate macro- and microeconomic theory constitute a minimum background for advanced study in agricultural economics. In certain cases, a student can take part of this work after admission but the work will not count towards a graduate degree.

Acceptance by an adviser in the department is not required prior to admission to the departmental graduate program. GRE test scores are required for admission to the program.

#### Agricultural Education

Robert Terry, Jr., PhD—Professor and Head

The programs of study offered in Agricultural Education are designed to provide both comprehensive and specialized training to prepare graduates for careers in a wide range of fields of agriculture. In addition to being prepared for licensure

as teachers, graduates are professionally prepared for work in cooperative extension and other federal and state programs and services, as well as international education endeavors. Graduates also may find employment as educational directors and consultants with agribusiness firms and organizations. Studies may culminate in the BS, MAG, MS or PhD degrees. The Agricultural Education program is accredited by the Council for the Accreditation of Educator Preparation (CAEP).

The undergraduate teaching option is designed to qualify the bachelor's degree recipient for the Oklahoma Agricultural Education Teaching License. This license is recognized as meeting requirements for initial employment as a teacher in most states. Graduates look forward to careers ranging from Agricultural Education teacher and Cooperative Extension Educator to agricultural sales, marketing and production positions. Some students find it advantageous to elect a dual major i.e., Animal Science/Agricultural Education or Agricultural Education/Agricultural Communications, thus meeting requirements in both Agricultural Education and another major within the College of Agricultural Sciences and Natural Resources. The undergraduate Agricultural Education major is structured to provide educational experiences in general education, agriculture and professional education.

#### Graduate Programs

Graduate programs in Agricultural Education are designed to (1) prepare students for entry into or advancement in teaching careers and (2) provide for further development of professional leadership skills for other educational careers in agriculture, agribusiness, government service, extension, or adult education. To meet the needs of both international and domestic students, plans of study are developed for academic excellence specific to students' career goals. The selection and organization of courses are made in consultation with the adviser and the student's advisory committee.

The Master of Science develops the theoretical and research foundation for advanced graduate studies in addition to further knowledge and skills in agriculture and education. It is designed primarily for those students interested in research. Two options are offered in the Master of Science program. The thesis option requires 30 approved credit hours of course work, which includes a six-credit-hour formal thesis following the graduate college format. The formal report option requires 32 approved semester hours of course work, which includes a two-credit hour formal report.

The Doctor of Philosophy program is designed to prepare graduates for careers in professional education, supervision, administration, curriculum development and other areas of professional leadership in Agriculture, Agricultural Extension, Career and Technology, and Agricultural Communications. Within the minimum 60 credit hour requirement, 15 credit hours must be completed in Agricultural Education. In addition, 15 credit hours must be completed in an area of specialization such as Agricultural Extension, Technical Agriculture, Educational Administration, or other similar areas. The additional hours include 15 hours of research design and statistics and 15 hours for the dissertation.

**Admission Requirements.** Students seeking admission to the master's degree program must have earned a bachelor's degree in Agricultural Education, Agriculture or Education. A student with background deficiencies must compensate for such deficiencies before completing the masters degree. Evidence of academic ability (2.80 GPA or above) in undergraduate course work is required. Three letters of reference and a statement of purpose are also required. Graduate Record Exam (GRE) scores are required for students seeking admission to the Master of Science degree program.

Admission to the doctoral degree program is based upon evidence that the applicant meets the general requirements of the Graduate College, has demonstrated superior achievement, and can successfully complete a doctoral program as evidenced by three letters of recommendation, GRE scores, a minimum of 2.80 undergraduate grade-point average and 3.00 graduate grade-point average, three years of successful professional experience, and a philosophy statement and goals. Alternative criteria may be considered by the graduate committee for those who submit ample supportive evidence of other exemplary qualifications.

#### Agricultural Leadership

Robert Terry, Jr., PhD—Professor and Head

The Agricultural Leadership curriculum is guided by five core values: commitment to agriculture, authentic leadership, diversity, critical thinking and professionalism. Agricultural leadership faculty align course objectives, learning opportunities and student experiences with the five core values. Beginning students study historical and theoretical foundations in leadership, authentic leadership and transformational leadership before exploring contemporary leadership issues, leadership program facilitation and current scholarship in the discipline. Specific topics within course work include leadership styles, power, decision-making, ethical leadership, motivational theories and team processes.

In addition to leadership course work, the curriculum provides a broad introduction to the agricultural sciences and natural resources and allows students to develop an area of emphasis or pursue a minor in areas such as Animal Science, Soil Science or Agricultural Economics.

**Minor in Leadership Education.** The minor is designed to prepare students to serve as leadership educators within the context of their chosen major. Students explore career options in leadership education, develop an understanding of

their own leadership style and philosophy, acquire knowledge about leadership theories, explore contemporary issues in leadership, evaluate current leadership research and learn to design and facilitate leadership training. Requirements of the minor include 17 hours of leadership course work, including six hours of controlled electives.

#### Graduate Programs

Students may pursue graduate studies in agricultural leadership through the Master of Agriculture in Agricultural Leadership or the department's Doctor of Philosophy or Master of Science in agricultural education. The Master of Agriculture degree in Agricultural Leadership is an advanced studies program for practitioners seeking to develop their knowledge related to leadership and its application to the agricultural industry. Graduates pursue careers in extension, government, corporate agriculture, and human resources and training. The Master of Agriculture program requires 32 approved semester hours of course work including a 17 hour area of emphasis. Graduate course work in agricultural leadership includes leadership theory and practice, developments in agricultural and extension education, and a creative component. More information on graduate studies in Agricultural Leadership is available under Agricultural Education graduate programs.

#### Agriculture

Cynda R. Clary, PhD—Professor and Associate Dean

#### Graduate Programs

The Master of Agriculture degree is designed for students interested in graduate professional training. The degree is offered with specializations in: Agribusiness and Agricultural Leadership.

**Purpose.** The purpose of this degree is to provide a program which will give additional specialization in technical fields, as well as increased breadth of training. Students who are interested in working toward the PhD degree will generally follow the regular Master of Science degree program.

**Character of Program.** This program provides a greater breadth of study than the Master of Science program. Emphasis is on practical application of the technical aspects of the discipline as well as discipline interrelationships. In some areas of specialization, the focus is on an applied research concept and a broader program of study than is normally available with the specialized research degree.

**Admission Requirements.** A baccalaureate degree in Agriculture or a related field is required for admission. The candidate must meet requirements for acceptance into the Graduate College and be recommended by the departmental graduate committee responsible for the program.

**Degree Requirements.** The requirements for this degree are the same as those listed in the *Catalog*, "Graduate College" section, under "The Master's Degree."

In addition, each candidate approved for study under this program will be assigned an adviser and advisory committee with whom he or she will develop a plan of study in accordance with guidelines and requirements established in the department responsible for the program.

#### Animal Science

Clint Rusk, PhD—Professor and Head

Animal science focuses on the science, art and business of the production of beef cattle, dairy cattle, horses, poultry, sheep, goats, swine and pet/companion animals. An animal scientist is concerned with the application of the principles of the biological, physical and social sciences to the problems associated with domestic animal production and management.

Animal science is also concerned with food production. The food industry is one of the largest and most important industries in the United States. Food scientists are concerned with the processing, safety, quality control and marketing of food.

Undergraduate students may elect to pursue a Bachelor of Science degree in the department by majoring in either animal science or food science. Internship programs providing one to six months of off-campus work experience are available in all animal science options and are part of the curriculum for food science. Participation in undergraduate organizations (Animal Science Leadership Alliance, Block and Bridle, Dairy Science, Horsemen's Association, Food Science Club, Meat Science Association, Oklahoma Collegiate Cattlewomen, Oklahoma Collegiate Cattlemen, Pre-Vet Club), judging teams (livestock, meats, horses, or dairy cattle) and academic programs (honors, undergraduate research scholars, and academic quadrathlon) improves social, communication, leadership and academic skills and abilities.

**Animal Science.** Undergraduate students may elect study emphasis programs in the areas of Animal Biotechnology, Business, Livestock Merchandising, Pre-Veterinary Animal Science, Production, and Ranch Operations, or a double major with Agricultural Communications or with Agricultural Education. In addition, students have the opportunity to concentrate their studies on one or more animal species.

Students interested in veterinary medicine may complete the pre-veterinary medicine requirements at the same time they are working toward a BS degree in animal science. In addition, pre-vet students gain valuable insight into the care and management of animals throughout the Animal Science curriculum.

Undergraduate students follow a similar curriculum during the first two years which includes basic courses in the physical, biological and social sciences,

and a series of introductory courses in agriculture and business. Upper-class students take a basic core of advanced animal science courses, including genetics, reproductive physiology, and nutrition. As seniors, students complete a series of advanced animal science courses which are designed to apply knowledge obtained in previous courses to livestock systems. Every opportunity is taken in teaching to utilize the excellent herds and flocks owned or operated by the department.

Students completing a degree with a major in Animal Science have a wide choice of challenging careers, including ownership or management of farms, ranches, feedlots; employment with state and federal agencies concerned with inspection, grading or regulation; banking and financial activities, sales and service positions with companies involved with feeds, pharmaceuticals or other animal products; biotechnology; opportunities in Agricultural Extension or teaching; and work in the processing, distributing and merchandising of dairy, poultry and meat products.

**Minor in Animal Science.** The minor is designed to give students the core courses in Animal Science to supplement their chosen major. Animal Science coursework required for the minor will provide students with the knowledge to be competitive and succeed in the animal agriculture industry. The requirements include ANSI 1124; Introduction to Animal Science and 18 additional hours of core Animal Science courses that the student can select to personalize their programs. The basic core of advanced Animal Science courses include genetics, reproductive physiology, and nutrition. Students can then complete a series of advanced animal science courses designed to apply knowledge obtained in previous courses to animal systems.

**Food Science.** Food science is an applied field. A food scientist is someone who applies the basic sciences: biology, physics, chemistry, and mathematics to further our understanding of the factors that affect food quality, safety, and nutrition. Food science is applied to the selection, preservation, processing, packaging, distribution, and use of safe, nutritious, and wholesome foods.

There are four study emphasis programs in the food science major: Science, Industry, Meat Science and Food Safety.

The Science emphasis gives students a well-grounded background in chemistry, physics, mathematics and biology as well as food science. Students who elect this option usually have a primary interest in science and will be prepared to enter graduate education programs in food science.

This Science emphasis is also an excellent choice for students interested in professional schools such as medical school, dental school, pharmacy, physical therapy and veterinary medicine. Students who elect not to pursue a graduate degree or a professional degree are prepared to work in any facet of the food industry, especially those jobs focused on research, product development and food analysis.

The Industry emphasis provides a basic understanding of the chemical and physical processes of food processing. Students pursuing this option are prepared to enter food plant management, quality assurance, quality control, product development and sales.

The Meat Science emphasis provides a background knowledge and understanding in live animal production, slaughter and fabrication, and meat processing along with a basic understanding of chemical and physical processes of meat production. Students pursuing this option are prepared to enter the meat industry working in quality assurance, slaughter/fabrication, meat processing, product development and sales.

The Food Safety emphasis provides knowledge and experience in food safety issues and practices affecting all sectors of the food industry from production agriculture to wholesale and retail distribution channels. Students pursuing this option are prepared to enter the food industry with expertise in food safety programs, auditing, and quality assurance.

**Minor in Food Science.** The minor includes the core courses in Food Science. Requirements include FDSC 1133 – Introduction to Food Science and 18 additional hours of core Food Sciences courses that the student can select from to personalize their programs. The basic core of food science courses include food chemistry, food microbiology, quality control, and food analysis, as well as meat science courses for students interested in the meat industry or dairy and dairy products courses for students interested in the dairy industry. Students can complete their program with advanced courses in these areas.

**Graduate Programs.** The Department of Animal Science offers programs leading to the Doctor of Philosophy or Master of Science degree in Animal Science and contributes to the interdepartmental food science graduate program. Research areas of emphasis are available in Animal Breeding (quantitative and molecular genetics), Animal Behavior, Animal Nutrition, Grazing Livestock, Nutrition and Management, Immunology, Animal Reproduction and Physiology, Animal Biotechnology, and Meat Science.

**Prerequisites.** Admission to the graduate program requires an undergraduate major in Animal Science, Dairy Science or Poultry Science, or in closely-related biological sciences or biochemistry. In addition, students with a major in Dairy Manufacturing, Microbiology, Human Nutrition, Food Science, or Food Technology can qualify for the program in Food Science. A student enrolling in a degree program must have been accepted by an adviser prior to official admission. In all cases, the student's graduate adviser or committee may recognize specific undergraduate deficiencies and require measures to attain proficiency.

## Biochemistry and Molecular Biology

John E. Gustafson, PhD—Professor and Head

Biochemistry, the central scientific discipline linking the chemical, physical and biological sciences, exerts a profound influence on the progress of medicine and agriculture. By applying concepts and methods of chemistry and physics to the fundamental problems of biology, biochemists have made great progress in their effort to understand the chemistry of living organisms. Major discoveries concerning the biochemistry of genetic material provide the tools of molecular biology that are essential to contemporary life sciences research.

Biochemists and molecular biologists are concerned with living things and thus, must be fluent in the concepts of biological sciences. Since a biochemist's tools include many techniques derived from the physical sciences, he or she must receive sound education in mathematics, physics and chemistry. Our academic programs are designed to integrate these disciplines, preparing students for a wide range of professional careers.

Challenging positions for well-trained biochemists and molecular biologists are available in colleges and universities, state and federal laboratories, research institutes, medical centers and in an increasing number of industrial organizations, particularly the pharmaceutical and food industries. Biochemists are involved with research on the chemistry of processes occurring in plants, animals, and various microorganisms, and with the discovery and development of antibiotics, vitamins, hormones, enzymes, insecticides and molecular genetics techniques.

The Department of Biochemistry and Molecular Biology administers two BS degree options in Biochemistry and Molecular Biology through the College of Agricultural Sciences and Natural Resources, and a BS degree in Biochemistry through the College of Arts and Sciences. In 2016, the two BS degree options administered through the College of Agricultural Sciences and Natural Resources became accredited by the American Society of Biochemistry and Molecular Biology. This provides students taking these degree options an opportunity to take the American Society of Biochemistry and Molecular Biology certification exam. An honors program is available in all three degree plans. Also available is a 4+1 Year Masters by Coursework program. The undergraduate curriculum provides a broad background in chemistry and the biological sciences and permits flexibility to meet particular interests of the student. Courses in biochemistry are based on general, organic and analytical chemistry. The undergraduate curriculum also provides students with sufficient background in the basic sciences of mathematics, physics, chemistry and biology needed for graduate study in most disciplines of contemporary science of agriculture or medicine and other allied health subjects, and is excellent for pre-professional students. The Department's research activities provide opportunities for part-time employment of undergraduate majors to improve their professional competence.

**Minor in Biochemistry and Molecular Biology.** This minor is designed to give students a firm background in the fundamentals of Biochemistry and Molecular Biology and to develop critical thinking skills for the interpretation of new findings in these disciplines. Students will gain primary knowledge in modern biochemistry through two lecture courses (BIOC 3713 and BIOC 3813). Hands on training with experimental tools of these disciplines will be emphasized during the Biochemistry and Molecular Biology laboratory course (BIOC 3723). The knowledge gained by this minor gives a science educator, a laboratory technician, an industrial employee or a life sciences researcher the ability to apply these disciplines. This minor will also demonstrate competency in these disciplines to post-graduate health institutions.

### Graduate Programs

Many career opportunities in biochemistry require advanced course work, and so part of the Department of Biochemistry and Molecular Biology's curriculum is focused on its graduate program leading to the MS or PhD degree. This graduate program is also an integral part of the extensive basic research activities supported by the Oklahoma Agricultural Experiment Station.

**Prerequisites.** Although a BS in Chemistry or Biochemistry is preferred, students with strong backgrounds in other biological or physical science disciplines are eligible for the graduate programs in Biochemistry and Molecular Biology. Individuals not having at least eight semester credit hours each of organic chemistry and calculus, plus four credit hours each of analytical and physical chemistry, must take appropriate undergraduate courses to make up deficiencies. The results of the three general GRE exams (verbal, quantitative, analytical) are required for entrance to the Graduate College. The preferred minimum GRE scores required for admission to the Biochemistry and Molecular Biology graduate program are: Verbal Reasoning 154 (64%); Quantitative Reasoning 153 (65%); and Analytical Writing 4.0 (48%).

**Degree Requirements.** A more detailed description of the graduate study program in Biochemistry and Molecular Biology is available on the Department's website: <http://biochemistry.okstate.edu/graduate-program>. The requirements listed below complement the general graduate requirements described in the "Graduate College" section of the Catalog. All Biochemistry and Molecular Biology graduate students are expected to attend and participate in the Department's Graduate Student Association Journal Club and the Department's Seminar Series throughout the academic year.

**The Master of Science Degree.** Twenty-four (24) credit hours of formal graduate courses are required, including BIOC 5002, 5753, 5824, 5853, and 5930. In addition, a student must present an acceptable research thesis (six

hours of BIOC 5000) and pass a final oral examination covering their thesis work and related material. Research advisers are selected at the end of the student's first semester.

A non-thesis Master of Science degree is also available. It does not require a research thesis, but requires a report and extensive technical training in the laboratory. The non-thesis MS plan requires thirty (30) credit hours of coursework and two (2) hours of research. The non-thesis MS is not recommended for students wishing to pursue a PhD.

**The Doctor of Philosophy Degree.** The PhD program course requirements are determined with the assistance and approval of the student's advisory committee and are based on whether a BS or MS has previously been earned: (a) a minimum total of (60) graduate credits are required if a student enters the PhD program having earned an MS in a related discipline; (b) a minimum total of ninety (90) graduate credits are required if a student enters the PhD program having earned not higher than a BS in a related discipline.

A formal "Plan of Study" with a minimum of 30 credit hours of graduate coursework, a minimum of 15 credit hours of research, and a minimum total of (a) 60 credit hours or (b) 90 credit hours must be approved by the student's advisory committee and submitted to the OSU Graduate College before completing (a) 17 credit hours or (b) 28 credit hours of graduate study. The student's advisory committee is selected at the end of the student's second semester. All graduate students must maintain a B average in their graduate coursework. A grade of C in a single graduate course can place the student on academic probation.

The Department offers research experience in a variety of areas. Formal PhD program graduate coursework includes all of the courses listed for the MS degree, at least four of the advanced graduate courses in biochemistry (6000 level) including BIOC 6740, and additional courses and lab experience appropriate to the student's interests. Each student will take a series of preliminary examinations in January of his or her third semester.

Each student also presents and defends their research thesis proposal sometime in their 4th -5th semester, and at the end of their program presents their research and defends their dissertation in a final oral examination. The doctoral dissertation must contain a substantial original contribution to the discipline of biochemistry and molecular biology.

### Bioinformatics Graduate Certificate Program

The Department of Biochemistry and Molecular Biology also offers the Bioinformatics Graduate Certificate Program - a multi-disciplinary program that involves faculty in Departments across the University. This Program's mission is to train post-baccalaureate students in the techniques required to generate, analyze, and interpret complex biologically-derived data sets. The Graduate Certificate in Bioinformatics requires completion of 16 credit hours of course work eligible for graduate credit. A minimum of 12 credit hours must be at the 5000 level or above. Required courses include 9 credit hours from the core areas of life sciences, statistics and computer sciences. Additional information on this Certificate Program is available online: <http://www.bioinformatics.okstate.edu/>.

### Review Process for Admission

The Department's Graduate Studies Committee reviews all eligible applications for the graduate program in Biochemistry and Molecular Biology. To be eligible for committee review, each applicant must submit an application for admission to the Graduate College, along with transcripts of all academic records, GRE scores and TOEFL scores if their undergraduate education was in a language other than English. Applicants must submit to the Department three reference letters, a current resume, and a statement of purpose.

### Biosystems and Agricultural Engineering

Daniel L. Thomas, PhD, PE—Professor and Head

The Department of Biosystems and Agricultural Engineering is administered jointly by the College of Agricultural Sciences and Natural Resources and the College of Engineering, Architecture and Technology.

Biosystems engineers are professionals who create and adapt engineering knowledge and technologies for the efficient and effective production, processing, storage, handling and distribution of food, feed, fiber and other biological products, while at the same time providing for a quality environment and preserving and protecting natural resources. Biosystems engineers directly address problems and opportunities related to food, water, energy, and the environment - all of which are critical to the quality of life in our society. Subject-matter specialization is provided through the following four undergraduate option areas: food processing, environment and natural resources, biomechanical, and bioprocessing and biotechnology

Biosystems engineering courses integrate engineering sciences, physical sciences, and biological sciences, and teach students to address real-world challenges. With the guidance of experienced faculty, students work both as individuals and in teams to design creative solutions to complex problems.

The overall objective of the undergraduate biosystems engineering degree program is to provide the comprehensive education necessary to prepare students for successful, productive and rewarding careers in engineering for agricultural, food and biological systems.

Within a few years of graduation, Biosystems Engineering program graduates will become top professionals, managers or leaders in a wide variety of

industries and organizations involved with Biosystems engineering, where they apply discovery, problem solving, and leadership skills for the benefit of their organization and the society at large.

The undergraduate educational program is divided into two components—pre-professional and professional. In the pre-professional portion of the biosystems engineering program (usually equivalent to two years of study) the focus is on the underlying biological, physical, chemical and mathematical principles of engineering, supplemented by appropriate general education courses in English, social sciences and humanities. Students who demonstrate proficiency in this portion of the program are eligible for admission to the professional school in Biosystems Engineering.

The professional school of biosystems engineering curriculum (typically two years) builds systematically upon the scientific knowledge acquired in the pre-professional curriculum. In professional school, students have the opportunity to focus on the option areas given above. The degree is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under agricultural engineering and similarly named programs.

Each professional school course builds upon preceding engineering courses to develop in the student the ability to identify and solve meaningful engineering problems. The course work is specifically sequenced and interrelated to provide design experience at each level, leading to progressively more complex, open-ended problems. The course work incorporates the social and economic aspects of technical problems, and stresses the responsibilities as engineering professionals to behave ethically and promote occupational and public safety. The program culminates in senior year design courses in which students integrate the analysis, synthesis and other abilities they have developed throughout the earlier portions of their study into a capstone experience. At this point, they are able to design components, systems and processes that meet specific requirements, including such pertinent societal considerations as ethics, safety, environmental impact and aesthetics. The students have also developed and displayed the ability to conduct experiments essential to specific studies and to analyze the experimental results and draw meaningful conclusions.

An integral part of this education continuum from basic science through comprehensive engineering design is learning experiences that facilitate the students' abilities to function effectively in both individual and team environments. Moreover, the program provides every graduate with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational tools are introduced and used as a part of their problem-solving experiences. Finally, the students' experiences in solving ever-more-challenging problems enable them to continue to learn independently throughout their professional careers.

A wide variety of employment opportunities are available for biosystems engineers in industry, public service and education. Some of these opportunities include positions in governmental agencies, consulting engineering firms, and agricultural and food equipment industries. Biosystems engineers are employed throughout the U.S. as well as internationally.

Students interested in a degree in Biosystems Engineering may initially enroll in the College of Engineering, Architecture and Technology or the College of Agricultural Sciences and Natural Resources. Through either college, they will be assigned a biosystems engineering advisor.

#### Graduate Programs

The Department of Biosystems and Agricultural Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees in Biosystems Engineering. These degrees emphasize research and development.

Excellent laboratory and computer facilities are available for students to explore research and design in such areas as bioprocessing and food engineering, machine vision, sensor and control technology, waste management and utilization, hydrology, water quality, porous media flow, and intelligent systems for agricultural machine design and production.

Research projects are supported by the Oklahoma Agricultural Experiment Station and by state, federal and private grants and contracts. Well-trained faculty members, many of whom are registered professional engineers with research, consulting and design experience, guide the graduate students' activities and plan programs to meet students' needs. Graduate students design experiments and special equipment to conduct their work. They are expected to demonstrate, by supporting research or by designs, the ability to identify a problem, define alternatives, propose a solution, organize a design or an experimental investigation, manage the project to completion and report the results through peer-reviewed papers and professional presentations.

**Admission Requirements.** Admission to either the Master of Science or Doctor of Philosophy degree program requires graduation from an engineering curriculum accredited by the Engineering Accreditation Commission of ABET ([www.abet.org](http://www.abet.org)). Students without accredited degrees may be admitted provisionally and may be required to take additional courses. A student must be accepted by an adviser in the department prior to official admission to the graduate program.

**Degree Requirements.** A candidate for the graduate degrees listed above follows an approved plan of study which must satisfy at least the minimum University requirements for that particular degree.

#### Entomology and Plant Pathology

Phillip G. Mulder, Jr., PhD—Professor and Head

The mission for the Department of Entomology and Plant Pathology is to discover, develop and disseminate science based knowledge concerning arthropods and plant pathogens. Entomology is the science and study of insects and related arthropods. Plant Pathology is the science and study of bacteria, viruses, fungi, and nematodes that cause diseases in plants. A strong academic background in the physical and biological sciences is essential for success in both disciplines. Research and education programs range from basic studies of cellular, physiological, and genetic aspects to broad ecological and population studies, and focus on the development of practical pest management strategies.

The undergraduate program in entomology leads to the BS in Entomology and offers students opportunities to explore the diversity of nature through the study of arthropods and their interactions with plants, animals, and human culture. Specialized course work in entomology includes insect identification, biology, ecology, physiology, biochemistry, population dynamics, medical and veterinary entomology, and insect pest management.

Plant pathology as a discipline encompasses the science required to understand the causes of plant diseases as well as prevention and controlling diseases. Undergraduate level courses are available in Plant Pathology and are valuable additions to programs in entomology, horticulture, agronomy, ecology and botany. Specialized course work in plant pathology includes pathogen identification, genetics, host pathogen physiology, biotechnology, molecular genetics, and disease management.

There are many, and diverse, career opportunities for graduates of these programs, including positions involved with pest management in crops and livestock production, stored products such as grains and processed foods and protecting structural systems such as houses from termites and agricultural biotechnology. Undergraduate options in entomology include insect biology and ecology, bioforensics and pre-medical/pre-veterinary sciences. Undergraduates of the entomology program are prepared to enter graduate programs in several disciplines, including entomology and plant pathology and have been successful in seeking and receiving professional degrees in medical and veterinary science programs. Others gain employment with private industry, research laboratories or county, state or federal agencies. Some develop their own businesses as consultants and/or entrepreneurs.

**Minor in Entomology.** This minor is designed to provide students with a basic understanding of insect biology, ecology, and classification. Students are also instructed on applications of Entomology related to ecosystem function, conservation, and agricultural impacts. Directed electives in this major also allow students to explore aspects of insect behavior, aquatic entomology, specific applications of entomology in horticulture, forestry, agronomy, and stored product scenarios. Requirements of the minor include 15 hours from core courses.

**Minor in Pest Management.** This minor is designed to introduce students to pests including insects, plant pathogens, and weeds that damage, reduce the quality, or increase production costs of agricultural crops or livestock, turf or ornamental plants, and trees. Integrated management methods for these pests will be presented including cultural, biological, and chemical control strategies. The minor is intended for students majoring in horticulture, plant and soil science, natural resource ecology and management, animal science, environmental science, entomology, or other majors in biological sciences. Requirements of the minor include 18 hours with 9-12 hours from core courses.

#### Graduate Programs

The Department of Entomology and Plant Pathology offers programs of study that lead to the MS of Entomology and Plant Pathology, the PhD in Entomology or the PhD in Plant Pathology. These programs offer students opportunities to specialize in a wide range of basic or applied research fields. To qualify for graduate study in entomology and/or plant pathology an applicant should obtain a solid background in the basic sciences, especially biology, chemistry, mathematics, English and communications skills. All requirements of the Graduate College must be satisfied for entry to the graduate programs. In addition, applicants for graduate programs should take the Graduate Record Examination and submit their scores. Students applying to the graduate program must be accepted into a research program by a major professor. The applicant must secure appropriate financial support in the form of a scholarship, fellowship, or graduate assistantship to be negotiated with the major professor and department and be approved by the departmental screening committee and department head before being admitted to the Department. Each graduate student is under the direction of the major professor as adviser and a selected faculty advisory committee. The program of study will be adapted to the individual's needs within departmental and Graduate College guidelines. Graduate students are required to meet with their advisory committees every six months for program reports and examinations. Each student will follow a program of study and research approved by the student's committee and, must submit an approved thesis or dissertation, and present a public defense. Students supported as half-time research assistants are expected to be active participants in the research projects of their major professors. Additional information regarding the graduate programs in Entomology and Plant Pathology may be obtained from the department's website at: [www.entopl.okstate.edu](http://www.entopl.okstate.edu).

## Environmental Sciences

Brian J. Carter, PhD—Professor and Director

The College of Agricultural Sciences and Natural Resources offers an undergraduate major in environmental sciences. This interdisciplinary program is designed to improve the current and future welfare of the human race through understanding environmental policies based on scientific principles in accordance with the true benefits and costs as evaluated by an informed society.

As an interdisciplinary and science-oriented major, the student takes courses in biology, chemistry, math, physics, statistics, and social sciences. The student may choose one of three areas of emphasis (options): Environmental Policy, Natural Resources, or Water Resources. Depending on the option, upper-division course work will involve problem-solving work in water and soil quality, economic and social policy, political science, resource management and engineering. The student will also be exposed in general education subjects, including communications, philosophy, ethics and sociology.

A primary goal is to enable graduates to solve environmental problems based on scientific principles and in accordance with society's needs. Successful completion of this major earns the student the Bachelor of Science in Agricultural Sciences and Natural Resources degree.

The environmental sciences undergraduate major is directly supported by faculty from the departments of Agricultural Economics, Biosystems and Agricultural Engineering, Entomology and Plant Pathology, Horticulture and Landscape Architecture, Natural Resource Ecology and Management, and Plant and Soil Sciences. The major and its students also benefit from working in and out of the classroom or laboratory with faculty who are conducting cutting-edge research related to environmental problems through the Freshman Research Scholars Program.

Graduates work in such areas as land-use planning, environmental management, natural resources management, waste disposal, water and soil quality, environmental remediation and policy analysis. Industries associated with the extraction, utilization and manipulation of natural resources have increased the number of employees with environmental training to address regulation compliance, litigation, monitoring, public relations and management practices.

Graduates may also work with federal, state and local government agencies involved in regulation, resource management and policy development.

Graduates, particularly those who have gone on to earn advanced degrees, find employment with consulting firms that are involved with solving environmental problems. Many graduates go on to graduate school or pursue a degree from a professional school, such as law or medicine.

## Horticulture and Landscape Architecture

Janet C. Cole, PhD—Regents Professor and Head

**Horticulture** is the science, business and art associated with the culture, production, preservation and processing of flowers, trees, shrubs, turfgrass, vegetables, fruits and nuts. It also includes the proper environmental use and maintenance of plants in the landscape. Horticulture is involved with the production and processing of a significant part of the nation's food supply. It provides a major source of the beauty in and around homes, cities, parks, highways, golf courses and other public areas. Educational opportunities for study in horticulture cover a wide variety of plants and subjects and range from the cellular to the whole plant level. Factors such as nutrition, irrigation, genetics, propagation, control of flowering, and fruit and seed production are considered in their relationship to culture, production, conservation of resources, harvesting, processing and storage. Students can prepare themselves for careers in public garden management (arboreta, parks and zoos), golf course management, horticulture business, environment and sustainability areas, sales and marketing, production, teaching, extension and research.

**Landscape Architecture** is an environmental design discipline. It applies artistic and scientific principles to the design, planning, and management of both natural and built environments. Landscape architects work a wide variety of projects including garden design, residential design, community planning, urban design, parks and recreation, commercial /campus design, and sustainable site design. The design process involves creative expression that comes from an understanding of the context of site (or landscape), natural systems, cultural systems and social dynamics. It requires one to interpret, imagine, draw, conceptualize, synthesize, and construct project ideas that transform both the landscapes and the users of those landscapes. As issues of sustainability are becoming more critical, Landscape Architects are poised to address them, as they design the interface between humankind and the urban, suburban, and natural environment.

The Department of Horticulture and Landscape Architecture offers undergraduate programs leading to the following degrees: BS in Horticulture, BS in Landscape Management and BLA in Landscape Architecture. [www.hortla.okstate.edu](http://www.hortla.okstate.edu)

**Horticulture Science** emphasis is on preparing students for science-based careers, including laboratory science or graduate study. This option provides the training and expertise for production, maintenance, and preservation of fruits, nuts, vegetables, nursery crops, flower crops, etc. Training can be general or be chosen to emphasize a particular commodity area of horticulture. Students learn plant care techniques and the role plants and landscape applications play in

sustaining the environment.

**Horticulture Business** option features opportunity to combine horticulture with principles of running a business. A built-in requirement for a formal academic minor in a business area is a feature of this option.

**Turf Management** provides the training for turfgrass production and for management of turfgrass in golf courses, parks, athletic fields, home landscapes, airports and along highways.

**Public Horticulture** focuses on the people-plant interface, particularly in urban settings. Students may choose to specialize in either garden management or urban horticulture. The program is appropriate for those interested in careers in arboreta, botanic gardens, zoos, horticultural societies, park systems, museums, habitat creation and restoration (especially disturbed areas and/or wetlands) civic garden centers, and specialty crop production in developed areas. The option can also lead to graduate study. Students have the opportunity to be involved in The Botanic Garden at OSU and the department's television show, *Oklahoma Gardening*.

**Landscape Architecture** is the study of artistic, scientific and technical principles as they are applied to landscape planning, design, and management services. Landscape architects develop detailed landscape plans to be aesthetically pleasing, functional, and compatible with the built and natural environment. Students will experience a strong landscape design curriculum that is supported with courses in art, construction, horticulture, ecology, environmental science, and social science. This five-year Bachelor of Landscape Architecture (BLA) degree focuses on professional practice. This degree is nationally accredited by the Landscape Architectural Accreditation Board (LAAB). Study plans may be tailored to the individual with emphasis areas in Design, Environmental Planning, and Horticulture. Typical employers of landscape architects include landscape architecture firms, architectural/engineering firms and government agencies dealing with land planning, environmental and conservation applications, urban planning and parks/recreation.

**Landscape Management** emphasizes the construction and management phases of landscape development, including plants, environmental applications, and structures. This four-year program leads to a BS degree accredited by the National Association of Landcare Professionals (NALP). Courses include basic landscape architectural design, construction technology, business and horticulture. Students may emphasize either landscape design or business management. Students emphasizing business management may complete a minor in Management through the OSU Spears School of Business. Graduates are employed by landscape contracting companies, design-build firms, landscape maintenance companies, landscape nurseries, and governmental agencies.

**Minor in Horticulture.** Additional formal training in horticulture can benefit students in career areas as diverse as education, interior design, or entrepreneurship. The minor includes 15 hours of core courses in soil science, plant biology, and horticultural science, along with advanced cross-commodity applications in plant propagation. The core provides the basic prerequisites for further study. Students then select at least eight hours of controlled electives in horticulture according to their areas of interest. A total of 23 hours is required for the minor.

## Graduate Programs

The department offers programs of study leading to the degrees of Master of Science in Horticulture (with areas of specialization in Horticultural Science, Sustainable Landscape Design and Management, Phytochemistry and Turfgrass Science) Doctoral students can participate in multidisciplinary PhD programs in Crop Science, Environmental Science, Food Science, and Plant Science. Areas of study include floriculture crops, fruit and nut crops, vegetables, ornamental nursery crops, and turf. In addition to commodity-oriented specialties, students may emphasize food processing, environmental applications, plant extraction applications, postharvest physiology, or stress physiology disciplines. Applicants should indicate their interest area(s). Research opportunities range from whole plant production/management studies to fundamental cellular studies. Additional information on programs, application procedures, and financial assistance is available at: [www.hortla.okstate.edu/students/graduateprogram/](http://www.hortla.okstate.edu/students/graduateprogram/).

**Prerequisites.** Admission requires a bachelor's degree in Horticulture, Landscape Architecture, or a related field with at least a 3.00 ("B") grade-point average. Students with course work deficiencies in fundamental areas may be required to take remedial courses to attain proficiency in accordance with the advisory committee's guidance. In addition to Graduate College requirements, applicants must submit official GRE scores, a statement of research and career interests, and three letters of reference.

Admission to the program requires approval by the graduate committee, a departmental adviser on the Graduate Faculty, the department head, and Graduate College. The program of study and research will be directed by the student's graduate adviser and advisory committee.

## International Agriculture

Shida R. Henneberry, PhD—Professor and Director

**Master of Agriculture in International Agriculture (MAIA).** The Master of Agriculture in International Agriculture (MAIA) is a multidisciplinary degree

program that provides students the diverse background necessary to design, implement, and manage agricultural programs in developed and developing areas. The program prepares candidates for positions in the public and private sectors related to international agricultural development and marketing. Graduates work in international agribusinesses, non-profit organizations, development agencies, government and diplomatic service, education, agricultural extension, agricultural trade associations and commodity groups and other positions in global agriculture. Others pursue a personal desire to make a difference in the world by entering the Peace Corps, doing agricultural development work in a developing country, or working in areas recovering from a natural disaster. The MAIA is for students who prefer to blend theory and practice to improve the lives of people, develop professional skills and network through an international agricultural experience, develop a focus area to support professional goals, develop broader understanding of world cultures and issues, and engage in international travel.

Three alternatives exist for satisfying requirements for the MAIA degree:

1. 32 credit hours, including two credit hours for a formal report,
2. 36 credit hours and a creative component, and
3. 36 credit hours, including six hours for a professional internship.

A minimum of 21 credit hours must be earned at the 5000 level or above. The creative component, research for formal report, and professional internship are expected to be in the area of international agriculture. Each student must take 17 semester credit hours of approved core courses, a minimum of 12 semester credit hours of focus area course, and at least three hours of electives. Each student is required to have an international experience of four weeks or longer.

**Master of Science in International Agriculture (MSIA)** The Master of Science in International Agriculture is designed to prepare candidates for positions in the public and private sectors related to agricultural sciences and natural resources, or for continuation in a Ph.D. program. The MSIA accommodates those students who prefer to take theoretical courses preparing them for research. This program will provide students the theoretical, science, and research backgrounds necessary to design, implement, and manage agricultural programs in developed and developing countries. It allows participants to blend theory and practice to improve the lives of people. Advanced study leading to the Master of Science degree in the field of International Agriculture prepares students for such professional careers as business analyst, international trade and development specialist, college-level educator, agricultural extension specialist, and professional work with non-profit organizations, government sectors, and agricultural commodity groups. The program is multidisciplinary, allowing students the freedom to focus on the area of study they choose.

Three alternatives exist for satisfying requirements for the M.S. degree:

1. With thesis, 30 credit hours, consisting of 24 hours of course work and six hours for a thesis\*
2. With report, 32 credit hours, consisting of 30 hours of course work and two hours of research\*
3. With no thesis or report, 32 credit hours of course work and a creative component\*

Degree candidates are expected to conduct research related to a topic on international agriculture. The prerequisites include two courses in statistics, mathematics, or quantitative analysis; nine additional semester credit hours in agricultural sciences and natural resources or related areas.

### Natural Resource Ecology and Management

Robert J. (Jim) Ansley, Jr., PhD—Professor and Head

Faculty in the Department of Natural Resource Ecology and Management (NREM) have expertise in conducting interdisciplinary instruction, research, and extension education which focus on the natural resources of fisheries, forests, rangeland, and wildlife within and beyond the boundaries of Oklahoma. Increased public understanding of the ecology and management of these natural resources which are important in agriculture, hunting and fishing, ecotourism, forest production and use, as well as the conservation of wildlife habitat is an important goal of the faculty in NREM.

The NREM faculty support undergraduate and graduate programs in Fire Ecology, Fisheries, Forestry, Rangeland, and Wildlife. The NREM curriculum prepares students to plan, implement, and research the management, protection, and sustainable use of natural resources within Oklahoma and throughout the world. The department provides an integrated education in renewable natural resource management, conservation, and utilization, as well as a valuable perspective for understanding and solving critical contemporary environmental problems at local, regional, and global scales.

Courses in NREM study options fulfill the requirements for many applied and professional careers in the natural resource disciplines, including preparation for graduate programs and certification with the Society of American Foresters, The Wildlife Society and The American Fisheries Society. Graduates may be employed by governmental agencies, non-profit organizations, private agencies or individuals. Federal agencies hiring NREM graduates include U.S. Department of Agriculture, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Geological Survey, U.S. Fish and Wildlife Service,

Agricultural Research Service, Bureau of Indian Affairs, National Park Service, Animal and Plant Health Inspection Service, and the Natural Resources Conservation Service. In addition, state, county, and municipal governments employ NREM graduates in a variety of resource management consultant, restoration, service, and technical positions.

### Natural Resource Ecology and Management Degree Options.

**Fire Ecology and Management** option was developed in response to the need for understanding the ecological role and management of wildland fire in natural ecosystems, and the importance and implementation of prescribed fire in land management. This option offers students the opportunity to accomplish specific land management objectives through the proper use of prescribed fire. The curriculum combines experience with prescribed fire plans, policy and law, weather, equipment, conducting prescribed burns, and post-burn management. In addition, students will be assisted in completing federal fire training requirements.

**Fisheries and Aquatic Ecology** is an option designed for students with interest in the management of fish populations and habitats. Courses offer research techniques and methodology in fisheries science, including sampling design, habitat measurements, sampling techniques and abundance estimation, age and growth analysis, recreational surveys, data analysis and report writing.

**Forest Ecology and Management** emphasizes the science-based conservation and management of forest lands, ecosystems and related natural resources. Students gain the skills that are necessary for the measurement, assessment, and valuation of natural resources and the evaluation of management strategies for forest and related wildlands. Successful completion of the curriculum will provide competency in the general areas of basic science, forest biology, forest mensuration, forest economics, natural resource policy, decision-making and problem solving, and communications. The option is accredited by the Society of American Foresters (SAF), the specialized accrediting body for forestry programs in the U.S. Requirements for this option include the successful completion of two, three-week field camps in May, which are scheduled to follow the sophomore and junior years, and are held annually in diverse forest settings. Field forestry skills, forest ecology, integrated natural resource management, and state-of-the-art operations are emphasized at camp.

**Natural History and Conservation** option provides a broadly integrated science background in the classification, biology and ecology of plants and animals with an emphasis on natural history and conservation. The option specifically prepares students for careers in environmental stewardship and outdoor education and stresses the development of excellent communications, interpersonal, and leadership skills.

**Rangeland Ecology and Management** program emphasizes understanding management of grasslands, shrub lands, and forests for forage and habitat production. This includes the effects of grazing, fire, and other disturbances on biotic and abiotic processes. Students learn to integrate their knowledge of soil, water and vegetation attributes into management of public or private wild lands for multiple uses.

**Wildlife Ecology and Management** option provides insight into the biological basis for management of wildlife populations and habitats, with emphasis on current management problems. This option combines research techniques, including aging and sexing, wildlife and vegetation sampling, and wildlife population and habitat analysis with the methodology of wildlife science.

**Wildlife Biology and Preveterinary Science** option provides ecological background and training in natural wildlife science and population dynamics in addition to the basic sciences necessary to prepare students for graduate education in wildlife biology or veterinary medicine. The option combines research and management training in population ecology with basic biology and chemistry.

Students entering the NREM department are encouraged to join and become active members of one of the many student organizations: Society of American Foresters, Society for Range Management, The Wildlife Society, and the American Fisheries Society. Participation in one or more of these organizations provides students the opportunity to attend state, regional, or national meetings where they will gain valuable advantages through networking, student competitions, and interacting with various career-related activities.

### Graduate Programs

The Department offers the MS and PhD degrees in Natural Resource Ecology and Management with specializations in Fisheries and Aquatic Ecology, Forest Resources, Rangeland Ecology and Management, and Wildlife Ecology and Management. In addition, students may work toward the MS and PhD degrees in the Environmental Science Graduate Program and the PhD degree in the Plant Science Graduate Program with faculty members from the Department.

The overall goals of the Department are to provide high quality advanced training and instruction in the application of the scientific method to problems in natural resource ecology and management. This includes problem analysis and identification, research methods, synthesis of results and communication of findings. The Department strives to develop the capability for original and creative work under the guidance of established professionals and scientists. Graduate instruction is a critical component of the research, instruction and extension missions of the Department.

Students work directly with a member of the faculty to design a program of study to serve individual career goals. The prerequisite for graduate study in the Department is a bachelor's degree in an area aligned with the student's research interests with a minimum overall GPA of 3.00. Please refer to the website [nrem.okstate.edu](http://nrem.okstate.edu) for a full description of the application process. A student must be accepted by a member of the Department's faculty prior to official admission to the program.

### Plant and Soil Sciences

Jeffrey T. Edwards, PhD—Professor and Head

The goal of the department is to meet societal needs for food, fiber, energy, and intrinsic value related to the conservation and management of plant and soil resources. Teaching, research and extension efforts are designed to assist decision makers in matters regarding land management.

Undergraduate students select an option of study from: agronomic business, crop production and management, plant biotechnology and improvement, or soil and water resources. Students may choose to specialize in an area such as: entrepreneurship, forage and livestock production, pest management, plant genetics, precision agriculture, or environmental management. In addition, students can fulfill prerequisites for professional programs such as pharmacy school. Students interested in professional certification will complete the necessary course requirements in their degree programs. Students have flexibility to work with their academic advisers to develop a plan of study to suit their interests. Many undergraduate students work with the research faculty on projects providing the student an opportunity to assist in gathering new information related to plant breeding and genetics, biotechnology, environmental remediation, plant physiology, crop production, weed science, soil nutrient management, soil chemistry, soil physics, water quality, and land restoration.

Upon completion of a Bachelor of Science program, students are employed by private firms, public institutions, state and federal agencies, or non-profit organizations that require personnel with expertise in plant and soil systems. Typical careers include: federal employment in soil and rangeland conservation; crop consulting; technical sales and service for seed, fertilizer or agricultural chemical supply companies; farm or ranch operation; research positions as plant and soil scientists with federal agencies, state agricultural experiment stations or private industries; teaching and extension positions with colleges and universities; and a broad range of employment or ownership in retail businesses supplying feed, seed, grain, fertilizers, equipment, agricultural chemicals and other agricultural supplies and services. Demand for individuals with experience in plant and soil sciences will continue as long as society demands a safe, secure food supply balanced with a desire to conserve natural resources.

**Minor in Agronomy or Soil Science.** The Department of Plant and Soil Sciences offers two minors, Agronomy (24 hours) and Soil Science (19 hours). Students pursuing a minor in Agronomy will take courses in areas that are most important for understanding the science of crop production, including genetics and biotechnology, weed science, and nutrient management in order to prepare them for careers that support crop production. The Soil Science minor has a great deal of flexibility (12 credits of controlled electives) that will allow students to explore diverse aspects of soils ranging from chemistry to conservation while helping them prepare for a variety of environment-related careers.

### Graduate Programs

Programs of course work and research are offered leading to the Master of Science degree in plant and soil sciences. A Doctor of Philosophy degree can be attained in Crop Science or Soil Science. Specific programs are available in the areas of plant breeding and molecular biology, biotechnology, bioenergy, environmental remediation, forage and pasture management, weed science, crop physiology, crop management, conservation cropping systems, soil morphology and genesis, soil microbiology, soil fertility and plant nutrition, soil physics, soil-water management, soil chemistry, soil and water quality, and waste management. Applicants should indicate their specific area of interest upon application. Plant and soil sciences faculty also serve on advisory committees for the Environmental Science and Plant Science interdisciplinary degree programs.

The graduate programs in plant and soil sciences prepare individuals for successful careers in a variety of areas including research, teaching, environmental sciences, waste management, farming and ranching, extension education, agricultural business, and all aspects of crop production.

**Prerequisites.** Admission to the graduate program requires a BS degree in plant and soil sciences, agronomy or a closely related field. Applicants should have completed basic courses in plant and soil sciences, agronomy, biology, chemistry and mathematics required of undergraduate majors. Deficiencies in fundamental course requirements will be met by the student under the direction of the student's advisory committee. Applicants must be accepted by an adviser in an appropriate discipline prior to official admission.

**Degree Requirements.** Students must follow approved plans of study that meet the minimum University and program requirements for the respective degrees they are pursuing.

The Master of Science degree in plant and soil sciences may be earned by using the thesis option. This plan requires a minimum of 30 credit hours of course work, including six credit hours of PLNT, or SOIL 5000, master's thesis.

The degree plans of study for the Doctor of Philosophy degree in crop science and soil science are developed individually for each candidate and must be approved by the students advisory committee. Doctoral programs in crop science and soil science require 60 credit hours beyond the MS degree, including a minimum of 15 credit hours of PLNT or SOIL 6000 (Dissertation). All students must meet certain requirements in basic disciplines such as statistics, mathematics, botany, and chemistry. Study of a foreign language is not required, but can be incorporated if the student and advisory committee feel that it is desirable.