Graduate Area of Specialization in Agroecosystems Science

The Ohio State University
Environmental Science Graduate Program

Scientists studying agroecosystems need the analytical tools to understand complex systems, and measure variation over large spatial extents and long time frames. A growing number of graduate school candidates are interested in approaching agricultural science from an agroecosystems perspective, stemming from interest in such topics as food systems, sustainability, adaptation of agriculture to climate change, and systems approaches to maintaining environmental quality. Agroecosystems function as a combination of people and the land. Therefore, research on agroecosystems is interdisciplinary and, consistent with the goals of the ESGP, requires ability to bridge the social and natural sciences. The Agroecosystems Management Program (AMP) is an interdisciplinary research program hosted by the Ohio Agricultural Research and Development Center. It was founded in the early 1990’s by a group of faculty that spanned the physical, biological and social sciences. Based on their innovative approaches to research, education, and outreach associated with agroecosystems management, the program was endowed by the W. K. Kellogg Foundation in 1998, and the first Kellogg Chair in the US followed that appointment. This specialization will provide a pathway for ESGP students to become integrated more effectively into AMP’s ongoing research and outreach efforts.

Examples of the cutting edge themes addressed by this specialization include:

Local food system development, food system assessment and sustainability – Over $2.5 million in federal and foundation grants have been received by AMP faculty in the past few years in the area of building local economies around food and agriculture.

Watershed ecology and participatory water quality management programs – the Sugar Creek Project has been enormously successful in attracting major research funding, a NSF GK12 training grant, and community-based approaches to creating new incentives for water quality improvement.

Renewable energy from agroecosystems – Research is needed to develop a rational approach to using open space found in agroecosystems for capturing wind and solar energy, and for converting biomass from agroecosystems to materials and energy in sustainable ways.

Sustainability science and policy – Based on the success of AMP, the W. K. Kellogg Foundation has established nine additional Kellogg Chairs throughout the US, and a new endowed network of these Chairs and other scholars from throughout the land grant system (INFAS, the Inter-institutional Network for Food, Agriculture and Sustainability) is currently developing a national research and research-driven policy agenda for sustainability in agriculture and food systems.

Relationship between the specialization and core requirements of ESGP:

For all ESGP specializations, students must complete the requirements for both ESGP and the specialization. The purpose of specializations is to meet the needs of students with common, identifiable interests within the broad arena of environmental sciences and provide formal recognition for developing a particular area of expertise. The ESGP core courses are selected to be broadly applicable to any student in ESGP. Some, but certainly not all, of these courses may be relevant to a given specialization. We expect overlap but not exact correspondence between the ESGP core requirements, and how they are organized, and the specialization objectives and requirements.
Eligibility for the specialization in Agroecosystems Science in ESGP:
Any student admitted to ESGP is eligible to pursue the specialization in Agroecosystems Science. Requirements for admission to the specialization course of study, therefore, are 1.) consent of the student’s advisor, and 2.) completion of the specialization coursework requirements as outlined in this document. The Specialization in Agroecosystem Science Plan of Study form, signed by the student, advisor, and specialization subcommittee chair (appointed by the ESGP Director for each specialization) will be required to document completion of the requirements.

Objectives for the specialization in Agroecosystems Science:
Objective 1: Students will develop a set of Analytical Skills and Engineering expertise that are needed to address the measurement and analysis of variation and change in agroecosystems, including their biological, physical, social and economic dimensions.

Objective 2: Students will develop an understanding of ecology, in terms of the relationship among species and between the biological and physical components of ecosystems, consistent with the core biology and physical sciences subject areas of ESGP. In particular, however, students in the specialization in Agroecosystems Science must demonstrate understanding of these ecological concepts through coursework that relates specifically to agriculture and food systems.

Objective 3: Students will develop an understanding of social, economic and political relationships that impact the functioning of agricultural ecosystems. This requirement will be met by requiring social science coursework that either relates specifically to agriculture and food systems or develops understanding and capabilities in the social sciences that are particularly important in addressing social, economic and policy issues in agriculture and food systems.

Specialization Subcommittee and Core Faculty Members:
The specialization in Agroecosystems Science subcommittee of the ESGP Graduate Studies Committee currently consists of Casey Hoy (subcommittee chair, Entomology and Agroecosystems Management Program), John Cardina (Horticulture and Crop Sciences), Jay Martin (Food, Agricultural and Biological Engineering), and Richard Moore (School of Environment and Natural Resources).

Additional collaborating faculty include:
Biological Sciences: Richard Dick, Charles Goebel, Susan Fisher, Parwinder Grewal, Brian McSpadden-Gardner, Alison Snow, Li Zhang
Physical Sciences and Engineering: Jay Martin, Steve Gordon, Karen Mancl, Fred Michel
Social Sciences: Joe Heimlich, Elena Irwin, Tom Koontz, Brent Sohngen

Required and Optional Coursework:
Coursework is organized according to the three specific objectives described above for the specialization in Agroecosystems Science. The required coursework in each of these areas is outlined below. Courses marked with a √ may also satisfy core requirements of the ESGP. Depending upon the student’s choices, a PhD student pursuing the specialization in Agroecosystems Science in ESGP could take as few as 25 required credit hours to achieve both the ESGP and specialization requirements (18 credit hours that satisfy both ESGP core and specialization requirements plus 2 ESGP seminar credits plus 5 credit hours in GIS and special topics that are unique to the specialization) or as many as 43 credit hours (18 credit hours that satisfy ESGP core requirements plus 23 credit hours of non-ESGP core courses for
the specialization plus 2 ESGP seminar credits). Regardless, 37 to 55 of the student’s 80 required credits will be electives selected by the student, advisor, and advisory committee.

Consistent with ESGP policy, courses taken to satisfy the requirements of a specialization in Agroecosystems Science during a student’s MS will not count toward the requirements for an Agroecosystems Science specialization during the PhD, with the exception of GEOG 5220 Fundamentals of Geographic Information Systems, which will be required for either degree and once taken will count for either or both.

Objective 1: Analytical and Engineering Skills for Agroecosystem Analysis

**Required of all students:**

GEOG 5220 - Fundamentals of Geographic Information Systems G 3

**Choose at least 3 (MS) or 6 (Ph. D.) credits from the following:**

- AEDECON 6120 - Applied Quantitative Methods II G 4
- AEDECON 7120 - Advanced Quantitative Methods II G 3
- AEDECON 7130 - Advanced Quantitative Methods III G 3
- CIVILEN 5420 - Remote Sensing of Environment G 3
- CIVILEN 5421 - Spatial Analysis Techniques for Civil Engineering G 3
- ENVENG 7217 - Applied Mathematical Ecology G 4
- √ ENR 5225 - Ecosystem Modeling G 3 (ESGP Core: Biological Science)
- FABENG 3510 - Introduction to Biological Engineering U G 4
- √ FABENG 5320 - Agroecosystems G 3 (ESGP Core: Physical Science)
- √ FABENG 5180 - Ecological Engineering and Science G 4 (ESGP Core: Physical Science)

Objective 2: Biological and Physical Sciences Related to Agricultural Ecology

**Choose at least 3 (MS) or 6 (Ph. D.) credits of the following:**

- √ EEOB 5470 - Community and Ecosystem Ecology G 3 (ESGP Core: Biological Science)
- √ HCS 5602 - The Ecology of Agriculture G 3 (ESGP Core: Biological Science)
- √ ENR 5263 - Biology of Soil Ecosystems G 3 (ESGP Core: Biological Science)
- √ EARTHSC 5651 – Hydrogeology G 4 (ESGP Core: Physical Science)
- ENR 7700 - Watershed Ecology and Restoration G 3

Objective 3: Social Sciences and Policy Important in Agroecosystem Function and Change

**Choose at least 3 (MS) or 6 (Ph. D.) credits of the following:**

- √ AEDECON 5330 - Benefit-Cost Analysis G 3 (ESGP Core: Social Science)
- AEDECON 7320 - Advanced Resource Economics G 2
AEDECON 7410 - Advanced Regional Economics G 2
√ CRPLAN 6410 - Planning for Sustainable Development G 3 (ESGP Core: Social Science)
√ ENR 8350 - Ecosystem Management Policy G 3 (ESGP Core: Social Science)
ENR 8400 - Human Dimensions of Ecosystems Management G 2
√ RURLSOC 5530 - Sociology of Agriculture and Food Systems G 3 (ESGP Core: Social Science)
RURLSOC 7600 - Concepts and Theories in Rural Sociology G 3
√ RURLSOC 7560 - Environmental Sociology G 3 (ESGP Core: Social Science)

Special topics:

Seminars, studios and group studies courses are offered regularly by faculty participating in the Agroecosystems Management Program, allowing students to focus on key topics in Agroecosystems Science, work in interdisciplinary teams, and partner with stakeholders on real-life case studies. At least 2 credit hours are required in special topics courses related to the specialization in Agroecosystem Science for both the MS and Ph. D. degrees (e.g. Entomol 7890, ENR 8890.03, EEOB 8896.04, etc). These courses will be approved for credit by the specialization subcommittee.

Total ESGP core course options for the specialization:
Biological Sciences - 4; Physical Sciences and Engineering - 3; Social Sciences - 5