



Davis College of Agriculture, Natural Resources, and Design
School of Natural Resources
Division of Resource Economics & Management

Graduate Program Handbook

2018-2020

Master's Degree

MS in Resource Economics and Management

**PhD in Resource Management and Sustainable Development:
Areas of Emphasis**

- a) Natural Resource Economics
 - b) Resource Management
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I. GENERAL INFORMATION

1. Introduction

The Division of Resource Economics and Management (REM) offers a Master of Science degree and the PhD in Resource Management and Sustainable Development. The Division is an administrative unit consisting of one academic program and two research centers: the Natural Resource Analysis Center and the US-China Clean Energy Research Center. The PhD program, because of the interdisciplinary and multidisciplinary nature of its areas is a joint effort of faculty represented in the Division along with faculty in the School of Design & Community Development (<http://designcomm.wvu.edu/>), particularly in offering the Human and Community Development area. Like the Division of Resource Economics & Management, this school is located in the Davis College of Agriculture, Natural Resources, and Design.

The Natural Resource Economics PhD. specialization relies on collaboration with the Department of Economics, College of Business and Economics, which teaches required courses in econometrics and mathematical economics. The Economics Department also offers other courses of interest to our students. This collaboration also benefits the MS in Resource Economics and Management.

1.1. Program History

The Division of Resource Management was formed in the 1960s. At that time, graduate programs were comparatively small and consisted of the MS in Agricultural Education and MS in Agricultural Economics. The Division, in collaboration with the Department of Economics, offered a doctoral specialization in Agricultural Economics under the auspices of Economics, but this collaboration was eventually abandoned. In 1992, the governing body of West Virginia University approved the merger of Agricultural Economics and Mineral and Resource Economics, respectively, to form the program in Agricultural and Resource Economics. Mineral and Resource Economics, which had previously been housed in the College of Engineering and Mineral Resources, brought with it their PhD program in Mineral and Resource Economics. The faculty of the newly formed Program in Agricultural and Resource Economics revised this PhD program and thus created the PhD in Natural Resource Economics. Until 2006, this remained the only option for doctoral study in the Division of Resource Management, and it was administered by the faculty in Agricultural and Resource Economics program.

In 2006, the Division changed the title of the PhD Program and added three new areas. In addition to Natural Resource Economics (NRE), the program now also offers areas in Agricultural and Extension Education (AgEE), Human and Community Development (HCD), and Resource Management (RESM). Because the new areas require significant cross-disciplinary collaboration, the PhD Program is now administered by the Division and its faculty. The degree title on the diploma received upon graduation reflects the graduate's area of emphasis while in the program.

In 2014, the Davis College formally re-organized into three schools. The Division of Resource Management was placed on the School of Natural Resources. The Agricultural and Extension Education and the Landscape Architecture program (formerly part of Resource Management) were placed in the School of Design & Community Development. Thus, the AgEE and HCD areas of emphasis in the PhD degree are now administered out of the School of Design & Community Development. In 2016, the Division of Resource Management was formally changed to the Division of Resource Economics & Management and the references to the Agricultural and Resource Economics program were dropped. Then, in 2017, the M.S. degree name was changed from Agricultural and Resource Economics to Resource Economics and Management.

1.2. West Virginia University and Morgantown Area

- West Virginia University (WVU) is one of two land grant institutions in West Virginia and the state's flagship research university.
 - Fall 2016 WVU System enrollment is 31,287 (Morgantown campus - 28,488).
 - The WVU campus consists of three distinct locations:
 - The Downtown campus
 - The Evansdale campus
 - Robert C. Byrd Health Sciences campus.
 - The three campuses are connected through the Personal Rapid Transit (PRT) system and buses. Parking for those who drive to school is available, but is often scarce. Parking permits are usually valid for one specific lot only.
 - Morgantown, W.Va., population 31,073 (US Census Bureau, 2014), was rated "No. 1 Small City in America" by BizJournals.com.
 - Morgantown is within easy traveling distance of Washington, D.C., to the east, Pittsburgh, Pa., to the north, and Cleveland and Columbus, Ohio, to the northwest.
 - The climate is moderate with an average January temperature of 36.7 Fahrenheit (2.62°C) and a July average of 68.3 Fahrenheit (20.17°C).
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1.2.1. Housing

Most graduate students live off campus; on campus housing for graduate students is very limited. For contact information, check the web page of graduate housing services.¹ Since convenient and reasonably priced apartments and houses are most sought after, they will rent quickly. Often students will renew their contract before they leave WVU for the summer break. Therefore, the search for housing should start early.² The Office of Student Life provides a webpage with useful information about resources for finding off-campus housing and for evaluating housing safety features.³ Student legal services will review lease agreements, if asked, and will also mediate in disputes between students and landlords.⁴

1.2.2. Travel

Travel by car is easy and convenient. The area has good highway connections, with Interstate 79 providing convenient north-south access, and Interstate 68 connecting to Maryland and the Washington-Baltimore MSA. I-79 connects with I-70, a major national east-west transportation corridor, in Washington, PA, some 46 miles (50 minutes) north of Morgantown.

¹ http://housing.wvu.edu/graduate_student_faculty_and_staff_housing

² The following website provides information about apartment rentals: <http://www.morgantownwvrentals.com/>.
Craigslist can also be a good source: <http://morgantown.craigslist.org/apa/>

³ http://campuslife.wvu.edu/off_campus_housing/off_campus_housing_search

⁴ <http://campuslife.wvu.edu/r/download/103308>

Pittsburgh, PA, is a large city close to Morgantown and Monongalia County, about 75 miles by car or approximately 1.5 hours travel time, except during the height of rush hour. Pittsburgh International Airport is located north of the city and can also be reached in about 1.5 hours by car. Washington, DC is located some 215 miles east of Morgantown and the estimated travel time by car is 3 hours and 40 minutes.

Morgantown has its own municipal airport. There is also an airport in Clarksburg, WV, about 40 minutes south. Many travelers to Morgantown take flights into Pittsburgh. To connect to the Pittsburgh airport, you must drive or take a bus (<http://www.busrider.org/>).

Morgantown has no passenger rail service connection. However, bus service is available to Washington DC and Pittsburgh from Megabus and along I-79 cities via I-79 RIDE. Both offer departures from Mountaineer Station, 1112 Van Voorhis Road.

Traffic in Morgantown is congested during rush hours. Everywhere on campus parking is scarce, but nowhere more so than on the downtown campus. The City of Morgantown maintains a bus service, the Mountain Line Transit,⁵ which is free if you show a valid WVU student, staff, or faculty identity card. The university Personal Rapid Transit (PRT) also provides between-campus transportation.⁶ There are limited numbers of on-campus parking permits available.⁷

1.2.3. Health Care

Taking care of your health is an important aspect of your academic success. The Students' Center for Health provides comprehensive services, including nutrition, counseling, assessment of learning disabilities, and medical services.⁸ It also provides services to students who travel abroad as part of their learning experiences at WVU, including vaccinations and counseling on preventive steps that can be taken. The Student Recreation Center offers many opportunities for those who seek to exercise, from minor workouts to major personal fitness programs.⁹ All students are required to have health insurance. Insurance is available for students without insurance coverage elsewhere at a cost of \$912 per semester as of spring 2018.

1.2.4. Recreation

Success requires hard work, but it is important to balance study efforts with recreational activities. Morgantown and its surroundings offer many opportunities to get away and return back to work and study refreshed. On a daily basis, the Student Recreation Center offers swimming, jogging, weights, yoga classes, and much more. The area also has a substantial and growing network of running, bicycling, and hiking paths, including old railroad lines that have been converted to bike trails. The city offers an open-air swimming pool and in winter maintains an ice rink. Monongalia County has active youth sport leagues, particularly in basketball, baseball, and soccer and it also offers opportunities for adults.

There are several scenic and cultural sites of interest within roughly one hour by car from Morgantown. A few of them are internationally famous. For example, Frank Lloyd Wright's famous residential building, Falling Water, is located about an hour's drive north of Morgantown in Pennsylvania. Reservations are highly recommended. This is one of America's most famous architectural sites. <http://www.fallingwater.org/>

Kentuck Knob is another residence designed by Frank Lloyd Wright. Smaller than Falling Water, it was intended as a home for an average middle class family. The two residences are located in fairly close

⁵ <http://www.busrider.org/>

⁶ <http://transportation.wvu.edu/prt>

⁷ <http://transportation.wvu.edu/parking/parking-options>

⁸ <http://www.well.wvu.edu/>

⁹ <http://studentreccenter.wvu.edu/intramurals>

proximity so that it is possible to visit both of them on the same day; reservations are necessary.

<http://www.kentuckknob.com/>

Friendship Hill, PA, National Historic Site contains the home of Albert Gallatin, who served as U.S. Secretary of the Treasury from 1801 to 1814 and managed the financing of the Louisiana Purchase. To this day, Gallatin remains the longest-serving Secretary of the Treasury in the history of the United States. The site is maintained by the National Park Service. From April through October the house is open daily. The rest of the year it is open only on Saturday and Sunday. The site is about 30 minutes from Morgantown. <http://www.nps.gov/frhi/index.htm>

Coopers Rock State Forest is located 13 miles east of Morgantown in Monongalia and Preston County. It provides many shaded hiking/mountain biking trails, a beautiful overlook over the Cheat River, camping sites, covered shelters for picnics and get-togethers (reservations required), and picnic tables and barbecue grills. The park contains the Henry Clay Iron Furnace, a testimony to the early industrialization of the region. In winter, some of the trails are open for cross-country skiing.

<http://www.coopersrockstateforest.com/trails.html>

Prickett's Fort State Park. The fort is a re-creation of the original fort build in 1774. The park also contains a historic farm house that is open to visitors. On weekends and during special events, crafts-people demonstrate traditional activities such as baking, blacksmithing, etc. Prickett's Fort is located in Fairmont, 30 to 40 minutes by car. <http://www.prickettsfortstatepark.com/>

West Virginia Public Theater is located in Morgantown and offers Broadway quality musical theater. <http://www.wvpublictheatre.org/>

Wisp resort and Deep Creek Lake State Park in Maryland offer year-round activities, particularly boating, golfing, and skiing. Wisp resort offers downhill skiing in winter and is open for night-skiing during the week. Deep Creek Lake State Park has a nice beach to relax and cool down, as well as walking trails and an educational center. McHenry/Wisp can be reached within an hour by car.

<http://www.wispresort.com/> <http://dnr2.maryland.gov/publiclands/Pages/western/deepcreek.aspx>

Canaan Valley rises above 3000 feet (more than 1000 meters above sea level) and contains two ski resorts, two state parks (Blackwater Falls and Canaan), the Canaan Valley National Wildlife Refuge, and the Dolly Sods U.S. Wilderness Area. It can take up to two hours to get to Canaan Valley by car.

http://www.stateparks.com/canaan_valley.html, <http://www.blackwaterfalls.com/>
<http://canaanresort.com/13/wp-content/uploads/2013/05/TrailMapProofV5lowres.pdf>
http://en.wikipedia.org/wiki/Dolly_Sods_Wilderness

Finally, Arthurdale, which is located in neighboring Preston County, is a National Historic District dating back to the Great Depression of the 1930s, when Eleanor Roosevelt, the wife of President F.D. Roosevelt, wanted to contribute to poverty mitigation in Appalachia and proposed and was able to realize, a federally funded new homestead community.

<http://www.arthurdaleheritage.org/>

2. Admissions Process

The admission process can be started at any time. Normally, the fall semester is the time for entering into the program. International students should take into consideration the time it takes to obtain the necessary visa and other permits. Early application is a safeguard against missing immigration paperwork deadlines. See more on deadlines below.

Admission requirements to the program fall into three categories: University requirements, College requirements, and Division requirements. Specific programs may have additional requirements in the form of course prerequisites and professional experience. The University requirements apply to masters as well as to PhD program applicants. Please note that meeting requirements does not guarantee admission.

2.1. Admission Requirements

2.1.1. University Requirements

Regular admission requirements at West Virginia University for domestic graduate students are specified at:

<http://graduate.wvu.edu/future-students/admissions-requirements>

Additional requirements for international students are specified at:

<http://graduate.wvu.edu/future-students/information-for-international-students/admissions-c>

2.1.2. Davis College of Agriculture, Natural Resources, and Design Requirements

In addition to the University requirements, the Davis College of Agriculture, Natural Resources, and Design requires that applicants take the Graduate Records Examination (GRE) and obtain scores adequate to demonstrate an aptitude for graduate study (see Table 1), provide three (3) letters of reference, and submit a statement of 500 words or more indicating the applicant's goals and objectives for graduate study.

2.1.3. Division Requirements

In addition to the University and the Davis College of Agriculture, Natural Resources, and Design requirements, the Division requires that applicants to the PhD program have an earned grade point average (GPA) of at least 3.0 on a 4.0 scale. The combined total of the verbal and quantitative GRE scores on exams given since 2011 must add to at least 300 and 3.0 is the minimum acceptable score for the analytical writing section (see Table 1). The code for sending GRE, TOEFL, and IELTS scores to WVU is 5904.

Requirements that apply to specific programs are listed with the description of those programs in Part II of the Handbook. Please note that meeting the minimum requirements does not guarantee admission into a program.

Table 1. Summary GPA, GRE, and TOEFL Minimum Requirements.

Criteria Program	GPA	TOEFL or IELTS	GRE ¹⁰	
			Combined Score Verbal and Quantitative	Analytical Writing Score
MS Programs	2.75/4.00	213 computer-based 550 paper-based test 79-80 Internet-based or 6.5 on IELTS	Demonstrate aptitude for graduate study	
PhD Program	3.00/4.00		1000/1600 (2011 and before) 300/340 (test since 2011)	3.0/6.0

¹⁰ Verbal reasoning and quantitative reasoning GRE scores, respectively, range from 200 to 800 and proceed in increments of 10. The analytical writing score ranges from 0 to 6 and proceeds in half-point (0.5) increments. For more information, see <http://www.ets.org/gre/general/scores>.

2.2. Admission

There are three types of admission. The first two types of admission discussed below, regular and provisional, are for students wishing to pursue a degree. The third admission type, non-degree, is for students wishing to attend a specific set of classes to enhance their professional skills and qualifications.

2.2.1. Regular Admission

A regular graduate student is a degree-seeking student who meets all the criteria for admission to the applicable program and who has no deficiencies to make up.

2.2.2. Provisional Admission

A degree-seeking applicant with strong credentials who does not meet all of the criteria for admission, but whose application materials nonetheless indicate a high probability of success, may be admitted as a provisional student. Provisional students are required to remove deficiencies at the earliest possible time, usually by the end of the first semester. For example, an academically strong applicant who is missing the Graduate Record Examination (GRE) may be admitted on a provisional basis so as not to miss the start of the semester and the program. Such a student should register for and complete the GRE at the earliest possible date.

Students with deficiencies in course work, such as inadequate background in theory, introductory research methods, or mathematics and statistics, should enroll in the appropriate class or classes in their first semester so as to gain regular status no later than one year after the initial provisional admission. Only regular students in good standing, which usually also means a GPA of 3.3/4.0 or better, are eligible for financial assistance from the Division or for a research or teaching assistant position.

2.2.3. Admission as a Non-Degree Student

A graduate student may be admitted to the Davis College of Agriculture, Natural Resource, and Design without being admitted to any specific program in the College. Non-degree students wishing to take a particular course must meet the requirements and/or prerequisites for that course or obtain the permission of the course instructor.

Applicants may be admitted as non-degree students for a variety of reasons, including a missed application deadline for a degree program, incomplete credentials beyond minor deficiencies, or an academic record that does not qualify them for admission unless they can demonstrate their ability by first successfully completing several courses in the program. Please note, however, that such success does not guarantee admission, which is awarded on a competitive basis.

To be admitted as a non-degree student, the applicant must present evidence of a baccalaureate degree and at least a 2.50/3.00 GPA. Once admitted, the non-degree student must also obtain at least a 2.50/3.00 GPA on the first 12 credit hours of course work and maintain this average or better as long as enrolled as a non-degree student. To be eligible to enter a MS degree program the student must obtain a minimum GPA of 2.75/3.00 on all course work taken since admission as a non-degree graduate student. The minimum GPA for admission to the PhD program is 3.0/4.0.

The non-degree program is administered by the Associate Dean for Academic Affairs of the Davis College of Agriculture, Natural Resources, and Design. Requests by non-degree students for admission into one of the Division of Resource Economics & Management's Graduate Programs, that is, for a change of admission status, will be evaluated by that Program's Graduate Admissions Committee.

3. Application Process

The application fee for graduate admission is \$60 for both West Virginia residents and non-residents. If you are a West Virginia University employee, contact the Office of Admissions at (304) 293-2121 for information on how to have the application fee waived.

Applicants should complete and submit the application form together with: (a) the required supporting documents, which include official transcripts of all undergraduate and previous graduate studies, curriculum vita, three letters of reference, personal statement describing research interests and professional aspirations, GRE test scores, and, for foreign students whose native language is not English, TOEFL examination results, and (b) the \$60 application fee to the WVU Office of Admissions and Records.

Do not send your application to the Division or Program. If you send your application to the Division or Program, the University has no record that you have applied and your application cannot be processed. All graduate program applications are online. The link below allows you to start the online application process:

https://app.applyyourself.com/AYApplicantLogin/fl_ApplicantConnectLogin.asp?id=wwugrad

Once your application is complete¹¹, the Office of Admissions will forward the application to the Davis College of Agriculture, Natural Resources, and Design, and then to the Division of Resource Economics & Management, where it will be reviewed and the admission decision will be made. MS applicants will be reviewed by a committee made up of faculty of the specific MS program, while PhD students will be evaluated by a committee of three to four Division faculty members and the Division Graduate Program Coordinator. The Division Director separately reviews all applications and occasionally sends a file back with a question or questions for the review committee, which then either affirms or reverses its decision. **Applicants who desire assistantship funding must fill out a separate assistantship application that can be obtained from Mrs. Lisa Lewis (llewis2@wvu.edu).**

3.1. Deadlines

The graduate programs accept applications at any time. Table 2 summarizes the deadlines for admission starting in the fall semester.

- a. However, since fall (August) is the time when students normally enter a program (because of the sequencing and availability of required courses), an application must be completed no later than mid-May for citizens and permanent residents (green card holders), and no later than the end of March for international applicants. The latter must allow for enough time to complete necessary visa paperwork, which can take several weeks, even months. In some countries, students also need to obtain an exit permit from their government. Failure to adhere to these deadlines may cause entry into the program to be delayed until the fall of the following year.
- b. The Division makes decisions about financial support (i.e. graduate assistantships) by the end of April. For full consideration, applicants should complete their applications by the end of March to be considered for assistantship funding.

¹¹ Transcripts, 3 letters of recommendation, statement of purpose, application form, GRE scores, TOEFL scores (for international non-native English speaking applicants), and application fee.

- c. Spring semester admission is strongly discouraged. Under exceptional circumstances, students may be able to start their program in the spring semester (January). However, these students will not likely be eligible for a graduate assistantship.

Table 2. De facto Application Deadlines.

	U.S. Students	International Students
<i>Fall Semester, does not request support</i>	No later than mid-May	No later than end of March, earlier date is preferred
<i>Fall Semester, requests financial support or assistant position</i>	Prior to the end of March, earlier date is preferred	

4. Student Employment

4.1. Graduate Assistants

The most common form of employment for graduate students is an assistantship position. There are two types of assistantships: (a) Graduate Research Assistant (GRA) and (b) Graduate Teaching Assistant (GTA). Some positions have a mix of GTA and GRA responsibilities. Graduate assistants are paid a salary for their work and full remission of their tuition, but not the various fees for which the student remains responsible.

GRA and GTA position should not be confused with financial aid. While the tuition remission and the salary are an important source of funding for most students holding assistant positions, these positions come with clear job expectations and responsibilities. These include: (a) Students are expected to work an average of 20 hours per week¹². They are given flexibility, in consultation with their supervisor, so that hours can be reduced below 20 during exam times or when term papers become due, but students are expected to make up the missed time when they face fewer course demands. (b) Assistants are assigned to a faculty member, and sometimes more than one, for whom they work. The assistant is expected to report about the progress of her or his work at least once a week with the supervisor and at least once a month the progress report should be in writing.

In addition to helping pay bills, assistantships offer graduate students the opportunity to gain experience in research and/or teaching, and thus support the process of building a record of achievements before entering the academic job market. In the ideal case, a student is very interested in the GRA project and carves out a part of it for the dissertation research, which is pursued under the guidance of the faculty supervisor, but relatively independently.

4.2. Selection of Graduate Assistants

Important criteria in the selection of GRA and GTA positions include an applicant's qualifications and skills relative to the needs of the work to be performed under the assistantship. Thus, while GPA plays a significant role, it is possible that a student with a lower GPA may be selected over one with a higher GPA, but less well prepared to meet the position requirements. The ability to perform required tasks is the most important criterion. Financial need plays a minor role.

The Division, in practice usually the Graduate Program Coordinator together with the Division Director, makes the final decision concerning the awards of Division-funded assistant positions (usually referred to as Hatch assistantship after the federal program that funds them). All other assistantship award decisions are the prerogative of the principal investigator (PI) with a grant that funds the position. In general, faculty members consult with the Graduate Program Coordinator to balance the needs of different faculty members and to achieve the best possible matches between applicants and assistant positions, but the faculty PI has the final say.

4.3. Limitations and Requirements on Assistant Positions

- a) Students who have been awarded GRA and GTA are expected to maintain a cumulative GPA of 3.3/4.0 or better. Should their GPA fall below this average, a student should immediately seek the advice of her or his supervisor on how to re-establish compliance with the requirement.

¹² Both full and half assistantships are given out. 20 hours per week is at a full assistantship level. One-half assistantship levels are 10 hours per week.

- b) PhD assistantships are normally employed for a total of no more than three years. Contracts are for an academic year and are subject to funding availability plus satisfactory student performance. Unsatisfactory work can lead to termination before the three-year period expires.
- c) PhD students are the most likely candidates for assistantship positions. MS students will generally not be offered an assistantship, although some partial (10 hours per week) assistantships are awarded.
- d) Most assistantship positions are nine-month positions and students need to find alternative work during the summer months (May 16 to August 15).
- e) We expect all of our students to abide by WVU's rules of conduct and academic integrity, and we expect graduate assistants to help set a high standard by example.¹³

4.4. Other Student Employment

A graduate student not holding an assistantship may be employed by the Division of Resource Economics and Management as a student worker on an hourly or other basis, subject to availability of funds and faculty needs.

Some of our graduate students seek and find assistantships in other divisions and colleges. For example, students have found employment as GRAs at the Regional Research Institute, as residence assistants in undergraduate dormitories, or been hired as GTAs in other departments (for example, by the Department of Biology). In addition, the Davis College has a cooperative agreement with the Natural Resource Conservation Service which provides assistantship opportunities for domestic graduate students. While some of these positions are not as ideal an assistantship in the Division, they offer similar benefits, including tuition waiver and a salary.

For international students, special rules apply to other part-time employment opportunities on campus. F-1 students must have studied in the United States for at least nine months before they can be considered for employment, and they must demonstrate unforeseen changes in their (financial) situation. If approval is obtained, students can work up to 20 hours per week. For more information, we recommend very strongly that you contact WVU's Office of International Students and Scholars.¹⁴

5. Financial Assistance

A limited number of tuition waivers are available during the fall and spring semesters. They are awarded on the basis of merit and need. These waivers are for a maximum of nine credit hours per student per semester. Other financial assistance opportunities may be available through the University's Financial Aid Office.¹⁵ Outright financial aid for international students is relatively scarce, but permanent residents are eligible for most federal student finance program. Also eligible are citizens of Freely Associated States: the Federated States of Micronesia and the Republics of Palau and the Marshall Islands. For more of who is eligible and for what programs, consult <http://ifap.ed.gov/sfahandbooks/attachments/0809FSAHbkVol1Ch2.pdf>.

6. Graduate Program Procedures

All of our graduate programs rely on the close interaction between a student and her/his major faculty advisor. The major professor helps select courses and, together with the student and the student's graduate committee, helps shape the former's curriculum and research program. The role of the major professor is that of teacher, mentor, advisor, counselor, and coach.

¹³ See http://campuslife.wvu.edu/office_of_student_conduct for details.

¹⁴ <http://oiss.wvu.edu/students>

¹⁵ http://www.finaid.wvu.edu/home/international_students

The student is responsible for meeting all degree and other requirements in a timely fashion. Information about college requirements and necessary forms mentioned below can be obtained at:

assets.slate.wvu.edu/resources/427/1292362661.pdf.

6.1. Major Professor

Each student must have a major professor, to be jointly determined by the student and the faculty member involved with guidance from the Graduate Program Coordinator and Division Director. The major professor must be a member of the Division faculty and be a regular member of the WVU graduate faculty. It is the student's responsibility to ensure that the major professor is selected or assigned. As covered in Part II, deadlines for selecting a major professor are program specific.

6.2. Graduate Committee

The student in cooperation with the major professor selects the other members of the Graduate Committee. The majority of the Committee must be regular members of the Graduate Faculty and a majority must be Division faculty members. Some programs may have additional requirements.

6.2.1. MS Program

The graduate committee consists of a minimum of three persons (the major professor as chair and two additional members). The chair of this committee must be a regular graduate faculty member of the Davis College as well as the majority of the committee must have regular graduate faculty status. One member can be from an area other than the MS Program area. The graduate committee should be established by the end of the first year of study.

6.2.2. PhD Program

The graduate committee consists of a minimum of four persons (the major professor as chair and three additional members). At least one member of a PhD student's graduate committee **must** be a faculty member from outside the program areas. The chair of this committee must be a regular graduate faculty member of the Davis College and the majority of the committee must have regular graduate faculty status. The PhD graduate committee should be established no later than after the student has passed the qualifying exam (information about this exam is provided in the program-specific section of this handbook).

6.3. Plan of Study

"All graduate students must have a plan of study, which is a formal agreement between the student and their program faculty regarding the conditions the student must meet to earn the desired degree. The plan of study usually lists required courses and activities and describes the timeline for these requirements. The plan may also include suggested or optional courses and activities. Each college or school determines the mechanisms for establishing, changing, and monitoring students' progress on plans of study." (Source: 2015-16 *WVU Graduate Catalog*, p. 23)

6.4. Registration Requirements

Normally, a student is expected to register for a full course load. A graduate student is classified as full-time if enrolled for at least 9 hours per semester and for 6 hours in summer, although summer enrollment is optional except for graduate research assistants on a 12-months appointment. Students using University facilities must be registered for at least one credit hour. In addition, students must be registered for at least one hour during the term when they receive the degree. Details on registration requirements, time limits for degree completion, etc. can be found in the *WVU Graduate Catalog*.¹⁶

Beyond taking courses, graduate students at WVU are expected to participate in such academic activities as lectures presented by visiting scholars, scholarly discussions with faculty and fellow graduate students, and in seminar courses (ARE 696 for MS and ARE or RESM 796 for PhD) throughout their graduate career. Further, it is recognized that graduate education, especially at the doctoral level, involves many learning experiences which take place outside the formal classroom setting. Toward this end, the program organizes such activities as brown bag lunches and occasional seminars during regular semesters. These are open to all graduate students and faculty. In addition, the Economics Department and the Regional Research Institute present seminars of interest to applied economists. Announcements for these and other events (including grant and scholarship opportunities) are distributed periodically by email.

6.5. Office Space and Facilities

The Division provides all PhD and most MS students with a work space in the Agricultural Sciences Building and with access to a personal computer. Offices are shared and some are relatively large spaces occupied by a number of students. The College and the Division support an impressive range of software, from office software to statistical, Geographic Information Systems, econometric, input-output, and operations research programs. In addition, the College maintains several computer labs which include additional software, particularly in design.

We encourage students to take full advantage of the opportunities offered by these resources, starting with common programs such as MS Word. Most students do not spend enough time learning the power of this word processing package, although better knowledge would make the writing of research papers and the dissertation easier and increase their quality. The Division also offers Endnotes¹⁷, a software package that allows you to track references and add them to your paper in almost any format required by major refereed journals.

The Division provides all graduate students with mail boxes in room 4433 of the Agricultural Sciences Building and the University provides all students with an email account. You should activate and regularly check your email once you have registered.

Many faculty members use eCampus (better known as Blackboard) to post course syllabi, readings, problems and solutions, and data for their classes. Students should be aware if their course instructors use this resource.

¹⁶ <http://coursecatalog.wvu.edu/fullcatalogs/generalinfo.pdf>

¹⁷ PhD students are required to use Endnotes when writing their dissertation. MS thesis students are very strongly encouraged to use Endnotes.

7. Student Clubs

There are a variety of student clubs on campus. Many of them have a social or cultural mission. Participation in a student club can enrich your experience at WVU.¹⁸ Graduate students in resource economics are organized in the Graduate Resource Economics Club (GREC), an organization that engages in social as well as professional and academic activities.

8. Special Needs

West Virginia University is a student-centered university. The inclusivity statement adopted by the WVU Faculty Senate states: “The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives: <http://diversity.wvu.edu>.”

Students with learning disabilities often qualify for special accommodations, such as extra time on tests. However, such disabilities must be diagnosed and the specific accommodations recommended by a specialist. Please contact the Office of Disability Services if you have questions.^{19 20}

9. Faculty and their Interests

The quality of degree programs and of the students’ learning experience depends to a large degree on the qualifications of the faculty, their commitment to students, and how well student and faculty interests match each other. Students almost always underestimate the influence that they have on faculty motivation and may even think they have no influence at all. Nothing could be further from the truth. Faculty members react positively when students demonstrate interest in their classes and/or their research. Thus, students who do research into the background of the faculty may reap rewards in the form of an advisor who is a better fit with the students’ area of interest than would otherwise be the case. These students may also become participants in conversations about ongoing research in the Division. To facilitate the “getting to know” process, the following pages contain bio sketches of the faculty. Faculty members are listed alphabetically and by major disciplinary area.

9.1. Division of Resource Economics and Management

Cheryl Brown, Associate Professor and Faculty Research Associate in the Regional Research Institute. PhD (1997, Berkeley, Ag and Resource Econ), MS (1991, Berkeley, Ag and Resource Econ), and BS (1990, Ag and Resource Econ, U of Massachusetts). Professor Brown joined WVU in 2002. Her research focuses on issues related to agricultural sustainability. Topics range from land use and pesticide policies to marketing to the impacts of the food system on health. Her research interests complement more traditional research in environmental and resource economics.

Alan R. Collins, Professor and Interim Director in the Division of Resource Economics & Management. PhD (1988, Ag and Resource Econ, Oregon State), MS (1981, Range Econ, Utah State), and BS (1979, Agriculture, U of Arizona). Dr. Collins joined WVU in 1989. His interests are in environmental and

¹⁸ For a list of student organizations at WVU, go to http://sos.wvu.edu/organization_listing.

¹⁹ <http://socialjustice.wvu.edu/>

²⁰ <http://accessibilityservices.wvu.edu/>

natural resource economics, watershed management; water quality; energy; performance-based incentives and solid plus agricultural waste management.

Michael Dougherty, Professor, Professor of Extension, Extension Specialist, and Coordinator of the Community Development Institute. PhD (Virginia Tech). His interests include community economic development and state and local public finance. Professor Dougherty is a founding member of the WVU Community Design Team.

Stratford Douglas, Adjunct Associate Professor and Associate Professor of Economics. PhD (1987, Econ, U of North Carolina), BA (1977, History, U of North Carolina). Professor Douglas joined WVU in 1990. He previously worked for three years as an economist for the Federal Energy Regulatory Commission.

Gerard E. D'Souza, Adjunct Professor and Faculty Research Associate of the Regional Research Institute. PhD (1983, Ag Econ, Mississippi State), MS (1980, Ag Econ, Mississippi State), and BS (1977, Ag Sciences, U of Ag Sciences, Bangalore, India). Professor D'Souza joined WVU in 1984. His research is in production economics; environmental economics; and sustainable development. Working on several interdisciplinary research projects, aimed at understanding the role of niche products in enhancing farm income, managing risk, and diversifying income sources. Examples of such products include aquaculture, pasture-raised beef, and organic foods. These projects are undertaken in collaboration with other disciplines such as plant sciences, animal sciences, nutrition, and recreation at WVU and other institutions.

Levan Elbakidze, Associate Professor and Faculty Research Associate in the Regional Research Institute, PhD (2004, Ag Econ, Texas A&M), MS (2000, Res Econ, University of Nevada, Reno), BS (1998, Res Econ, University of Nevada, Reno). His research program primarily revolves around natural resource economics: management, and valuation. Interdisciplinary projects address water resource management, pest and invasive species management, experimental methods and valuation of willingness to pay. He has collaborated with professionals from diverse fields including, but not limited to, hydrology, ecology, entomology, epidemiology, microbiology, and mathematics. He has published in *Water Resources Research*, *American Journal of Agricultural Economics*, *Risk Analysis*, *Journal of Agricultural and Resource Economics*, and *Ecological Economics*.

Xiaoli Etienne, Assistant Professor and Faculty Research Associate in the Regional Research Institute. PhD (2013, Ag and Applied Econ, U of Illinois), MS (2009, Ag and Applied Econ, U of Illinois), and BA (Rural and Regional Development, Renmin Univ of China). Her teaching interests include commodity futures markets, price analysis, and introductory microeconomics. Her research applies advanced econometric methods to address a number of important questions related to agricultural and energy economics.

Tesfa G. Gebremedhin, Professor Emeritus; Faculty Research Associate-Regional Research Institute; Faculty Research Associate-Center for Women's Studies; Faculty Teaching Associate-Center for Black Culture and Research. PhD (1981, Ag Econ, Oklahoma State), MS (1976, Econ, Colorado State), and BS (1972, Econ, Haile Selassie I University, Addis Ababa, Ethiopia). Dr. Gebremedhin came to WVU in 1989 from a faculty position at Southern University in Baton Rouge, LA. His interests are in rural, regional, and international development, the role of agriculture in development, and sustainable agriculture. He has held a sabbatical appoint at the United Nation's Food and Agricultural Organization in Rome, Italy, and served as a Fulbright Scholar in Bahrain.

Randall W. Jackson, Regional Research Institute Director, Professor of Geology and Geography, Adjunct Professor of Economics at WVU and the University of Pittsburgh, Adjunct Professor of Resource Economics & Management, and Adjunct Professor of Geography at Ohio State U. PhD (1983, Geography, U of Illinois), MS (1980, Geography, U of Illinois), BS (1976, Geography, U of Utah). He joined WVU in January 2002 coming from the geography department at Ohio State. Dr. Jackson's research interests center on regional economic health, performance, development, and sustainability with topics ranging from regional economic development strategies through the refinement and reformulation of regional economic modeling frameworks to interregional trade and conjoined macroeconomic energy and environmental modeling. He has been involved in a wide variety of funded research projects and serves on several editorial boards of international journals. He has participated on NSF review panels, and is on the Board of Directors for the Western Regional Science Association. Dr. Jackson is a past-chair of the North American Regional Science Council and current president of the Southern Regional Science Association. He received the David E. Boyce Award for distinguished service to the Regional Science Association International.

Tim T. Phipps, Professor, Adjunct Professor of Economics, Faculty Research Associate in the Regional Research Institute, Associate Dean for Research and Associate Director of the West Virginia Agricultural and Forestry Experiment Station. (1982, Ag Econ, UC Davis). Professor Phipps joined WVU in 1992. Dr. Phipps served as interim and the as Division Director from 2006 until 2009. He previously was a faculty member at the University of Maryland and a Research Associate at Resources for the Future (RFF) in Washington, DC. His interests are in agricultural policy and environmental quality, land use policy, environmental policy, applied econometrics.

Peter V. Schaeffer, Professor, Adjunct Professor of Economics, and Faculty Research Associate in the Regional Research Institute. PhD (1981, Econ, U Southern Cal), MA (1979, Econ, U Southern Cal), and licentiate (1975, Econ, U of Zurich, Switzerland). Professor Schaeffer joined WVU in 1993 as professor and division director. He served as division director until 2006. His interests are in economic policy, particularly regional and rural economics and development; international labor migration and domestic job mobility; and natural resource management issues related to amenities, planning, and energy, and their implications for economic development.

Dee Singh-Knights, Associate Professor, Extension. PhD (2003, Natural Resource Econ, WVU), MS (2002, Ag and Resource Econ, WVU), BSc (1997, Management Studies, U of the West Indies, Advanced Diploma in Business Administration (1997, Association of Business Executives, Wimbledon, London, UK), Certificate in Youth Work (1995, Commonwealth Secretariat, Ministry of Youth, Trinidad and Tobago), and Diploma in Agriculture (1989, Eastern Caribbean Institute of Agriculture and Forestry, Trinidad and Tobago). Dr. Singh-Knights joined the faculty in 2004, but returned to her native Trinidad and Tobago in 2007. She rejoined the faculty in 2010. Her interests are in sustainable agriculture, agribusiness, and extension education.

Dennis K. Smith, Professor Emeritus. PhD (1970, Ag Econ, Penn State), MS (1966, Ag Econ, Purdue U), BA (1963, Econ, Allegheny University). Professor Smith joined WVU in 1978. His interests are in agricultural cooperatives, agribusiness, and rural development. Dr. Smith served as Acting Division Director from 1999 to 2000.

Heather Stephens, Assistant Professor and Faculty Research Associate in the Regional Research Institute. PhD (2012, Agricultural, Environmental, and Development (AED) Economics, The Ohio

State University), MBA (2000, Finance and Marketing, The Ohio State University), and BA (1994, Economics and Public Policy Studies, Duke University). Dr. Stephens joined the faculty in 2015. Prior to that, she was an Assistant Professor and Director of the Office of Economic Research at California State University, Long Beach. Dr. Stephens conducts policy-oriented research that spans energy, environmental, and regional economics. She also has prior experience working for a U.S. Congressman, on strategic partnership development for a Fortune 100 company, as a local economic development director, and on regional economic development and energy-related issues at a university-based applied research institute.

Mark Sperow, Associate Professor and Faculty Fellow in the Institute for Advanced Energy Solutions. PhD (1998, Ag and Resource Econ, Colo State U), MS (1994, Ag and Resource Econ, Colo State U), MA (1980, History, Duquesne U), BA (1979, History, WVU). Dr. Sperow joined WVU in 2002. His primary research involves analyses of land-use and land-use changes that may help mitigate the accumulation of atmospheric greenhouse gases. The research focuses predominantly on agricultural and reclaimed mine lands. One outcome of the research is to identify alternative income streams for landowners, especially agricultural producers. This research also involves analysis of water allocation between urban and agricultural use, and combines the application of production, natural resource, and environmental economics.

Michael P. Strager, Professor and Adjunct Associate Professor of Forestry and Natural Resources. PhD (2004, Natural Resource Economics, WVU), MS (1995, Ag and Resource Econ, WVU), BS (1992, Penn State, Agriculture Business Management). Dr. Strager was a professional employee at WVU during all of his graduate studies. He accepted an Assistant Professor position in the Division of Resource Management in January 2007 and continues to collaborate with the Division of Forestry and Natural Resources as an Adjunct. Most of his work has been interdisciplinary and focused on using spatial analysis techniques to aid in the management of natural resources. His research interests include hydrological modeling and watershed management, prioritizing areas for conservation and restoration, modeling wildlife distributions, and performing landscape pattern analysis. When reporting the results, he is also interested in the role of spatial decision support systems to evaluate tradeoffs and guide the development of policy.

Qingyun Sun, Adjunct Associate Professor and Extension Associate Professor. PhD (2000, Soil Sciences, WVU), MS (1990, Env Eng, China U of Mining and Tech), BA (1984, Chemical Engineering, China U of Mining and Tech). Professor Sun's major interests are in energy, especially in clean coal technology, coal liquefaction and gasification, CO₂ sequestration, energy project management, mine land reclamation, GIS and remote sensing applications, and environmental and economic impact assessment.

II. PROGRAM INFORMATION

Program requirements differ by discipline and level (MS vs. PhD). Guidelines and expectations, however, can differ even within the same degree program. For example, a PhD student enrolled in the Natural Resource Economics area of emphasis who wishes to specialize in methods to evaluate non-market environmental goods and natural resources, would receive different advice than a student in the same program specializing in methods of regional economics and development, although there would be some overlap.

The core requirements in all degree programs share a common basic structure that consists of three distinct parts. This is true for the MS as well as the PhD programs. In each degree program the core courses can be distinguished into: (1) courses that teach us about the values of the discipline (underlying philosophy) and the working of relationships between events, phenomena, individuals and/or groups, and organizations (theory), (2) courses that teach us methods for analyzing problems in our discipline (for example statistical, econometric, case study, and/or survey research methods, qualitative research methods) and methods for adding to theory (for example, mathematical programming, calculus, calculus of variations), and finally (3) courses that put together what we learned from the courses in (1) and (2) to apply the combined knowledge of theory and method to practical issues and problems in the discipline. We can think of these three fundamental groups of core courses as (1) theory, (2) methods, and (3) practice, though the terminology may differ between disciplines.

Particularly for students who are about to enroll in one of the PhD programs, realize that you cannot learn everything you need and want to know just by going to classes any more than an athlete in a team sport will join the elite in her sport by just attending team practices. Working independently, reading beyond what is required, attending seminars, and otherwise ensuring that you acquire both breadth and depth in your discipline, are part of an excellent PhD education. Furthermore, the process of learning independently should continue after your graduation or you risk that some of your knowledge and skills will relatively quickly become obsolete.

1. Master's Program

The Division of Resource Economics & Management offers a Master degree in:

- Resource Economics and Management (MS in REM)

This MS is an applied economics degree that emphasizes environmental and natural resource economics, energy, agricultural economics, and rural development. This program offers courses in spatial analysis methods, including geographic information systems. Specific information about this degree is located below.

1.1 MS in Resource Economics and Management

The MS program in Resource Economics and Management (REM) provides advanced training in the areas of natural resource, environmental, agricultural, mineral, energy, agribusiness, international, and rural development economics. The primary objective of this program is to prepare students for further graduate study or a variety of careers in business and government. A candidate for the degree must comply with University, College, and Program requirements. The MS degree in REM can be obtained under either course work or thesis options. Three student learning outcomes have been identified by the REM faculty for this degree. Learning outcomes are that each graduate:

1. can apply microeconomic theories to analyze resource economics and management issues,
2. demonstrates the use of quantitative tools in the analysis of applied issues in resource economics and management, and
3. is proficient in oral and written communication.

1.1.1 Course Work Option

This option requires the completion of a minimum of 36 hours of approved course work to provide proficiency in economics as well as applied economics in natural resource, agricultural, energy, and rural development. Courses in closely related areas may be included if approved by the student's Graduate Committee. To familiarize students with the research process, an optional supervised research paper is strongly recommended under this option and can be accomplished under the ARE 695 (Independent Study) or RESM 691 (Advanced Study) course designation.

1.1.2 Thesis Option

The thesis option requires a minimum of 30 credit hours of approved course work to provide proficiency in economics as well as applied economics in natural resource, agricultural, energy, and rural development. The 30 credit hours may, at most, include 6 hours of credit for thesis research. Courses in areas closely related to economics and other disciplines may be included. The student's graduate committee must approve the student's plan of study and thesis topic using the appropriate form as described below. The thesis topic also must be approved by the Division Director. The thesis should be based on an approved, written research proposal, formally presented and defended by the student to his or her graduate committee in an open seminar. After completion of the thesis, an oral defense is scheduled.

1.1.3. Plan of Study

Students must choose a major professor before the end of their first year of study. In consultation with the major professor and the committee (if appointed), students should formulate a written plan of study at the earliest possible date. The plan should include all specified core courses, and identify additional classes the student plans to take to fulfill the degree requirements. Each candidate's plan of study is developed by the student in consultation with his/her major professor and graduate committee. Normally, the plan of study will comprise graduate-level courses in economic theory and quantitative methods from the ARE and Economics programs. Undergraduate courses (400 level) are allowed in a plan of study - a maximum of six credit hours for the thesis option and nine credit hours for the non-thesis option.

The plan of study must be approved by the student, his/her graduate committee, the Director of the Division of Resource Economics and Management, and the Associate Dean for Academic Affairs of the College of Agriculture, Natural Resource, and Design. A Plan of Study form must be used for this purpose. A hard copy can be obtained from the REM Program Secretary. The form is also available online at grad.davis.wvu.edu/r/download/137851 and must be printed on blue paper (the form is commonly referred to as the blue sheet).

1.1.4 Standards of Achievement

Each student must maintain a minimum cumulative GPA of 3.0 on a 4.0 scale for all graduate credit courses taken as part of their plan of study approved program for the degree. This includes graduate credit transferred and graduate credit accumulated while pursuing a degree in the ARE

program. Transfers of graduate credit must be approved by the student's Graduate Committee and the Graduate Program Coordinator. Students who are employed by the Division of Resource Economics and Management as either teaching or research assistants must maintain a cumulative GPA of at least 3.3.

1.1.5 Exams

Thesis Option

The requirement for the thesis option M.S. is satisfactory completion of an oral exam and, at the discretion of the student's graduate committee, a written exam. The exam(s) can cover any material relevant to the student's program and thesis, though the oral exam usually focuses on the student's thesis research. The student should discuss what will be covered on the exam with the major professor to ensure that the student and exam committee members have the same expectations.

Non-Thesis, Course Work Option

In addition to the 36 hour credit requirement, the course work MS option requires satisfactory completion of **both** a written and an oral exam covering **all** subject matter relevant to the student's program of study.

Rules and Procedures

The student's graduate committee organizes and conducts the exams. All faculty members may attend and participate in the examination, but only the student's graduate committee members vote on the exam results. The major professor notifies the Associate Dean of the College and ARE faculty of the time, place, and location of the exam. The final exam may not be taken until the semester or summer session in which all other requirements for the degree are to be met. The student's major professor must indicate in advance on a form, the Request for Shuttle Sheet, the time, place, and exam committee members and receive clearance from the office of the Associate Dean for Academic Affairs of the Davis College of Agriculture, Natural Resources, and Design before the exam can be given.

All committee members must be present for the final exam. If no feasible date and time can be found that permits every committee member to be present, then the dean or the dean's designee may permit another faculty member to substitute for an original committee member. However, there can be no substitute for the major professor and only one substitute is allowed. The request for a substitute must be made in writing and should be submitted at least two weeks in advance of the exam. The request for a substitute should be signed by the major professor, student, original exam committee member, and substitute committee member. The approval of the ARE Graduate Program Coordinator is required to ensure that the substitute committee member has the same or higher graduate faculty status as the original faculty member and represents the same academic discipline or specialization.

The student fails the final exam if more than one member of the exam committee casts an unfavorable vote. The results of each exam must be reported to the Associate Dean for Academic Affairs of the Davis College of Agriculture, Natural Resources, and Design within 24 hours of its completion, using the aforementioned Shuttle Sheet. Re-examination requires a new approval of the request by the Associate Dean. Students get two attempts; two failures are grounds for removal from the program.²¹

²¹ Students have the right to appeal the exam committee's decision to the Division Director and Associate Dean for Academic Affairs. The major professor and/or the graduate program coordinator should be available to

1.1.6 Thesis Requirements

A student who has chosen the thesis option must obtain the original signatures of the committee members as indication that the thesis has been completed and accepted. Regardless of the size of the committee, if more than one member refuses to sign, the thesis cannot be considered accepted and the degree cannot be recommended. If a substitute committee member attends the final exam, which includes but is not necessarily limited to the thesis defense, the substitute signs the “shuttle sheet,” but the original committee member must sign the thesis.

The thesis must (a) conform to written University thesis guidelines, which can be found on WVU’s webpage at <http://thesis.wvu.edu/>, (b) follow a consistent style, for example one used by major disciplinary professional journals or a manual such as the *University of Chicago Manual of Style: A Manual for Authors*, published by the American Mathematical Society and (c) submitted electronically prior to the deadline established for graduation. At WVU, theses and dissertations are published electronically.²²

1.1.7 Curriculum and Courses

The M.S. program consists of core courses taken by all students. Additional elective courses in the student’s area of interest must be approved by the student's committee.

Required Core Courses

All students must meet economic theory and quantitative requirements consisting of a total of at least twelve credit hours of course work. The theory requirement includes ARE 601 (Applied Microeconomics) or its equivalent. In addition, all students must take a minimum of nine (9) credit hours of quantitative courses. Quantitative courses include ARE 621 (Quantitative Methods), ARE 624 (Econometric Methods in Resource Economics), ARE 643 (Project Analysis and Evaluation), ECON 721 (Mathematical Economics), RESM 540 (Geospatial Modeling), and RESM 575 (Advanced Spatial Analysis). ECON 425 and ECON 421, or equivalents, are M.S. program prerequisites for the quantitative requirement and should ideally be met at the time of admission into the program. All course work should be selected in consultation with the student's major professor and graduate committee. In summary, all students in the M.S program are required to take the following set of core courses:

- ARE 601 Applied Microeconomics
- ARE 621 Quantitative Methods
- ARE 624 Econometric Methods in Resource Economics

Additional Courses

To make up the minimum course work requirement, elective courses should be selected in consultation with the student's advisor and graduate committee. University guidelines stipulate that all graduate students are expected to participate in a seminar course throughout their graduate career. ARE 696 is the program’s seminar course.

Suggested Electives

AGEE 642: Agriculture Education Research Methods and Design

counsel a student preparing an appeal, if asked. The appeal should be submitted within one month of the committee’s decision.

²² See <http://thesis.wvu.edu/>

- ARE 421: Rural Enterprise Development
- ARE 440: Futures Markets and Commodity Prices
- ARE 445: Energy Economics
- ARE 540 Rural and Regional Development
- ARE 600 Research Methods
- ARE 632: Natural Resource and Environmental Economics
- ARE 633: Natural Resource Policy Analysis
- FOR 438: Human Dimensions in Forestry
- FYHD 444: Watershed Management
- SOCA 511: Survey Research Methods

Structure of a Representative M.S. Program

The following representative program is based on the assumption that a student has met all pre-requisites, particularly ECON 421 and ECON 425 (or equivalent courses), at the time of entering into the M.S. program.

<u>YEAR ONE (FALL SEMESTER)</u>	<u>YEAR ONE (SPRING SEMESTER)</u>
ARE 601 <i>Applied Microeconomics</i> ARE 624 <i>Econometric Methods</i> <i>Elective</i> ARE 696 <i>Graduate Seminar</i>	ARE 621 <i>Quantitative Methods</i> <i>Research methods course</i> <i>Elective</i> ARE 696 <i>Graduate Seminar</i>
<u>YEAR TWO (FALL SEMESTER)</u>	<u>YEAR TWO (SPRING SEMESTER)</u>
<i>Electives</i> ARE 697 <i>Research</i> (thesis option only, 3 hrs.) ARE 696 <i>Graduate Seminar</i>	<i>Electives</i> ARE 697 <i>Thesis Research</i> (thesis option only, 3 hrs.) ARE 696 <i>Graduate Seminar</i>

Note: The non-thesis option requires at least 36 hours of approved course work. The thesis option requires a minimum of 30 hours of approved course work of which at most 6 (six) hours may come from ARE 697, Thesis Research.

2 Doctoral Programs

The Division of Resource Economics and Management offers the Doctor of Philosophy (PhD) in Resource Management. Students in the Division of Resource Economics and Management can choose among two areas of emphasis:

- Natural Resource Economics (NRE)
- Resource Management (RESM)

There are significant differences between these areas in degree requirements, research approach, and prospective career paths. The areas are aimed at individuals with strong interdisciplinary interests, educational background, and experience. Students enrolling in one of these two areas are expected to design a tailor-made curriculum for themselves, in consultation with their major advisor and graduate committee. The NRE area of emphasis is an applied economics PhD with emphasis in environmental and natural resource economics, rural and regional development, and agricultural economics. The program has particular strength in spatial analysis methods, including geographic information systems, spatial statistics, and spatial econometrics. Specific information about each area of emphasis follows in the descriptions below.

2.1 PhD in Natural Resource Economics

This program offers an area of emphasis in applied economics for natural resource economics (NRE). It allows students to further specialize in (1) natural resource and/or environmental economics, (2) regional economics and/or development, or (3) spatial analysis. The NRE program provides students with a strong foundation in economic theory, economic and policy analysis, and quantitative methods. The primary objective of the PhD in NRE is to educate professionals capable of meeting the demands at the highest levels of their chosen occupations. Two student learning outcomes have been identified by the REM faculty for this degree. Learning outcomes for this degree program are that each graduate:

1. demonstrate the capacity to produce economic research that can be accepted for publication in leading academic journals, and
2. be proficient in oral and written communication.

2.1.1 Requirements

Students entering this program should be well prepared to successfully complete advanced course work in economic theory, economic policy analysis, and quantitative methods, at least at the master level. A M.S. degree or a bachelor's degree which includes a strong background in economics and/or quantitative methods is required for admission. At the discretion of the graduate admissions committee and the Division Director, particularly promising students lacking some of the prerequisites may be admitted on a conditional basis as provisional students and given time to make up deficiencies in their preparation. However, the Division does not support provisional students with assistantships.

Prerequisites

- Intermediate Microeconomics (at WVU: ECON 301 or ARE 401)
- Microeconomics (at WVU: ARE 601)
- Statistics and Probability Theory (at WVU: ECON 425 or STAT 211 or 215)
- Econometrics (at WVU: ARE 624)
- Introduction to Mathematical Economics (at WVU: ECON 421)

- Calculus (at WVU: MATH 153 and MATH 154; MATH 150; or MATH 155 and MATH 156²³)

Recommended Additional Preparation

- History of Economic Thought (at WVU: ECON 306 or ECON 411)
- Business and Professional Writing (at WVU: ENGL 304)
- Introduction to Linear Algebra (at WVU: MATH 343)

Desirable Additional Preparation

- Multivariable Calculus (at WVU: MATH 251)
- Elementary Differential Equations (at WVU: MATH 261)
- Intermediate Statistical Methods (at WVU: STAT 312)

General Requirements

PhD students must meet all University, College, and Program requirements as outlined in the WVU *Graduate Catalog* and in Part I of this Handbook. These include enrollment, residency, and grade point requirements. Students are expected to enroll continuously and must register for at least one course every seven terms to remain an active student. The residency requirement consists of one year of full-time graduate study at WVU. A minimum GPA of 3.0 on a 4.0 scale must be attained on coursework in their plan of study and a GPA of 2.75 or higher on all courses taken as a graduate student. Graduate assistants must maintain a minimum GPA of 3.3. Students who fail to maintain the required GPA must immediately see their advisor to plan corrective action.

2.1.2 Plan of Study and Course Requirements

PhD students should select a major professor and complete a written plan of study during their first or second year in the program. This plan should be developed by the student in consultation with the major professor and graduate committee members. The major professor and at least two (out of five) other graduate committee members must be on the faculty (as regular or adjuncts) in the Division of Resource Economics and Management. This plan must be approved by the Director of the Division and the Associate Dean for Academic Affairs of the Davis College Agriculture, Natural Resource, and Design. A green *Plan of Study* form should be used for this purpose. An electronic copy can be obtained from the REM Program Secretary, Mrs. Lisa Lewis.

A PhD program is composed of (1) core courses taken by all students and (2) field courses, which are selected based on the student's research focus. The PhD degree involves conducting research and courses should be taken that prepare students to successfully undertake a research project and advance knowledge in Natural Resource Economics.

Core Courses

All doctoral students in the Division of Resource Economics & Management take a set of common core courses in (1) research methods, (2) a teaching practicum, and (3) graduate seminar for a total of at least 9 credit hours in these three areas. Course requirements may be waived if a student has received equivalent training in prior coursework. Coursework pertaining to each student's field(s) and research emphasis will be determined by the student's major professor and graduate committee. In addition to the requirements indicated above, all NRE doctoral students are also required to take or have taken prior to admission the following set of core courses:

²³ MATH 155 covers roughly the same materials as MATH 153 and 154. Thus, MATH 155 and MATH 156 offer a stronger preparation than MATH 153 and MATH 154.

- ARE 601 Applied Microeconomics
- ARE 621 Quantitative Methods in Resource Economics
- ARE 624 Econometric Methods in Resource Economics
- ARE 710 Advanced Environmental Economics
- ARE 703 Advanced Natural Resource Economics
- ECON 701 Advanced Microeconomics 1
- ECON 711 Advanced Microeconomics 2
- ECON 721 Mathematical Economics
- ECON 725 Econometrics 1
- ECON 726 Econometrics 2
- ECON 727 Econometrics 3 or ARE 729 Spatial Econometrics or ARE 793 Advanced Applied Econometrics

Field Courses

Each student must have two fields of specialization. The first field required for all students will be Natural Resource and Environmental Economics. This field includes courses of:

Natural Resource and Environmental Economics

- ARE 703 Advanced Natural Resource Economic Theory
- ARE 710 Advanced Environmental Economics
- ARE 632 Natural Resource and Environmental Economics or equivalent

The second field is designated in conjunction with the students' graduate committee. This field will consist of a minimum of two courses. In addition to fields offered within the Economics Department, fields of Economic Development and Regional Economics, and Spatial Economic Analysis are offered by the Division. In addition, students can take ECON 702 and 712 for a field in macroeconomics. To be counted as a field course, a grade of B- or better must be earned.

Economic Development and Regional Economics

- ARE 540 Rural and Regional Development
- ARE 542 International Agricultural Economic Development
- ECON 751 International Trade
- ECON 754 Comparative Economic Systems
- ECON 761 Advanced Regional Economics
- ECON 762 Advanced Urban Economics

Spatial Economic Analysis

- ARE 729 Spatial Econometrics or ARE 793 Advanced Applied Econometrics
- ECON 727 Econometrics 3
- ECON 761 Advanced Regional Economics
- ECON 762 Advanced Urban Economics
-
- RESM 575 Spatial Analysis for Resource Management

In addition to the core and field courses, University guidelines stipulate that all graduate students are expected to participate in a seminar course throughout their graduate career. The *REM* program

seminar course is ARE 796. The seminar may be repeated for credits, and must be taken on a satisfactory/unsatisfactory basis. Students are also encouraged to attend seminars organized by REM, the Regional Research Institute and/or by the Department of Economics.

Elective Courses

Students should choose elective courses to further strengthen their skills and their competitive position in their area of specialty. While graduate courses in macroeconomics and/or the history of economic are not required, they are strongly recommended. A student interested in furthering the development of spatial econometric theory should seriously consider taking courses in mathematics (real analysis, linear algebra, stochastic processes) and statistics (theory of probability, theory of statistics). By contrast, a student interested in conducting research in nonmarket environmental and/or natural resources, may wish to acquire strong survey research skills by taking courses in the department of sociology. Those who plan to be working in economic development may wish to take advantage of opportunities to improve their skills in input-output (I-O) analysis, computational general equilibrium (CGE) modeling, case study analysis, and/or spatial econometrics.

Regardless of fields, students interested in working with dynamic models should consider taking intermediate differential equations (usually offered in the department of mathematics) and calculus of variations (often available at the PhD level in economics departments). Since dynamic models very quickly lead to questions of uncertainty, course work in probability theory and in stochastic process is also recommended.

All fields of economics are about optimization. Thus, courses in applied linear programming, analytical techniques of operations research, nonlinear programming, and dynamic programming will benefit all. These courses can usually be found in engineering, economics, and/or mathematics departments.

Recommended Electives Include

- ECON 741 Public Economics I
- ECON 742 Public Economics II
- ECON 743 State and Local Public Economics

If this is intimidating and sounds like more than you can handle in the three to four, maybe five, years that you will be here, take heart. You do not stop learning when you graduate and not all learning must occur in the classroom. You will probably be able to learn some of the technically or philosophically less challenging materials on your own or together with friends pursuing the same goals.

2.1.3 Required Exam and Mentored Research Paper

Qualifying Exam

The qualifying exam is designed to evaluate students on their general background in two important areas: 1) microeconomic theory, and 2) quantitative methods (including econometrics). It is usually taken at the end of the first year of study. Course material covered in this exam is from: ARE 601, ECON 701, and ECON 711 (microeconomic theory) and ARE 621, ARE 624, ECON 721, and ECON 725 (quantitative methods). Students should have taken these courses at WVU or equivalent courses at other universities to be adequately prepared for this exam.

This exam is scheduled to be given on the second Thursday (microeconomic theory) and Friday (quantitative methods) after final exams have concluded in the spring semester. Each exam will be limited to 4 hours. Students who have a GPA of less than 3.0 for all the courses taken from the above

exam material list will not be allowed to sit for the exam. Each student will be given only two attempts at each of the qualifying exams. The second round of exams in microeconomic theory and quantitative methods will take place on the last Thursday and Friday of July. After the second failure, a student is no longer eligible to advance in the program. Students do have the right to appeal exam decisions to the Division Director and the Associate Dean of the College.

Mentored Research Paper

This requirement is for every second year student. To fulfill this requirement, each student must identify and get the approval of a faculty member to be her/his mentor for this paper by January of their second year. In May, at the end of their second year, every student must submit a paper to be reviewed by a committee of at least three faculty members, including the student's mentor. The Division Director will appoint a "second year paper" review committee. However, a second year student may choose to form their own graduate committee by the end of the second year. In this case, the student's graduate committee would serve as the review committee. This paper must include a research idea or concept worthy of publication, although it may not be complete (for example, limited or no data has been collected yet). Unacceptable papers at this date will lead to loss of funding for students on Division supported assistantships. Each approved second year paper will be presented at graduate seminar in the fall of a student's third year.

Mentored Research Paper Timeline

- Submit a tentative title of your paper and the name of the faculty mentor who you will be working with on this paper by January 31.
- Submit a mentored research paper draft by May 31. This paper will be reviewed by a faculty committee (including your mentor) with feedback provided to you by June 30.
- A re-submission is required by August 1st. Along with this revised paper, you are expected to submit a list of responses to reviewer comments which provide details on how you changed the paper in response to each individual comment.
- You are required to give a presentation during the fall graduate seminar on this paper. The presentation should last the full (50min) seminar.

2.1.4 Dissertation

During the second year the student develops a dissertation topic in consultation with a selected faculty committee. Part of this process includes the development of a comprehensive research proposal or prospectus that forms the basis for the dissertation, and which is formally presented and defended by the student to his or her graduate committee in an open seminar. It normally takes up to two additional years to conduct the research and write the dissertation. During the period of dissertation research the student may take a limited amount of course work. The dissertation must (a) be based on a previously approved research proposal or prospectus, which the student formally presents to his or her graduate committee, (b) conform to written University dissertation guidelines,²⁴ and (c) follow a consistent style (e.g., that reflected in the major disciplinary professional journals or a widely used manual such as the

²⁴ http://grad.wvu.edu/academics/electronic_theses_dissertation

University of Chicago Manual of Style: A Manual for Authors published by the American Mathematical Society). Doctoral students are encouraged to use the software Endnotes to organize their references.

University regulations pertaining to PhD candidacy and the dissertation, as well as a summary of doctoral requirements, are outlined in the *Graduate Catalog*.²⁵ The dissertation research and the research conduct have to comply with accepted standards of academic and research integrity.²⁶

Sequence of Events in Completing Dissertation

- Publicly defend your dissertation proposal. The preparation and defense of a proposal should happen before the end of the third year in the program.
- If your committee accepts the proposal, then you have to complete a signature form. Once the form is signed and filed, you can officially proceed with your dissertation research. Dissertation research can take one to two years to complete.
- Keep your dissertation committee well informed of your dissertation research progress. Do not show them your results the first time when you ask to defend your dissertation.
- When your major professor, who is also the chair of the dissertation committee, judges you to be ready to defend your dissertation, obtain a shuttle sheet (*Dissertation Approval Form*) on yellow paper, set a date, reserve a room, and advertise the event. The Division staff will help you with advertising in the college.
- Suggested timeframes for your defense: (a) give the dissertation committee at least one month to review your dissertation prior to the defense; (b) the shuttle sheet needs to be signed by the committee and turned in at least three weeks prior to the defense date; and (c) publicly announce the defense at least one week prior to the presentation.
- On the day of the defense, there will be a public and a private part of the defense. In the first, the public part, you have about 40 minutes to explain your work, how it contributes to the profession, and your most important results. You may also mention challenges and how you solved them or think they can be solved in the future. Then there will be time for questions and answers. Anyone may attend this part of the defense. Once this part is concluded, only the PhD candidate and the dissertation committee members stay in the room. The committee members usually have additional questions and/or suggestions for the candidate. Not all questions will be of a technical nature, but cover such areas as interpretation of equations, or of results, or be about which journals might be interested in publishing your research. The standard for passing the defense is that the committee judges your research to be of a quality high enough to result in at least one article in an appropriate refereed journal. Two to three published articles that result from a dissertation are common.
- Once your committee accepts the dissertation, the members will sign the shuttle sheet.
- After a student has passed the dissertation defense, the student must implement changes and corrections to the dissertation. This may take weeks or even months. The final step before submission of the dissertation is committee member approval of the final dissertation document.

Representative PhD Program in Natural Resource Economics (NRE)

A typical doctoral program takes approximately three to five years depending on among other things, whether or not the student has a related prior MS degree. The first year is dedicated to the study of economic theory and quantitative methods in preparation for the qualifying exam. That is, students will mostly take core course, although some field courses may also be taken. During the second year, students normally complete their fields and begin work on their dissertations. The dissertation

²⁵ Accessible online from <http://coursecatalog.wvu.edu/>

²⁶ See <http://oric.research.wvu.edu/> for more information.

takes one to three additional years of work. A typical plan of study for the PhD program is outlined below.

Year 1: The first year of the PhD program in NRE is designed to give the student a sound foundation in economic theory and quantitative methods to prepare for advanced study in the second year of the program. At the end of the first year, the student is expected to demonstrate mastery of microeconomic theory and quantitative methods by passing the comprehensive qualifying examination.

Years 2 and 3: The second and third years of the PhD program are designed to complete the study of advanced theory and quantitative courses, but it leaves enough flexibility for students to pursue specialized fields of study. The mentored research paper requirement is to be completed in year 2.

Beyond Year 3: The time beyond this year is usually devoted to dissertation research, which normally will have already been initiated during the third year. In addition, the student may use self-study or a very limited amount of class time, to further enhance her or his knowledge in an area of specialization (field). During this time the student should prepare research papers, attend conferences, and work on the process of building a network of professional contacts. In cooperation with and with the advice of the dissertation committee, the student should also turn parts of the dissertation into draft articles and submit them to refereed journals for publication consideration.

<u>YEAR ONE (FALL SEMESTER)</u>	<u>YEAR ONE (SPRING SEMESTER)</u>
ECON 701 <i>Microeconomic Theory 1</i> ECON 721 <i>Mathematical Economics</i> ARE 601 or Elective ARE 796 <i>Graduate Seminar</i> ARE 624 or equivalent, if necessary	ECON 725 <i>Econometrics 1</i> <i>ECON 711 Microeconomic Theory 2</i> ARE 621 <i>Quantitative Methods</i> ARE 796 <i>Graduate Seminar</i>
<u>YEAR TWO (FALL SEMESTER)</u>	<u>YEAR TWO (SPRING SEMESTER)</u>
ARE 632 <i>Natural Resource and Environmental Economics</i> , if necessary ECON 726 <i>Econometrics 2</i> Field Courses or Electives* ARE 796 <i>Graduate Seminar</i>	ARE 703 <i>Advanced Natural Resource Economic Theory</i> ARE 710 <i>Advanced Environmental Economics</i> ECON 727 <i>Econometrics 3</i> or equivalent ARE 796 <i>Graduate Seminar</i>
<u>YEAR THREE (FALL SEMESTER)</u>	<u>YEAR THREE (SPRING SEMESTER)</u>
Field Courses or Electives ARE 796 <i>Graduate Seminar</i>	Field Courses or Electives ARE 796 <i>Graduate Seminar</i>
SUMMER TERMS: Research/Field Courses/Electives	

* Strongly recommended to include a course in macroeconomic theory or history of economic thought.

By the time the dissertation is completed, each student should have a professional looking CV and letter of application ready, be aware of the job market situation and where opportunities in her or his field(s) are best, and hopefully already made some contacts. Note that it has standard for assistant

professor candidates to already have one or two refereed journal articles published or accepted. To have at least some articles submitted has become an expectation of the profession.

2.1.5 Where are they now? Selected Recent NRE Graduates and their Careers

- Caleb Stair, 2018, Post-doctoral research fellow, University of Florida.
- Kofi Nkansah, 2016, Economist, Wisconsin Department of Natural Resources, Madison, WI
- Seth Wiggins, 2016, Visiting Instructor, Colorado School of Mines, Golden, CO
- Chairat Choesawan, 2016, Assistant Professor in the Economics Department, Naresuan University, Thailand
- Chris Shultz, 2015, Quantitative Analyst, State Street Corporation, Boston, MA
- Tizita Wasihun, 2015, Instructor in Department of Finance and Economics, Southern New Hampshire University
- Srimoyee Bose, 2015, PhD graduate student in the School of Public Health, Georgia State University
- Nazia Arbab, 2014, Post-Doctoral Associate position in the Department of Ecology, Evolution, and Natural Resources at Rutgers University in NJ.
- Xueting Zhao, 2014, Post-Doctoral Research Fellow with Regional Research Institute, West Virginia University.
- Sudiksha Joshi, 2014, working at Sapling Learning Statistics in Austin, TX.
- Nyakundi Michieka, 2013, Assistant Professor, California State University at Bakersfield.
- Oleg Kucher, 2013, Assistant Professor, Frostburg State University in Maryland.
- Arun K.C., 2012, Regional Science Officer (South Asia), CGIAR Program on Climate Change, Agriculture and Food Security located in India.
- Inocencio Rodriguez, 2012, Assistant Professor, University of Puerto Rico.
- Saman Herath Bandara, 2012, Assistant Professor, Mt. Olive College, North Carolina.
- Saima Bashir, 2011, Visiting Assistant Professor, California University of Pennsylvania.
- Maitreyi Mandal, 2010, Analyst at MU Sigma
- Wilbert Karigomba, 2009, faculty member at Northwest Arkansas Community College, Bentonville, AR.
- Mulugeta S. Kahsai, 2009, Assistant Professor, Virginia State University in Petersburg, VA.
- Maribel Mojica, 2009, Assistant Professor at Alcorn State University in Alabama.
- Chali Nondo, 2009, Associate Professor at Central State University in Ohio.
- Semoa DeSousa-Brown, 2008, Outgoing Exchange Coordinator, International Programs, West Virginia University.
- Peter J. Maille, 2008, Associate Professor at Eastern Oregon University.
- Jason Evans, 2007, Associate Professor at the State University of New York-Cobleskill.
- Serkan Catma, 2007, Associate Professor at University of South Carolina at Bluffton, SC.
- Vishakha Maskey, 2007, Associate Professor at West Liberty University in West Virginia.

2.2 PhD in Resource Management

This program was designed to offer a multi- and inter-disciplinary degree combining applied economics, particularly natural resource and environmental economics, with studies of and coursework in the natural and spatial sciences. The program is currently under review by the REM faculty and will not accept applicants into the program during the 2018/19 academic year. Once program changes have been made, applicants will be considered for this program.

III. LIST OF GRADUATE COURSES

1. Agricultural and Resource Economics (ARE)

- ARE 540. Rural and Regional Development. 3 Hr. 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 Hr. 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 Hr. 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 Hr. 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 600. Research Methods. 1 Hr. 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 Hr. PR: ECON 301 and ECON 421 or equiv. Producer and consumer economics used in resource, environmental, and agricultural analysis.
- ARE 621. Quantitative Methods in Resource Economics. 3 Hr. 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 Hr. PR: ECON 425. Application of econometric 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 Hr. 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 Hr. 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 Hr. 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 Hr. 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 Hr. PR: Consent. Supervised practice in college teaching. 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 695. Independent Study. 1-6 Hr. Faculty supervised study of topics not available through regular course offerings.
- ARE 696. Graduate Seminar. 1 Hr. PR: Consent. It is anticipated that each graduate student will present at least one seminar to the assembled faculty and graduate student body of his/her program.
- ARE 697. Research. 1-15 Hr. PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)
- ARE 703. Advanced Natural Resource Economic Theory. 3 Hr. 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 Hr. 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 hr. 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. (Also listed as ECON 729.)
- ARE 735. Resources of Development Planning. 3 Hr.
- ARE 795. Independent Study. 1-6 Hr. Faculty supervised study of topics not available through regular course offerings.
- ARE 796. Graduate Seminar. 1 Hr. PR: Consent. It is anticipated that each graduate student will present at least one seminar to the assembled faculty and graduate student body of his/her program.
- ARE 797. Research. 1-15 Hr. PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)

2. Resource Management (RESM)

- RESM 540. Geospatial Modeling. 3 Hr. 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 Hr. PR: RESM 440. 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 575. Spatial Analysis for Resource Management. 3 Hr. 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 Hr. 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 A-Z. Advanced Topics. 1-6 Hr. PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.
- RESM 640. GIS-Aquatic Resource Management. 3 Hr. Using Geographical Information Systems (GIS) to analyze the special components of a stream, river, or large water body for aquatic resource management and habitat assessment.
- RESM 690. Teaching Practicum. 1-3 Hr. 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 will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.)
- RESM 691 A-Z. Advanced Topics. 1-6 hr. PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.
- RESM 693 A-Z. Special Topics. 1-6 Hr. A study of contemporary topics selected from recent developments in the field.
- RESM 694. Seminar. 1-6 Hr. Seminars arranged for advanced graduate students.
- RESM 695. Independent Study. 1-6 Hr. Faculty supervised study of topics not available through regular course offerings.
- RESM 696. Graduate Seminar. 1 Hr. PR: Consent. It is anticipated that each graduate student will present at least one seminar to the assembled faculty and graduate student body of his/her program.
- RESM 697. Research. 1-15 Hr. PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)

3. Selected Courses in Other Disciplines

3.1 Communication Studies (COMM)

COMM 713. Qualitative Research Methods. 3 Hr. Qualitative research methods in human communication and related professional areas with major emphasis on conducting and evaluation qualitative research procedures. Special focus on practical application.

3.2 Economics (ECON)

- ECON 701. Advanced Micro-Economic Theory 1. 4 Hr. PR: Consent. Theory of production and allocation, utility theory, theory of the firm, pricing in perfect and imperfect markets, models of firm's operations.
- ECON 702. Advanced Macro-Economic Theory 1. 3 Hr. PR: Consent. Classical, Keynesian and modern macroeconomic theories.
- ECON 706. History of Economic Doctrines and Analysis. 3 Hr. PR: ECON 701 and graduate standing or consent. Writings of the major figures in the development of economic doctrines and analysis.

- ECON 709. Research Design/Methodology. 1-3 Hr. PR: Consent. Basic research approaches based on examples from the student's own work, papers presented at the departmental research seminar series, and economics literature in general.
- ECON 711. Advanced Micro-Economic Theory 2. 4 Hr. PR: ECON 701. General equilibrium analysis, distribution economics.
- ECON 712. Advanced Macro-Economic Theory 2. 3 Hr. PR: ECON 702. Models of economic growth and fluctuations, and other advanced topics in macroeconomic theory.
- ECON 721. Mathematical Economics. 3 Hr. PR: Consent. Mathematics used in economics.
- ECON 723. Dynamic Methods of Economics. 1 Hr. PR: ECON 721. This course covers the basic techniques of dynamic economic analysis that economics graduate students will be working with in advanced economic theory and field courses.
- ECON 725. Econometrics 1. 3 Hr. PR: ECON 721. Mathematical statistics, including probability, mathematical expectation, distributions. Linear regression, ordinary least squares and simple extensions. Students will use a computer to analyze data.
- ECON 726. Econometrics 2. 3 Hr. PR: ECON 726. Econometric methods used by practicing economist. Includes simultaneous equations, asymptotic properties of estimators, and generalizations of and alternatives to least squares estimation. Also may include qualitative response, panel data, nonlinear, spatial, and time series models.
- ECON 727. Econometrics 3. 3 Hr. PR: ECON 326. Completes the graduate econometrics sequence. Topics may include computational methods and time series, spatial, nonlinear, qualitative response, and panel data models.
- ECON 735. Portfolio Theory. 3 Hr. PR: ECON 701 and ECON 702. Basics of decision making under risk. Portfolio choice under various utility and returns specifications. Asset allocation over time.
- ECON 736. Asset Pricing. 3 Hr. PR: ECON 735. Theories of the determination of prices and returns in financial markets. Properties of general static and intertemporal asset pricing models and determinants of equilibrium returns in specific general equilibrium models.
- ECON 741. Public Economics 1. 3 Hr. PR: ECON 701. Economic role of government in a mixed economy with regard to topics such as resource allocation and distribution of income; social choice mechanisms; fiscal federalism; and revenue.
- ECON 742. Public Economics 2. 3 Hr. PR: ECON 741. Continuation of public economics.
- ECON 743. State and Local Public Economics. 3 Hr. PR: ECON 741 and ECON 742 or consent. Economic roles of state and local governments emphasizing empirical research and policy implications. Particular attention to intergovernmental competition, government performance, service provision, and revenue sources.
- ECON 751. International Trade. 3 Hr. PR: ECON 701. Contemporary theories of international trade; analysis of current problems in world trade.
- ECON 752. International Macro-Economics. 3 Hr. PR: ECON 702. Current theories and policies concerning balance of payments, international capital movements, and foreign exchange, and their relation to the macro economy.
- ECON 754. Comparative Economic Systems. 3 Hr. PR: ECON 701. Comparative study of economic systems, including planned and market socialism and capitalism and the experience of countries in transition from socialism to capitalism.
- ECON 755. Development Economics. 3 Hr. PR: ECON 701. This course explores why some countries are rich and others are poor. Class examines the major phases of thinking in development economics and themes in the contemporary development literature.
- ECON 761. Advanced Regional Economics. 3 Hr. PR: ECON 701 and graduate standing or consent. Regional income and flow of funds estimation, regional cyclical behavior and multiplier analysis,

industrial location and analysis, techniques of regional input-output measurement, impact of local government reorganization on regional public service and economic development.

ECON 762. Advanced Urban Economics. 3 Hr. PR: ECON 701. Theory, policy, and empirical research regarding growth and decline of cities, urban spatial structure and land-use patterns, intrametropolitan employment location, urban transportation, housing, housing market discrimination, local government structure, fiscal problems, and urban redevelopment.

3.3 Finance (FIN)

FIN 530. Energy Financial Economics. 3 Hr. Introduction to the ways in which legal/regulatory systems affect the energy industry and to important economic and political concerns that underlie the regulation of the production and trading of energy and the connections to the derivative markets for the energy sector.

FIN 531. Energy Law/Regulation/Ethics. 3 Hr. Provides an understanding of energy markets and the ancillary markets, the legal and regulatory environments, and the ethical questions surrounding this business sector. Additionally, the course will help prepare participants to address the ethical standards of the finance profession.

FIN 532. Energy Financial Accounting. 3 Hr. Provides the tools to interpret and analyze external financial information from the viewpoint of investors and creditors. The energy sector has a unique perspective from other industries. The role of mark to market accounting techniques will be emphasized.

FIN 533. Energy Financial Risk Management. 3 Hr. Investigates the evolving and expanding practice of financial risk management in the energy sector. Risk management is a complex process of identifying, quantifying, and managing risk exposures. The course analyzes and discusses the various sources of risk.

3.4 Forest Hydrology (FHYD)

FHYD 644. Watershed Hydrology. 3 Hr. PR: FHYD 444. A qualitative and quantitative understanding of principles governing the occurrence, distribution, and circulation of water near the Earth's surface. Emphasis is on the physical understanding and parameterization of hydrologic processes and the water cycle.

3.5 Geography (GEOG)

GEOG 550. Geographic Information Science. 4 Hr. PR: Instructor's permission. Principles and practice of geographical information science. Geospatial data handling for research, planning and decision-making. Spatial analysis, information production, and display.

GEOG 553. Environmental Impact Assessment. 3 Hr. Study of the process and methods, including GIS, by which the environmental consequences of development actions are assessed and evaluated in advance of their occurrence.

GEOG 612. Gender, Society and Space. 3 Hr. PR: GEOG 601 or Consent. Examines how gender and feminist perspectives are an integral part of how space is used, distributed, and perceived in society. Overviews of major developments in the field including diversity and difference, representation, identity, and nature.

GEOG 615. Development Geography. 3 Hr. PR: Consent. An analysis of the concept and practice of development. Alternative people-centered approaches to social change are investigated.

3.6 Landscape Architecture (LARC)

LARC 570. Meanings of Place. 3 Hr. PR: Consent Study of place as a psychological and social phenomenon with implications for community development, historic preservation, interpretation, design, management, natural and cultural sustainability, and human well-being. (equivalent to RPTR 570).

3.7 Law (LAW)

LAW 604. Natural Resources. 3 Hr. A survey course that includes law, theory, and practical management challenges of natural resource policy, with a strong substantive foundation in a broad range of resources, including water, timber, minerals, and wildlife.

LAW 612. Agriculture/Rural Land Use. 2-3 Hr. A consideration of the impact of various aspects of law and policy (e.g., land use regulation, environmental law, property rights, subsidies) on agricultural and other rural lands and the resulting effect on the food system.

LAW 630. Energy Law. 3 Hr. An examination of law and regulatory policies that govern and impact the energy industry, including all energy sources and alternative fuel possibilities.

LAW 634. Energy Reg, Markets & Environ. 3 Hr. This course focuses on the legal basis for the economic regulation of energy, the environmental impact of energy production, and the development of policies promoting renewable energy and energy efficiency.

3.8 Mathematics (MATH)

MATH 520. Solution of Nonlinear Systems. II. 3 Hr. PR: MATH 420 or MATH 441. Solution of nonlinear systems of equations. Newton and Secant Methods. Unconstrained optimization. Nonlinear over relaxation techniques. Nonlinear least squares problems.

MATH 543. Linear Algebra. II, S. 3 Hr. PR: MATH 441. Review of theory of groups and fields; linear vector spaces including the theory of duality; full linear group; bilinear and quadratic forms; and theory of isotropic and totally isotropic spaces.

MATH 551. Real Variables 1. 3 Hr. PR: MATH 451. A development of Lebesgue integral, function spaces and Banach spaces, differentiation, complex measures, the Lebesgue-Radon-Nikodym theorem.

MATH 555. Complex Variables 1. 3 Hr. PR: MATH 451. Number systems, the complex plane and its geometry. Holomorphic functions, power series, elementary functions, complex integration, representation theorems, the calculus of residues, analytic continuation and analytic function, elliptic functions, Holomorphic functions of several complex variables.

MATH 557. Calculus of Variations. 3 Hr. PR: (MATH 261 and MATH 452) or MATH 568. Necessary conditions and sufficient conditions for weak and strong relative minimums of an integral, Euler-Lagrange equation. Legendre condition, field construction, Weierstrass excess function, and the Jacobi equation.

MATH 564. Intermediate Differential Equations. 3 Hr. PR: MATH 261. A rigorous study of ordinary differential equations including linear and nonlinear systems, self-adjoint eigenvalue problems, non-self-adjoint boundary-value problems, perturbation theory of autonomous systems, Poincare-theorem.

MATH 567. Advanced Calculus. I. 3 Hr. PR: MATH 261. Primarily for engineers and scientists. Functions of several variables, partial differentiation, implicit functions, transformations; line surface and volume integrals; point set theory, continuity, integration, infinite series and convergence, power series, and improper integrals.

MATH 568. Advanced Calculus. II. 3 Hr. PR: MATH 567. Primarily for engineers and scientists. Functions of several variables, partial differentiation, implicit functions, transformations; line surface and

volume integrals; point set theory, continuity, integration, infinite series and convergence, power series, and improper integrals.

- MATH 571. Combinatorial Analysis 1. 3 Hr. PR: One year of calculus. Permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, compositions, trees and networks.
- MATH 578. Applied Discrete Mathematics. 3 Hr. PR: MATH 375 or MATH 378 or MATH 341 or MATH 343 or MATH 283. Topics may include combinatorial optimization, applied coding theory, integer programming, linear programming, matching, and network flows.
- MATH 581. Topology 1. 3 Hr. PR: MATH 452. A detailed treatment of topological spaces covering the topics of continuity, convergence, compactness, and connectivity; product and identification space, function spaces, and the topology in Euclidean spaces.
- MATH 621. Computational Matrix Theory. 3 Hr. Matrix norms singular value decomposition, QR factorization, least-square problems, conditioning and stability, eigenvalue problems, and iterative methods for solving large systems.
- MATH 651. Real Variables 2. 3 Hr. PR: MATH 551. A development of the Lebesgue integral, function spaces and differentiation, complex measures, the Lebesgue-Radon-Nikodym theorem.
- MATH 655. Complex Variables 2. 3 Hr. PR: MATH 555. Number systems, the complex plane and its geometry. Holomorphic functions, power series, elementary functions, complex integration, representation theorems, the calculus of residues, analytic continuation and analytic function, elliptic functions, Holomorphic functions of several complex variables.
- MATH 681. Topology 2. 3 Hr. PR: MATH 581. A detailed treatment of topological spaces covering the topics of continuity, convergence, compactness, and connectivity; product and identification space, function spaces, and the topology in Euclidean spaces.
- MATH 683. Set Theory and Applications. 3 Hr. PR: MATH 541 or MATH 551 or MATH 581. The course concentrates on the typical methods of set theory, transfinite induction, and Zorn's Lemma with emphasis on their applications outside set theory. The fundamentals of logic and basic set theory are included.
- MATH 751. Functional Analysis 1. 3 Hr. PR: MATH 551. A study of Banach and Hilbert spaces; the Hahn-Banach theorem, uniform boundedness principle, and the open mapping theorem; dual spaces and the Riesz representation theorem; Banach algebras; and spectral theory.
- MATH 752. Functional Analysis 2. 3 Hr. PR: MATH 751. A study of Banach and Hilbert spaces; the Hahn-Banach theorem, uniform boundedness principle, and the open mapping theorem; dual spaces and the Riesz representation theorem; Banach algebras; C^* algebras; spectral theory.

3.9 Political Science (POLS)

- POLS 530. Policy Analysis. 3 Hr. Overview of the field of political science and the sub-field of public policy studies. Focuses on the issues and problems involved in studying policymaking, and an assessment of policy analysis as a mode of thinking and inquiry. (3 hr. seminar.)
- POLS 531. Economic Analysis of Politics. 3 Hr. Application of economic analysis to questions of politics and public policy. Consideration of problems of public goods, voting behavior, and legislative behavior. (3 hr. seminar.)
- POLS 536. Politics of Agenda Setting. 3 Hr. Examines the social, economic, institutional and political influences on the development of public problems and their placement on the policy agenda. (3 hr. seminar.)
- POLS 555. Comparative Public Policy. 3 Hr. Comparison of public policy stages in several advanced industrial democracies with emphasis on various explanations of public policy in these countries in different policy areas. (3 hr. seminar.)

- POLS 600. Introduction to Political Research. 3 Hr. Introduction to the research methods and techniques used in political and policy analysis. Topics include logic of inquiry, research design, measurement, and survey and unobtrusive research.
- POLS 601. Quantitative Political Analysis. 3 Hr. PR: POLS 600 and STAT 511, or equivalent. Application of a range of statistical techniques in political and public policy research. Includes use of selected computer software commonly used in political science and policy analysis.
- POLS 602. Advanced Quantitative Methods. 3 Hr. PR: POLS 601 or equivalent advanced topics in quantitative methods for political science and policy research. Methods surveyed include multiple linear regression, time-series analysis, causal modeling, and linear programming.
- POLS 603. Advanced Quantitative Analysis. 3 hr. A survey of advanced statistical applications in political science, covering time series analysis, maximum likelihood estimation, and structural equation modeling.
- POLS 611. Intergovernmental Relations. 3 Hr. Examination of the politics and policy consequences of intergovernmental relations among the national, state, and local governments in the United States. Topics include the development of intergovernmental relations, regulatory federalism, and intergovernmental fiscal relations. (3 hr. seminar.)
- POLS 635. Seminar: Policy Evaluation. 3 Hr. Methods and techniques in evaluating public policies. Topics include the relation of policy analysis to policymaking; types of evaluation; planning, evaluations; alternative evaluation designs; measuring program consequences; problems of utilization, and the setting of evaluation research. (3 hr. seminar.)
- POLS 638. Seminar: Policy Implementation. 3 Hr. Research seminar focusing on how the intentions of policy-makers are transformed into programs and policies which have both intended and unintended consequences. Topics include traditional implementation studies, rational choice approaches, neo-institutionalism, and principal-agent theory. (3 hr. seminar.)

3.10 Public Administration (PUBA)

- PUBA 610. Public Management Theory and Practice. 3 Hr. Graduate-level introduction to management theory and practice in the public sector, including contextual influences, administrative behavior and motivation, decision-making, leadership, organizational design, communication, and evaluation.
- PUBA 611. Public Planning. 3 Hr. Principles and practices of government planning including development and management of policy, political and economic context of strategic planning, and social planning.
- PUBA 620. Public Financial Management. 3 Hr. PR: Consent. Principles and practices of public sector financial management including management control concepts, governmental financial accounting and reporting, analytical and managerial techniques, and microcomputer applications to public financial management.
- PUBA 630. Research Methods. 3 Hr. Introduction to the foundations and processes of applied research applicable to public administration, with emphasis upon data collection and analysis, statistical modeling and research design.
- PUBA 640. Legal and Political Foundations. 3 Hr. PR: Consent. Constitutional-legal basis of American public administration; the policy making process; administrative agency relationships with executive, legislative, and judicial branches; bureaucratic power and legitimacy; and administrative legal process.
- PUBA 645. Public Administration and Policy Development. 3 Hr. Policy development examined in terms of values, process, specific policy cases, alternative “futures” analyses, and policy science.
- PUBA 650. Local Governance. 3 Hr. Introduction to the institutions and processes of local governance. Institutions include: government structure (county, municipal, special districts), volunteer boards and commissions, and various types of community-based organizations.

- PUBA 655. Public Engagement. 3 Hr. Explores theories of community engagement. Develops skills in techniques for engaging citizens and other stakeholders in collaborative local governance and community building efforts.
- PUBA 670. Health Systems. 3 Hr. Graduate-level introduction to the development, structure, and current issues in the healthcare in the United States including health promotion, disease prevention, epidemiology, delivery and utilization of health services, financing, policy, regulation, and ethical concerns.
- PUBA 674. Rural Health Care. 1 Hr. PR or CONC: PUBA 670 or CHPR 635. Provides an overview of the issues affecting healthcare in rural settings, the health status of rural populations, and initiatives to provide improved access and address issues in service delivery and administration of rural health care settings.
- PUBA 710. Administrative Behavior in Public Organizations. 3 Hr. Introduces and familiarizes the student with the nature of individual and group behavior in public organizations and bureaucratic settings.
- PUBA 712. Administrative Ethics and Justice. 3 Hr. PR: PUBA 610 or consent. Analysis of ethical issues in public administration. Study of the concepts of distributive and procedural justice and their applications to administrative decision-making.
- PUBA 715. Organizational Development and Change Management. 3 Hr. Examines organization development and change management applied to public agencies. Explores basic organization development skills, and techniques for effective change management.
- PUBA 716. Creativity and Innovation. 3 Hr. Examines knowledge about creativity and innovation in public organizations. Explores approaches to increasing creativity for individuals and groups. Reviews organization structure and processes as they relate to creativity.
- PUBA 717. Performance Management. 3 Hr. Examines the principles of performance management in public organizations. Explores a variety of performance management models and practices with emphasis on service delivery to improve organizations.
- PUBA 720. Public Budgeting. 3 Hr. PR: PUBA 620. Advanced study of public budgeting at the federal, state, and local levels of government. Emphasis is placed on principles of public finance, budgeting processes and approaches; revenue sources and tax structures; and budget preparation and analysis.
- PUBA 743. Conflict Management. 3 Hr. PR: Consent. Explores the nature and causes of organizational, personal, and policy conflict in the public and non-profit sectors; develops approaches and tools for managing, negotiating, and resolving conflicts.
- PUBA 750. Public Planning. 3 Hr. Examine the substantive range of public planning arenas. Principles and practices of organizational, program, project, or physical planning with consideration of the political and economics context.
- PUBA 755. Sustainable Community Development. 3 Hr. PR: PUBA 645 or PUBA 750. Explores the theory, principles, and ethics of economic, environmental, and social sustainability as applied to community and economic development activities, with a focus on project and program implementation.

3.11 Recreation Parks and Tourism Resources (RPTR)

- RPTR 570. Meanings of Place. 3 Hr. Study of place as a psychological and social phenomenon with implications for community development, historic preservation, interpretation design, management, natural and cultural sustainability, and human well-being. (Equivalent to LARC 570.)
- RPTR 680. Non-Personal Interpretation. 3 Hr. This course focuses on the theoretical underpinnings and application of non-personal communication methods. This is a project-based course about interpreting historical, cultural, and natural resources.

- RPTR 685. Personal Interpretation. 3 Hr. This course focuses on the theoretical underpinnings and applications of personal communication methods. This is a project-based course about interpreting historical, cultural, and natural resources.
- RPTR 714. Outdoor Recreation Behavior. 3 Hr. This course explores the biophysical, psychological, social psychological, and sociological constructs that contribute to a contemporary, interdisciplinary understanding of outdoor recreation behavior. These concepts will be related to recreation resource management.
- RPTR 718. Participatory Approaches NRM. 3 Hr. This seminar-style class focuses on the adoption of more participatory approaches to managing natural resources. Specific topics will include the use of advisory committees, mediating conflicts, facilitation skills, management partnerships and public participation plans.
- RPTR 738. Tourism Planning. 3 Hr. Use of natural settings; integration of tourism development with respect to environmental protection concerns. (Field trip required; some transportation and food costs.)
- RPTR 752. Tourism & Natural Resource Mktg. 3 Hr. Apply the principles of marketing to tourism and natural resources emphasizing the convergence of increasing tourism demand and destination/resource competitiveness and sustainability.

3.12 Safety Management (SAFM)

- SAFM 501. Safety Management Integration. 3 Hr. Consideration of integrated arrangements, staff roles, management theory, staff liaison, project improvement, effectiveness, audits, and collaboration needed to assure success of the safety function.
- SAFM 502. Controlling Environmental and Personnel Hazards. 3 Hr. Investigation of hazard control principles relating to environmental facilities and equipment including control procedures recommended by authorities from the fields of engineering, medicine, and public health as well as from the field of safety.
- SAFM 505. Safety Legislation and Compliance. 3 Hr. Comprehensive study and analysis of federal and state legislation that mandates compliance with certain safety conditions and practices related to work performed in occupational and comparable settings.
- SAFM 528. Economic Aspects of Safety. 3 Hr. PR: Graduate standing. An overview of economic factors that must be considered when justifying the development and implementation of safety initiatives, including examining published research, cost estimating, ROI, risk assessment, benefit-cost analysis, and project planning.
- SAFM 533. Disaster Preparedness. 3 Hr. Major elements involved in disasters and emergencies, preparedness planning, systems utilization, and attention to essential human services, with emphasis on community action.
- SAFM 580. Fundamentals of Environmental Management. 3 Hr. An introductory but comprehensive overview of topics related to environmental technology as it applies to safety management. Focuses on regulation and technology relative to environmental management. Includes field trip

3.13 Social and Behavioral Sciences (SBHS)

- SBHS 601. Social and Behavioral Theory. 3 Hr. The focus of this course is on the role of individual behavior in attaining health. Integration of the concepts of health education and behavioral science to facilitate changes in health behavior is addressed.

- SBHS 610. Public Health Research Methods. 3 Hr. This course is designed to introduce students to the basic elements of conducting effective evaluation of health promotion programs.
- SBHS 611. Community Assessment. 3 Hr. This course is designed to provide students with the knowledge and skills needed to conduct meaningful community health assessments using direct observations, secondary data sources, key informants and public documents, integrating community perceptions and published evidence.
- SBHS 613. Public Health Program Evaluation. 3 Hr. Examination of research design, methods, and practices in the assessment and evaluation of public health programs; emphasis on practical applications of program evaluation to change behavior, allocate funds, build and strengthen programs.
- SBHS 614. Cmmnty-Bsd Participatory Rsrch. 3 Hr. This course focuses on initiating and conducting research projects in meaningful partnership with communities, including human research ethics and community-based participatory research elements, principles, and theories via a combination of readings, lectures, videos, and exercises.
- SBHS 660. Survey Research Methods. 3 Hr. This course presents scientific knowledge and practical skills used in survey research. Focus is on question construction and development, questionnaire design, sampling and surveying modes, interviewing techniques, and survey data analysis.
- SBHS 661. Qualitative Research Methods. 3 Hr. Introduces students to qualitative research methods and study designs. Includes critiques of qualitative study literature, student- driven studies using various types of study designs and how to analyze and report the results of qualitative studies. (Also listed as SBHS 761 - students may not count both this course and 761 toward degree requirements.).

3.14 Statistics (STAT)

- STAT 505. Foundations of Probability and Statistics. 3 Hr. PR: MATH 156 or consent. Probability, random variables, discrete and continuous probability distributions, point and interval estimation, chi-square tests, linear regression, and correlation.
- STAT 511. Statistical Methods 1. 3 Hr. PR: MATH 126. Statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, transformations, F and Chi-square distributions, analysis of variance and multiple comparisons. (Equivalent to EDP 613 and PSYC 511.)
- STAT 512. Statistical Methods 2. 3 Hr. PR: STAT 511 or equivalent. Completely random, randomized complete block, Latin square, and split-plot experimental designs. Unplanned and planned multiple and orthogonal comparisons for qualitative and quantitative treatments and factorial arrangements. Multiple linear regression and covariance analysis. (Equivalent to EDP 614 and PSYC 512.)
- STAT 513. Design of Experiments. 3 Hr. PR: STAT 512 or equivalent. Expected mean squares, power of tests and relative efficiency for various experimental designs. Fixed, random, and mixed models. Use of sub-sampling, covariance, and confounding to increase power and efficiency.
- STAT 521. Advanced SAS Programming. 3 Hr. PR: STAT 511 or equivalent; any computer programming language. Advanced topics in Statistical Analysis System (SAS). Students will perform statistical data analyses, data modifications, file operations, statistical report writing.
- STAT 545. Applied Regression Analysis. 3 Hr. PR: STAT 512 or equivalent. Matrix approach to linear and multiple regression, selecting the “best” regression equation, model building, and the linear models approach to analysis of variance and analysis of covariance.
- STAT 551. Nonparametric Statistics. 3 Hr. PR: STAT 511 or equivalent. Distribution-free procedures of statistical inference. Location and scale tests for homogeneity with two or more samples (related or independent); tests against general alternatives. (Alternate years.)

- STAT 555. Categorical Data Analysis. 3 Hr. PR: STAT 215 or equiv. Bivariate association for ordinal and nominal variables, models for categorical or continuous responses as a special case of generalized linear models, methods for repeated measurement data, exact small sample procedures.
- STAT 561. Theory of Statistics 1. 3 Hr. PR: MATH 251. Probability and random variables, univariate and multivariate distributions, expectations, generating functions, marginal and conditional distributions, independence, correlation, functions of random variables, including order statistics, limiting distributions, and stochastic convergence.
- STAT 562. Theory of Statistics 2. 3 Hr. PR: STAT 561. Techniques of point and interval estimation; properties of estimates including bias, consistency, efficiency, and sufficiency; hypothesis testing including likelihood ratio tests and Neyman-Pearson Lemma; Bayesian procedures; analysis of variance and nonparametrics.
- STAT 631. Sampling Theory and Methods. 3 Hr. PR: STAT 511 or equiv. Survey components, methods of sampling for finite and infinite populations, single and multi-stage procedures, confidence limits for estimating population parameters; sample size determination, area sampling, sources of survey error, a "hands-on" project in survey sampling is included.
- STAT 641. Multivariate Statistical Theory. 3 Hr. PR: STAT 541, and STAT 561 or consent. Euclidean vector space theory and matrix algebra, multivariate normal sampling theory, the theory of the multivariate general linear hypothesis including multivariate regression, MANOVA, and MANCOVA, and the theory of factor analysis.
- STAT 645. Linear Models. 3 Hr. PR: STAT 545 and STAT 362 or consent. Multivariate normal distribution, distribution of quadratic forms, linear models, general linear hypotheses, experimental design models, components of variance for random effects models.
- STAT 745. Data Mining. 3 Hr. PR: STAT 545 or equivalent. Development of predictive models for large data sets, including logistic and linear models, regression and classification trees, and neural networks. Data preparation, including imputation and filtering.
- STAT 763. Stochastic Processes. 3 Hr. PR: STAT 561. Modeling of random phenomenon, occurring over time, space, or time and space simultaneously. Modern techniques, such as the martingale decomposition, are applied to different statistical models.

3.15 Wildlife and Fisheries Management (WMAN)

- WMAN 512. Advanced Wildlife Population Ecology. 3 hr. PR: WMAN 313 or equivalent, or Consent. Case history approach to wildlife population ecology with emphasis on ungulates, gallinaceous birds, large predators; forest invertebrates and their vertebrate predators; endangered species; genetics and conservation of wildlife populations. Emphasis on current and historical literature. (3 hr. lec.)
- WMAN 534. Ecology and Management of Upland Wildlife. 4 Hr. PR: Consent. Ecology and management of upland game birds and mammals with emphasis on recent literature. (Offered in fall of even years.)
- WMAN 536. Ecology and Management of Wetland Wildlife. 4 Hr. PR: Consent. Ecology and management of waterfowl and wetland furbearers with emphasis on recent research and management literature.
- WMAN 547. Applied Wetlands Ecology and Management. 3 Hr. The management and ecology of wetland vegetation, soils, hydrology, and wildlife. (Cross listed as CE 547 and PLSC 547.)
- WMAN 644. Wildlife Data Analysis 1. 3 Hr. This course will cover data interpretations, statistical power, data techniques, use of correct data methods and alternatives and interpretation of results.
- WMAN 645. Wildlife Data Analysis 2. 3 Hr. PR: WMAN 644. This course will cover statistical power and sample size, selection of proper methods, identify assumptions of methods and use of proper alternatives, and identify results.