Natural Resource Economics, Ph.D.

Levan Elbakidze, Graduate Program Coordinator
e-mail: Levan.Elbakidze@mail.wvu.edu

Degree Offered

- Doctor of Philosophy in Natural Resource Economics

Nature of the Program

The Ph.D. degree is the most advanced degree offered and prepares candidates for work at the highest level of the profession as a faculty member, staff in a research organization or governmental and non-governmental agencies, or as a consultant.

Admissions

A regular graduate student is a degree-seeking student who meets all the criteria for regular admission to a program of their choice and be under no requirements to make up deficiencies.

For regular admission, a student must:

- Possess a baccalaureate degree from a college or university and have at least a grade point average of 2.75 on a 4.0 scale (or an average of 3.0 or higher for the last sixty credit hours).
- Provide three letters of reference from persons acquainted with the applicant’s professional work, experience, or academic background.
- Submit a written statement of 500 words or more indicating the applicant’s goals and objectives relative to receiving a graduate degree, and identify a potential faculty advisor.
- Have an adequate academic aptitude at the graduate level as measured by the Graduate Record Examination (GRE) or the New Medical College Admissions Test (New MCAT).

* International students have the additional requirement to submit a minimum score of 550 on the paper TOEFL examination or 213 on the electronic TOEFL examination if their native language is not English.

Major Code: 0783

Program Requirements

The requirements for obtaining a Ph.D. degree in Natural Resource Economics are outlined in the graduate handbook available on-line at http://resourcemanagement.wvu.edu/. All Ph.D. degree candidates are required to follow a planned program of study. The student develops this plan of study in conjunction with the graduate committee. The plan must be approved by the Director of the Division and the Associate Dean for Academic Affairs of the Davis College.

**Required Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 621</td>
<td>Quantitative Methods in Resource Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 701</td>
<td>Advanced Micro-Economic Theory 1</td>
<td>4</td>
</tr>
<tr>
<td>ECON 711</td>
<td>Advanced Micro-Economic Theory 2</td>
<td>4</td>
</tr>
<tr>
<td>ECON 721</td>
<td>Mathematical Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 725</td>
<td>Econometrics 1</td>
<td>3</td>
</tr>
<tr>
<td>ARE 703</td>
<td>Advanced Natural Resource Economic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ARE 710</td>
<td>Advanced Environmental Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 726</td>
<td>Econometrics 2</td>
<td>3</td>
</tr>
<tr>
<td>ECON 727</td>
<td>Econometrics 3</td>
<td>3</td>
</tr>
<tr>
<td>or ARE 729</td>
<td>Spatial Econometrics</td>
<td></td>
</tr>
</tbody>
</table>

**Required Field (select one of the following):** 6

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 540</td>
<td>Rural and Regional Development</td>
</tr>
<tr>
<td>ARE 542</td>
<td>International Agricultural Economic Development</td>
</tr>
<tr>
<td>ECON 751</td>
<td>International Trade</td>
</tr>
<tr>
<td>ECON 754</td>
<td>Comparative Economic Systems</td>
</tr>
<tr>
<td>ECON 761</td>
<td>Advanced Regional Economics</td>
</tr>
<tr>
<td>ECON 762</td>
<td>Advanced Urban Economics</td>
</tr>
</tbody>
</table>
Spatial Economic Analysis

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 729</td>
<td>Spatial Econometrics</td>
</tr>
<tr>
<td>ECON 727</td>
<td>Econometrics 3</td>
</tr>
<tr>
<td>ECON 761</td>
<td>Advanced Regional Economics</td>
</tr>
<tr>
<td>RESM 575</td>
<td>Spatial Analysis for Resource Management</td>
</tr>
</tbody>
</table>

Macroeconomics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 702</td>
<td>Advanced Macro-Economic Theory 1</td>
</tr>
<tr>
<td>ECON 712</td>
<td>Advanced Macro-Economic Theory 2</td>
</tr>
</tbody>
</table>

Seminar

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 796</td>
<td>Graduate Seminar</td>
</tr>
</tbody>
</table>

Research

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 797</td>
<td>Research</td>
</tr>
</tbody>
</table>

Teaching Practicum

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 690</td>
<td>Teaching Practicum</td>
</tr>
</tbody>
</table>

Qualifying Exam

Mentored Research Paper

Dissertation Proposal Defense

Dissertation

Total Hours 38

Major Learning Outcomes

NATURAL RESOURCE ECONOMICS

Learning outcomes for this degree program are that each graduate:

- Demonstrate the capacity to produce economic research that can be accepted for publication in leading academic journals.
- Be proficient in oral and written communication.

Agriculture Resource Econ Courses

ARE 540. Rural and Regional Development. 3 Hours.
PR: ARE 300 and ARE 321. Economic theories and quantitative techniques. Problems and goals for rural and regional planning; methods of policy analysis for community infrastructure development.

ARE 542. International Agricultural Economic Development. 3 Hours.
Current problems, theories, policies, and strategies in planning for agricultural and rural development for increased food production and to improve the well-being of rural people in the developing countries of the world.

ARE 580. Energy Industry Economics. 3 Hours.
PR: Graduate standing. Technical production and consumption methodologies, environmental concerns, and national and global economics and politics in making energy decisions.

ARE 581. Resource Appraisal and Decision Making. 3 Hours.
PR: ARE 500 or equivalent. Investment analysis, decision making under risk and uncertainty, and project analysis applied to resource exploration and utilization; mineral and energy reserve and resource estimation techniques.

ARE 585. Economics of Water Resources and Energy. 3 Hours.
PR: Calculus with a grade of B- or better or consent, introductory micro economics with a C- or better or consent. Allocation under scarcity, water institutions and management, risk, pricing, marketing, demand and supply estimation, interdependence between energy and water resources (Credit cannot be received for both ARE 485 and ARE 585).

ARE 591. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation in advanced topics that are not covered in regularly scheduled courses.

ARE 592. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

ARE 593. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

ARE 594. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.
ARE 595. Independent Study. 1-9 Hours.
Faculty-supervised study of topics not available through regular course offerings.

ARE 600. Research Methods. 1 Hour.
Research methods in agricultural, environmental, and resource economics. The application of scientific thinking in developing research proposals and critiquing published research.

ARE 601. Applied Microeconomics. 4 Hours.
PR: ARE 401 or equiv. Consumer and production economics applied to resource, environmental, and agricultural analysis.

ARE 620. Adaptation and Mitigation Strategies for Addressing Climate Change. 3 Hours.
This course identifies mechanisms that may be used to offset or reduce the effects of a changing climate. It addresses options that can help to protect agriculture and food production, protect human health, improve water resources and ecosystems services, and provide for the energy needed for continued economic activity. Students cannot receive credit for both ARE 420 and ARE 620.

ARE 621. Quantitative Methods in Resource Economics. 3 Hours.
PR: ARE 601 and ECON 421 or equivalents. Optimization techniques in economic analysis of natural resources; environmental and agricultural management problems; linear, nonlinear, and dynamic programming.

ARE 624. Econometric Methods in Resource Economics. 3 Hours.
PR: ECON 425. Application methods to natural resource, environmental, and agricultural economic problems; single and simultaneous equation models, specification problems, topics in time series, and cross-sectional analysis.

ARE 632. Natural Resource and Environmental Economics. 3 Hours.
PR: ARE 600 and ARE 621 or equivalent. Theory and institutions; market failure, externalities and property rights issues; renewable and nonrenewable resources, common property, environmental and resource management, and intergenerational decisions.

ARE 633. Natural Resource Policy Analysis. 3 Hours.
PR: ARE 600 and ARE 621, or equiv. Welfare economics applied to the analysis and evaluation of natural resources, environmental, agricultural, and energy policy issues.

ARE 643. Project Analysis and Evaluation. 4 Hours.
Analysis and evaluation of investment projects; economic and financial aspects of project analysis; risk analysis; preparation of feasibility reports.

ARE 644. International Markets and Trade. 3 Hours.
PR: ARE 600 and ARE 621. Causes and consequences of international trade and investment; commodity market structures, commodity price instability and international agreements; trade barriers and protection, export promotion, and impacts on developing countries.

ARE 690. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in college teaching of agriculture research economics. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It also provides a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).

ARE 691. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

ARE 692. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

ARE 693. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

ARE 694. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.

ARE 695. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

ARE 696. Graduate Seminar. 1-3 Hours.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

ARE 697. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)

ARE 698. Thesis or Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.
ARE 699. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use of the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is P/F; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.

ARE 703. Advanced Natural Resource Economic Theory. 3 Hours.
PR: ECON 710 and ARE 632. Allocation and distribution of natural resources in static and dynamic contexts; welfare economics, cost-benefit analysis, and optimal control approaches; applications to resource valuation, exhaustion, taxation, and regulation in theory and practice.

ARE 710. Advanced Environmental Economics. 3 Hours.
PR: ECON 701 and ARE 632 or Consent. Theory, efficient environmental design and analysis, modeling of economic and environmental systems, evaluation of non-market benefits and costs, and risk assessment.

ARE 729. Spatial Econometrics. 3 Hours.
Explores the various types of spatial econometric models and how they are estimated and interpreted. Maximum likelihood and Bayesian methodologies will be demonstrated both mathematically and in an applied setting.

ARE 730. Advanced Applied Econometrics. 3 Hours.
PR: ECON 701 and ECON 711 and ECON 721 and ECON 725 and ECON 726. Expands upon economic and econometric theory to develop further the research expertise in applied econometrics. This includes critical analysis of when certain methods are applicable given the research question or data available.

ARE 735. Resources of Development Planning. 3 Hours.

ARE 770. Teaching Practicum. 1-3 Hours.
Supervised practice in college teaching of agriculture. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).

ARE 791. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation in advanced topics that are not covered in regularly scheduled courses.

ARE 792. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

ARE 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

ARE 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

ARE 796. Graduate Seminar. 1-3 Hours.
PR: Consent. Each graduate students will present at least one seminar to the assembled faculty and graduate student body of his or her program.

ARE 797. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis (697), problem report (697), research paper or equivalent scholarly project (697), or a dissertation (797). Grading may be S/U.

RESOURCE MANAGEMENT COURSES

RESM 505. Drones in Resource Management. 3 Hours.
PR: An interest in aeronautical principals, spatial data collection and analysis, and natural resource applications is preferred. Provides training in the use of drones to collect and analyze spatial data in natural resource applications.

RESM 540. Geospatial Modeling. 3 Hours.
There are two goals for this course: to present the fundamental methods for analyzing spatial data statistically, and to demonstrate spatial model building implementation and analysis. A prior statistics or econometric course is recommended.

RESM 545. Spatial Hydrology and Watershed Analysis. 3 Hours.
PR: RESM 440 and consent. Introduction to applied spatial hydrology using GIS; integrates statistical modeling and terrain analysis; provides insights into water quality and quantity analysis for local and regional watershed scales. (Credit cannot be received for both RESM 445 and RESM 545.)

RESM 560. Advanced Energy Project and Program Management. 3 Hours.
This course builds around the concepts and best practices required to manage, coordinate and provide effective leadership for multi-dimensional programs and projects in the energy and environmental resource industries.

RESM 575. Spatial Analysis for Resource Management. 3 Hours.
This interdisciplinary course develops and applies advanced Geography Information System (GIS) and spatial analysis skills for natural resource and environmental management. (Previous GIS experience helpful.).
RESM 585. GIS and Spatial Analysis Project. 3 Hours.
PR: RESM 440 or GEOG 350 or consent. Provides an opportunity for students to pursue a research interest in the spatial sciences with development of an applied spatial project and paper. Guidance and direction will be provided to assure relevant integration of the geospatial techniques to address the problem addressed.

RESM 591. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

RESM 592. Directed Study. 1-6 Hours.
Directed study, reading and/or research.

RESM 593. Special Topics. 6 Hours.
A study of contemporary topics selected from recent developments in the field.

RESM 595. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

RESM 590. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in the college teaching of resource management. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It also provides a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).

RESM 691. Advanced Topics. 1-6 Hours.
RESM 691. Advanced Topics. 1-6 hr. PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

RESM 692. Directed Study. 1-6 Hours.
Directed study, reading and/or research.

RESM 693. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

RESM 694. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.

RESM 695. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

RESM 696. Graduate Seminar. 1-3 Hours.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

RESM 697. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

RESM 698. Thesis or Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.

RESM 699. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking course work credit but who wish to meet residency requirements, use of the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is S/U; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.

RESM 790. Teaching Practicum. 1-3 Hours.
Supervised practice in college teaching of agriculture. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).

RESM 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

RESM 795. Independent Study. 1-9 Hours.
Faculty Supervised study of topics not available through regular course offerings.

RESM 796. Graduate Seminar. 1-3 Hours.
PR: Consent. Each Graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

RESM 797. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis (697), problem report (697), research paper or equivalent scholarly project (697), or a dissertation (797). Grading may be S/U.