DEPARTMENT OF ECOSYSTEM SCIENCE AND MANAGEMENT

http://essm.tamu.edu

Head: K. L. Kavanagh

Graduate Advisor: T. W. Boutton

The Department of Ecosystem Science and Management (ESSM) offers graduate programs leading to the MS and PhD degrees in Ecosystem Science and Management, the MAgr degree in Ecosystem Science and Management, and the Master of Natural Resources Development (MNRD) degree. The MS and PhD degrees are intended to educate scientists and professionals in research and management in natural resources and related fields. The MS offers a thesis option for those who desire a serious research experience and a non-thesis option for those who seek a professional career outside of research. The MNRD and MAgr degrees are professional (non-research) degree programs providing advanced training in the science and management of natural resources, including a required internship.

Fields of study are available in:

1. Ecosystem Science: biogeochemistry, ecohydrology, global change ecology, landscape ecology, ecological restoration, ecophysiology;
2. Ecosystem Management: forest management, rangeland management, watershed management, natural resource economics and policy, human dimensions of ecosystem management;
3. Genetics, Systematics, Evolution: genetics, molecular biology, genomics, population genetics, tree improvement, plant systematics and evolution;
4. Spatial Sciences: geographic information systems, remote sensing, spatial analysis and statistics.

Facilities within the department include modern teaching classrooms and laboratories. There are fifteen state of the art research laboratories in the department, including the Stable Isotopes for Biosphere Sciences Laboratory, the Spatial Sciences Laboratory and the S.M. Tracy Herbarium. Field sites and facilities are available throughout Texas and many of them are associated with research and extension centers connected with the department. The ESSM faculty acquire external competitive research grants and contracts that provide funding for additional research avenues and graduate student support.

Graduate courses are designed to develop the academic skills of individuals and to advance their knowledge in the professional fields related to ecosystem science and management. Departmental seminars facilitate graduate student development and serve to relate the most recent research findings applicable to the discipline. The department welcomes applications from students with diverse educational backgrounds, experiences and interests. Individually planned graduate programs assure a focused education that meets the needs of each candidate.

Additional information on academic programs and faculty may be found at http://essm.tamu.edu.

Faculty

Boutton, Thomas W, Professor
Ecosystem Science & Mgmt
PHD, Brigham Young University, 1979

Briske, David D, Professor
Ecosystem Science & Mgmt
PHD, Colorado State University, 1978

Casola, Claudio, Assistant Professor
Ecosystem Science & Mgmt
PHD, University of Pisa, Italy, 2006

Eriksson, Marian, Associate Professor
Ecosystem Science & Mgmt
PHD, University of Minnesota, Twin Cities, 1989

Feagin, Russell A, Professor
Ecosystem Science & Mgmt
PHD, Texas A&M University, 2003

Gan, Jianbang, Professor
Ecosystem Science & Mgmt
PHD, Iowa State University, 1990

Hatch, Stephan L, Professor
Ecosystem Science & Mgmt
PHD, Texas A&M University, 1975

Hyodo, Ayumi, Research Assistant Professor
Ecosystem Science & Mgmt
PHD, University of Western Ontario, 2010

Kavanagh, Kathleen L, Professor
Ecosystem Science & Mgmt
PHD, Oregon State University, 1993

Knight, Robert W, Associate Professor
Ecosystem Science & Mgmt
PHD, Texas A&M University, 1980

Kothmann, Merwyn M, Professor
Ecosystem Science & Mgmt
PHD, Texas A&M University, 1968

Kreuter, Urs P, Professor
Ecosystem Science & Mgmt
PHD, Utah State University, 1992

Lawing, Anna M, Assistant Professor
Ecosystem Science & Mgmt
PHD, Indiana University, 2012

Loopstra, Carol A, Associate Professor
Ecosystem Science & Mgmt
PHD, North Carolina State University, 1992

Moore, Georgianne W, Associate Professor
Ecosystem Science & Mgmt
PHD, Oregon State University, 2004

Noormets, Asko, Associate Professor
Ecosystem Science & Mgmt
PHD, Michigan Technological University, 2001
Courses

**ESSM 600 Principles of Ecosystem Science and Management**  
Credits 3. 3 Lecture Hours.  
Ecological foundations for sustained use of natural resources; climatic, edaphic, biotic and cultural factors in land resource allocation; land and cover viewed with respect to population dynamics, succession and climax, gradients and graduation, equilibria and imbalance.  
**Prerequisite:** Graduate classification in agriculture or in allied subject.

**ESSM 601 Ecosystem Stewardship**  
Credits 3. 3 Lecture Hours.  
Integrates ecological concepts of resilience, sustainability, transformation and vulnerability within a framework of cosystem stewardship to support human well-being in a rapidly changing world; emphasizes social-ecological systems, adaptive management, and valuation of ecosystem services as mechanisms to strengthen management and policy recommendations supporting ecosystem stewardship.  
**Prerequisite:** Graduate classification.

**ESSM 604 Changing Natural Resource Policy**  
Credits 3. 3 Lecture Hours.  
Process through which environmental policies are changed; theories of social and political change; using these theories along with original research on environmental policy problems to create and implement plans for changing environmental policies in communities.  
**Prerequisite:** Graduate classification.

**ESSM 605 The Research Process**  
Credits 2. 2 Lecture Hours.  
Nature and objectives of graduate work, the scientific method and basic and applied research. Introduction to design of experiments and analysis of data; principles of organization of project proposals, theses and scientific reports.

**ESSM 610 Rangeland Resource Management**  
Credits 3. 3 Lecture Hours.  
Basic concepts and theories of rangeland resource management; trends in range classification, grazing management and improvement practices.  
**Prerequisite:** Graduate classification in agriculture or related subject matter areas.

**ESSM 611 Grazing Management and Range Nutrition**  
Credits 3. 3 Lecture Hours.  
Nutritional ecology of domestic and wild herbivores on rangelands; vegetation and animal response to various grazing management practices; diet selection, quality, intake and supplementation of herbivores.

**ESSM 612 Rangeland Vegetation Management**  
Credits 3. 3 Lecture Hours.  
Principles of rangeland brush and weed control with mechanical, chemical, burning and biological methods; interrelationships of brush management with grazing, wildlife and watershed management; planning and economic analysis of range improvement practices.

**ESSM 616 Arboriculture**  
Credits 4. 3 Lecture Hours. 2 Lab Hours.  
Tree selection and planting to fit climatic, space and edaphic conditions, diagnosing tree abnormalities, and practicing intensive tree care; frequent field work and demonstrations; includes seminar classes involving discussions and presentations of current arboriculture research from peer-reviewed journals.  
**Prerequisite:** Graduate classification.
ESSM 617 Urban Forestry
Credits 4.4 Lecture Hours.
Conceptual role of trees in improving the urban environment; optimum use of existing forested areas and the establishment of trees in appropriate open spaces; tree ordinances, species evaluation, street tree planning and tree inventory systems; includes seminar classes involving discussions and presentations of current urban forestry research from peer-reviewed journals.
Prerequisite: Graduate classification.

ESSM 620 Plant and Range Ecology
Credits 3.3 Lecture Hours.
Investigation of community/ecosystem/landscape distribution patterns, structure, spatial/temporal organization and function, paleoecology, ecological succession, disturbance regimes, ecological diversity and classification schemes. North American rangelands (grasslands, shrublands, deserts, wetlands, etc.) stressed but world ecosystems reviewed.
Prerequisites: RENR 205; RENR 215 or equivalent; graduate classification.

ESSM 621 Physiological Plant Ecology
Credits 3.3 Lecture Hours.
Investigation of physiological mechanisms influencing ecological patterns and processes, including plant acclimation and adaptation in contrasting habitats, abiotic controls on species productivity and distribution, relevant conceptual and experimental approaches, and integration among ecological scales.
Prerequisites: RENR 205 or MEPS 313 or equivalent; graduate classification.

ESSM 622 Biogeochemistry of Terrestrial Ecosystems
Credits 3.3 Lecture Hours.
Biogeochemical cycles of carbon, nitrogen, sulfur and phosphorus and their interaction with biotic and abiotic processes; biogeochemical processes investigated at the global level and in several types of terrestrial ecosystems; addressing global climate change, deforestation, acid precipitation, ozone depletion.
Prerequisites: RENR 205 or equivalent; graduate classification.

ESSM 624 Terrestrial Ecosystems and Global Change
Credits 3.3 Lecture Hours.
Identify the physical and biological principles governing the structure and function of terrestrial ecosystems in an earth-system context; analyze how plants and microorganisms respond to environmental change and affect global carbon, nutrient, and water cycles; evaluate ecosystem response to global change, including rising carbon dioxide, climate warming, and human impacts.
Prerequisite: Graduate classification.

ESSM 626 Fire and Natural Resources Management
Credits 3.2 Lecture Hours. 3 Lab Hours.
Behavior and use of fire in the management of natural resources; principles underlying the role of weather, fuel characteristics and physical features of the environment related to development and implementation of fire plans.
Prerequisites: Graduate classification and approval of instructor.

ESSM 628 Wetland Delineation
Credits 3.2 Lecture Hours. 2 Lab Hours.
Prerequisite: Graduate classification or approval of instructor.

ESSM 630 Restoration Ecology
Credits 3.3 Lecture Hours.
Review and discuss fundamental concepts, current literature, and contemporary topics relating to ecological restoration. This includes the theoretical development of restoration ecology and its application. The relationship with conservation biology will be explored. The goal is to inform, exchange views, and develop critical thinking skills through case studies.
Prerequisite: Graduate classification.

ESSM 631 Ecological Restoration of Wetland and Riparian Systems
Credits 3.2 Lecture Hours. 2 Lab Hours.
How wetland and riparian areas link terrestrial and aquatic systems and function hydrologically and ecologically within watersheds; integrated approaches for restoration of degraded wetland and riparian systems; improving water resources through vegetation management with a special interest in rangelands.
Prerequisites: RENR 205 or equivalent and WFSC 428 or equivalent.

ESSM 635 Ecohydrology
Credits 3.3 Lecture Hours.
Framework for understanding how plants and animals affect the water cycle; examine and explore the water cycle in all of its aspects with the idea of understanding how changes in land cover may influence the water cycle; implications for both upland and riparian systems.
Prerequisite: Graduate classification.

ESSM 636 Wildland Watershed Management
Credits 3.3 Lecture Hours.
Elements of watershed management and principles and practices of wildland management for protection, maintenance and improvement of water resources values; current literature and research advances.

ESSM 647 Range Grasses and Grasslands
Credits 3.2 Lecture Hours. 3 Lab Hours.
Basic concepts of grass structure and classification, recent advances in agrostological research, genetic and ecological basis for patterns of variation and evolution in grasses. Offered Spring Semester of even numbered years.

ESSM 648 Wetland Plant Taxonomy
Credits 3.1 Lecture Hour. 4 Lab Hours.
Interpretation of plant morphologies for keying and the identification of wetland plants from prime habitats; plant communities including the plant's adaptation to variation in salinity and soils; identification of inconspicuous flowered plant species including sedges, rushes and grasses.
Prerequisite: RLEM 304 or approval of instructor. Offered Fall Semester of even numbered years.
ESSM 651 Geographic Information System for Resource Management  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
Geographic Information System (GIS) approach to the integration of spatial and attribute data to study the capture, analysis, manipulation and portrayal of natural resource data; examination of data types/formats, as well as the integration of GIS with remote sensing and Global Positioning System; laboratory includes extensive use of GIS applications to conduct analyses of topics in natural resources.  
Prerequisites: Graduate classification.  
Cross Listing: BAEN 651/ESSM 651 and RENR 651.

ESSM 652 Advanced Topics in Geographic Information Systems  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
Advanced GIS topics with a focus on modeling actual GIS applications including relational and database theory, design and implementation and its connection to GIS; surface analysis with digital terrain models; and an introduction to spatial statistics.  
Prerequisite: ESSM 651 or BAEN 651/ESSM 651.

ESSM 655 Remote Sensing of the Environment  
Credits 3. 2 Lecture Hours. 1 Lab Hour.  
Remote sensing for the management of renewable natural resources; use of aerial photography and satellite imagery to detect, identify and monitor forest, range and agricultural resources; utilize remotely sensed data as input to computerized information management systems.  
Prerequisite: Graduate classification.

ESSM 656 Advanced Remote Sensing  
Credits 3. 2 Lecture Hours. 1 Lab Hour.  
Advanced techniques for information extraction using airborne and satellite imagery; active and passive sensors characteristics; customizing and developing image processing tools for remote sensing applications for a broad range of sensors and applications.  
Prerequisites: ESSM 655, RENR 444, GEOG 651, GEOG 661.

ESSM 660 Landscape Analysis and Modeling  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
Introduction to quantitative methods of landscape analysis and modeling for applications in natural resource conservation and management; quantification of landscape composition and configuration; spatial statistical methods for characterizing landscape pattern; methods for hypothesis testing with spatial data; landscape modeling approaches and applications; current literature and software.  
Prerequisite: Approval of instructor.

ESSM 663/SCSC 663 Applied Spatial Statistics  
Credits 4. 3 Lecture Hours. 2 Lab Hours.  
An introduction to the theory and practice of spatial statistics as applied to the natural resources. Spatial analyses focusing primarily on ordinary kriging, point processes, and lattice data.  
Prerequisites: MATH 141, MATH 142; STAT 651; or equivalents; ESSM 651 preferred.  
Cross Listing: SCSC 663/ESSM 663.

ESSM 665 Computer Programming for Natural Resources Applications  
Credits 3. 2 Lecture Hours. 2 Lab Hours.  
An introduction to programming concepts and applications; elements of Visual Basic programming including data types, control and program structure; introduction to objects and object-oriented programming; macro and applications development; automation of GIS programming through the use of macros.  
Prerequisites: Approval of instructor.

ESSM 670 Ecosystems and Markets  
Credits 3. 3 Lecture Hours.  
Concepts and analysis of supply chains for natural resource commodities and ecosystem services. Exploration of the economic uses of goods and services from ecosystems.  
Prerequisite: Graduate classification.

ESSM 671 Ecological Economics  
Credits 3. 3 Lecture Hours.  
Study of the relationships between ecosystems and economic systems; understanding the effects of human economic endeavors on ecological systems and how the ecological benefits and costs of such activities can be quantified and internalized.  
Prerequisite: Graduate Classification.

ESSM 672/RENR 660 Environmental Impact Analysis for Renewable Natural Resources  
Credits 3. 3 Lecture Hours.  
Analysis and critique of contemporary environmental analysis methods in current use; environmental impact statements; national policies; political, social and legal ramifications as related to development and use of renewable natural resources.  
Prerequisite: Graduate Classification.  
Cross Listing: RENR 660/ESSM 672.

ESSM 675 International Sustainable Community Development  
Credits 3. 3 Lecture Hours.  
Depicting global trends, paradigms and a comparative framework on sustainable community development; visioning, design, planning and developmental processes; leadership and management skills; marketing and promotion of sustainability concepts and practices; efficacies, indicators, analytic methods and case analyses; platforms for international cooperation; opportunities and careers in pertinent fields.

ESSM 676/RENR 650 Leadership, Development and Management of Environmental NGOs  
Credits 3. 3 Lecture Hours.  
Trends and increasing power of NGOs in environment and sustainable development; understanding of the organizational structures, functions, planning and management processes of environmental NGOs; technical skills and leadership qualities for careers with environmental NGOs.  
Prerequisite: Graduate Classification.  
Cross Listing: RENR 660/ESSM 672.

ESSM 681 Seminar  
Credit 1. 1 Lecture Hour.  
Reviews and discussions of current topics and advances in Ecosystem Science and Management.  
Prerequisite: Graduate classification.

ESSM 684 Professional Internship  
Credits 1 to 16. 1 to 16 Lecture Hours.  
On-the-job training in fields of ecosystem science and management.  
Prerequisite: Graduate classification in an ecosystem science and management major.

ESSM 685 Directed Studies  
Credits 1 to 9. 1 to 9 Lecture Hours.  
Investigations not included in student’s research for thesis or dissertation.  
Prerequisite: Graduate majors or minors in Ecosystem Science and Management.
ESSM 689 Special Topics in...
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.
Selected topics in an identified area of ecosystem science and management. May be repeated for credit.
**Prerequisite:** Graduate classification.

ESSM 691 Research
Credits 1 to 23. 1 to 23 Lecture Hours.
Research for thesis or dissertation.
**Prerequisite:** Graduate majors in Ecosystem Science and Management.