NATURAL RESOURCE SCIENCES GRADUATE STUDIES PROGRAM

DEPARTMENT
OF
NATURAL RESOURCE SCIENCES
AND
LANDSCAPE ARCHITECTURE

Fall 2002

HELPFUL WEBSITES

Department of Natural Resource Sciences & Landscape Architecture
http://www.nrsl.umd.edu/

Graduate Studies (Catalog)
http://www.gradschool.umd.edu/

Schedule of Classes
http://www.testudo.umd.edu/ScheduleOfClasses.html

NATURAL RESOURCE SCIENCES GRADUATE STUDIES PROGRAM

Graduate Studies in Natural Resource Sciences
University of Maryland

GRADUATE PROGRAM

The Department of Natural Resource Sciences and Landscape Architecture directs the graduate program in Natural Resource Sciences. The program offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. Candidates select one of two program areas: Plant Science or Soil Science. Candidates in Plant Science may specialize in Breeding and Genetic Engineering, Crop Management and Protection, Ecology and Environmental Physiology, or Physiology and Molecular Biology. Candidates in Soil Science may specialize in Biology and Ecology of Soils, Bioremediation, Chemistry and Biochemistry, Fertility and Nutrient Management, Land Management and Conservation, Mineralogy, Pedology, or Physics.

The faculty's graduate philosophy is summarized in the following statements:

> For success in a Master's program, knowledge, both general and detailed, must be combined with originality, reliability, and industry. A well-written thesis should foster scholarly interest and demonstrate knowledge of the tools and techniques necessary for research and the ability to integrate new and existing methods.
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> The Ph.D. degree is the highest degree conferred by the University. It is a degree in philosophy and is not a technical degree. A candidate is expected to develop an awareness of the relationship between his/her expertise and society. Required course work is one means of acquiring the broad-based knowledge fundamental to establishing one's own philosophy. The dissertation should demonstrate a candidate's acumen for pursuing the scientific method; illustrating the difference between observations and hypothesis, between answering questions and testing hypotheses, and between opinion and truth.

The objectives of the graduate programs in Natural Resource Sciences are:

1. To assist students in developing an understanding of plant sciences, soil sciences, and plant-soil environment relationships sufficient to allow them to make positive professional contributions to agricultural and horticultural field crop improvement and production; land and water resource management; management of turfgrass, nursery plants, and urban landscapes; and the characterization and management of soil resources.
2. To provide students with skills in analyzing and interpreting quantitative and qualitative information; using inductive and deductive reasoning; and communicating in both verbal and written form.
3. To develop students who have the education and skills to provide societal leadership in the area of sustainable natural resource and plant production systems.

The Department's main strength is an experienced faculty who have been recognized for their teaching and research excellence. The graduate program benefits from the research expertise and focus of the faculty as they strive to meet the Department's land-grant mandate to conduct basic and applied research on the impacts of agricultural and urbanization activities on environmental quality issues.

The Department's aspiration is to strengthen our position as one of the leading plant and soil science research and graduate training programs in the country. Our current research and extension programs have made major contributions in nutrient management and water quality issues as related to the Chesapeake Bay initiative. Basic and applied research in the Department will continue to focus on the

agricultural-environmental interface. The Department's research expertise and focus are clearly in agreement with the College of Agriculture and Natural Resources' strategic plan to emphasize "environmental issues" and "sustaining and strengthening agriculture in an increasingly urbanized state".

The Department's goal of being a national leader in plant and soil sciences, focused on environmental issues unique to our location, fits within the University's strategic plan to develop programs of excellence in graduate education and research. By focusing our graduate research and teaching in sustainable natural resource and plant production systems, we can continue to make important contributions to expand basic knowledge and serve the professional community. This is especially true since the concept of our University's land-grant mission is to address problems of citizens in the state of Maryland even though our efforts frequently have regional, national, and international significance.

FACILITIES AND SPECIAL RESOURCES

The majority of laboratory and office facilities for faculty in the Department are located at the College Park campus in H .J. Patterson Hall and the Plant Sciences Building. Well-equipped laboratories for chemical, physical, and mineralogical determinations of soil and plant properties are located in both buildings. Controlled-temperature storage and growth chambers provide facilities for post-harvest and environmental control studies. Laboratory instrumentation provides for chromatography, spectrophotometry, elemental analysis, tissue culture, genetic engineering and transformation, gel electrophoresis, radio-labeling, x-ray diffraction and fluorescence, and other procedures. Greenhouse facilities on campus are available for research with turfgrass and floricultural and ornamental plants, and are used for research in crop breeding, crop production and protection, weed control, and soil fertility.

Orchards for research with fruits are located at the Western Maryland Research and Education Center near Sharpsburg. Crops, horticulture, and soils research is also conducted at this center and at four other Research and Education Centers that are strategically located throughout Maryland. The Central Maryland Research and Education Center includes the Clarksville Facility, Turfgrass Research and Education Facility (Beltsville), Beltsville Field Unit (Laurel), and the Southern Maryland Research and Education Facility (Upper Marlboro). At this center a variety of agronomic, horticultural, and environmental research is conducted. East of the Chesapeake Bay agronomic, horticultural, and environmental studies are conducted at three locations: Wye Research and Education Center (Queenstown), and the Lower Eastern Shore Research and Education Center (Poplar Hill and Salisbury Facilities). In addition to the experiments at the Research Centers, many experiments are conducted with cooperating laboratories at USDA-Beltsville, cooperating farmers, and industry throughout the state.

The University of Maryland is located between Beltsville, Maryland, and Washington, D.C. Thus, it is located near the headquarters and principal laboratories of several federal agencies. The National Agriculture Library is only three miles from the campus and is readily available to graduate students. Scientists from the USDA at Beltsville, the Geological Survey, the National Academy of Sciences, NASA, National Institutes of Health, Department of Energy, Smithsonian, National Park Service, as well as other agencies, have cooperated with the Department's faculty on various projects. Scientists from some of these agencies have adjunct appointments in the Department, have taught special courses at the University, and participate on graduate committees. Cooperation with these agencies also provides opportunities for consultation with leading scientists and financial support of graduate studies. Some students obtain part-time work at these agencies which can be a valuable part of their training.

FINANCIAL AID

Graduate teaching assistantships and research assistantships are available in limited numbers in the Department and are offered to students on a competitive basis. Graduate assistants spend approximately 20 hours per week assisting with teaching or research activities in the Department. The remainder of their time is generally occupied by course work and thesis research. Highly qualified applicants may be nominated for fellowships, some of which are specific to this program, or scholarships. Fellowships and other financial aid programs are administered by the Graduate School. Graduate appointments carry varying stipends and generally also carry remission of fees. Appointments to research and teaching assistantships are for 12 and 10 months, respectively. The Department, however, will cover summer salary of all teaching assistants.

The Department encourages timely completion of graduate degree requirements by providing 2 and 3 years of full assistantship support for M.S. and Ph.D. students, respectively. The Department Chair can extend the time limit on a semester-by-semester basis if a student is making satisfactory progress in a degree program. Decisions on financial support are made separately from admission decisions. In both cases, the Department actively seeks a diverse population of students regarding gender, race, and nationality.

ADMISSION

Prospective graduate students in Natural Resource Sciences should have a strong academic record with a particular emphasis in the basic sciences and mathematics. The Graduate School requires as a minimum that the applicant hold a bachelor's degree from an accredited college or university in the United States or the equivalent in a foreign country. In addition, applicants are expected to have a 3.0 cumulative grade point average on a 4.0 scale in all previous academic work. The Graduate Record Examination (GRE) is required of all applicants to the Natural Resource Sciences Program. The Department considers it desirable that entering students have a combined verbal, quantitative, and analytical GRE score of 1800 or above.

Academic credentials of foreign applicants are evaluated by the Office of International Education Services before applications are considered by the Department. Foreign applicants must demonstrate proficiency in English, adequate financial support, and visa verification to the above office before an offer of admission can be made.

To be admitted with full admission status into a M.S. program, applicants must have completed a one-semester course in calculus I and 16 semester credits of basic science courses in chemistry and biochemistry, physics, or mathematics beyond calculus I. While course work in biology and related areas is not required for admission, it is essential for most areas of graduate study in the Department and is highly desirable. Potential applicants deficient in basic science courses will be encouraged to complete these requirements as an advanced undergraduate student prior to application to the Graduate School. Provisional admission status may be extended to applicants lacking some of the basic science credits; however, students must complete these courses in addition to the graduate degree course requirements.

All students entering a Ph.D. program in Natural Resource Sciences are expected to have an M.S. degree and meet the admission requirements of the M.S. degree. Exceptional students having unusual and noteworthy experience without an M.S. degree may petition the Department for admission in the Ph.D. program and may be accepted upon approval of the Department Graduate Committee.

Students who have completed the undergraduate program at the University of Maryland occasionally continue for the M.S. degree here. It is not advisable for these students to remain at the University of Maryland for a Ph.D. degree. Going to another institution for part of a student's professional training and education will promote wider contacts, broader points of view, enlarged experiences, and greater professional growth. Students receiving both B.S. and M.S. degrees from the Department of Natural Resource Sciences and Landscape Architecture will not be admitted to the Ph.D. program unless there are substantial mitigating circumstances**.** Students may petition the Department's Graduate Committee for a waiver of this rule if there are rare and extenuating circumstances.

All applications for the Natural Resource Sciences program are received in the Department of Natural Resource Sciences and Landscape Architecture. The Graduate Coordinator reviews all complete application files and assigns at least three faculty members, whose area of specialization is similar to the applicant's interest, to review the application. The faculty reviewers look for evidence of both strong academic preparation and that the applicant is capable of successfully accomplishing independent research. Careful consideration is given to each applicant's academic transcripts, GRE scores, letters of recommendation, and statement of personal goals. Evaluation comments of the faculty reviewers and the Graduate Coordinator are presented to the Graduate Committee, which also reviews the application and makes the final departmental recommendation on admission status of the applicant. The Graduate Coordinator notifies the Graduate School of the Department's recommendation on admission status, and the Graduate School extends an offer of admission if appropriate.

ADVISEMENT

Admission is dependent on the availability of at least one faculty member in the proposed major area of study who is willing to assume the responsibility of advising the student. To expedite this step, a prospective graduate student may wish to speak directly to a faculty member prior to or during the admissions process. After admission and during the first semester of study, the graduate student should visit with all the faculty he or she would be interested in working with. Not later than the end of the first semester of study the student's Advisor will be formally assigned. If more than one faculty member is willing to serve as the student's advisor, the student has the final choice of advisor**.** The assignment of an Advisor is generally made by the Graduate Coordinator in consultation with the Department's Graduate Committee, the prospective Advisor**,** and the student. Much of the success of a graduate education is dependent upon the close and effective relationship with the student and his or her Advisor.

As soon as possible after admission to the graduate program, the graduate student should contact his or her Advisor to begin discussions regarding the plan of study and research. Selection of the research problem requires particular care and effort. The research conducted should demonstrate the student's ability to do independent research, and should be sufficiently focused to permit completion in a timely fashion and publication in a scientific journal. Research problems are developed in consultation with the Advisor and Advisory Committee in an area of mutual interest.

Specific Guidelines for Advisors and Graduate Students

1. Advisors are responsible for appointing an Advisory Committee for each entering graduate student. This committee will assist the student with the development of a plan of study, and with the planning and organization of thesis or dissertation research. Responsibility for compliance with Departmental and Graduate School requirements rests with the student under the guidance of the Advisor and Advisory Committee. Students should be familiar with Graduate School requirements as outlined in the current issue of the Graduate Catalog.

2. The Advisory Committee should be formed as soon as reasonably possible, but no later than the end of the second semester after the student's entry into the Department. This committee will ordinarily be nominated to serve as the student's Examining Committee, so it should be appointed with attention to Graduate School requirements for the composition of an Examining Committee. The function of the Advisory Committee is to provide guidance to the student in all aspects of the graduate program. It is important to establish a strong working relationship with the Advisory Committee, and the student is encouraged to make good use of the collective expertise of this group of faculty.

3. The Advisory Committee will meet with the student at a minimum of once each year to discuss the student's progress both academically and with respect to research. The minimum cumulative grade point average (GPA) required by the Graduate School for graduation is 3.0, and grades below C are unacceptable for graduate credit. If a student's cumulative GPA falls below 3.0 at any time, the student must meet with the Advisory Committee as soon as possible in the semester following the occurrence of this deficiency. The purpose of this special meeting is to discuss the situation and to help the student set guidelines for its correction. A student whose cumulative grade point average falls below a 3.0 average for two consecutive semesters of enrollment will not be permitted to re-enroll, and the Department will recommend his/her admission status be terminated by the Graduate School.

4. The Student Data Form is to be completed (insofar as possible) immediately after entrance to the program, and filed with the Graduate Coordinator. Thereafter, it is to be updated annually and filed by November 1, or whenever significant changes or additions need to be made.

5. The appropriate (M.S. or Ph.D.) Plan of Study form is to be completed by the student no later than the end of the second semester of study. It should be approved and signed by the Advisor and Advisory Committee members before filing with the Graduate Coordinator.

6. A written Research Proposal is to be developed by the student with the assistance of the Advisory Committee. This will be submitted to the Graduate Coordinator by the end of the second semester of study. The Research Proposal should include a clear statement of purpose (objectives), a brief literature review, and a description of the experimental approach. A cover sheet signed by the student's Advisor and members of the Advisory Committee indicating their approval of the Research Proposal must be attached when it is submitted. All research at the University must be conducted in accordance with federal guidelines and University policy regarding the use of vertebrate animals, the use of human subjects, and the use of materials that may pose biological or chemical hazards.

7. When applicable, appropriate forms must be approved by the University committee prior to the initiation of any thesis-related research, and the approvals must be provided to the Graduate School at the time the student submits the Nomination of Examining Committee form. For non-thesis M.S. students, a plan for the required seminar papers must be prepared and submitted to the Department Graduate Coordinator by the end of the second semester.

8. Graduate students are strongly encouraged to develop research presentation skills by writing abstracts and presenting oral or poster presentations at local, regional, and national meetings of scientific societies. All students are expected to publish the results of their thesis or dissertation research in an appropriate refereed journal. Parts of the graduate research may be published prior to completion of the degree. Prior to completion of the graduate program, students are encouraged to have at least one manuscript from the thesis or dissertation submitted for publication.

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE (Thesis Option)

Course Requirements: A focused, coherent program of study approved by the Advisor and Advisory Committee is planned prior to or during the second semester in the student's residency. This program requires a minimum of 30 semester hours beyond the B.S. degree, including six hours of thesis research credit (799). Of the 24 hours required in graduate courses, at least 12 must be earned in a major area. A minimum of 12 credit hours must be earned at the 600 level or above, including two credit hours of Graduate Seminar (798). Only one credit of NRSC 608T (Teaching Methods) may be applied toward this requirement. If the student is inadequately prepared for the required graduate courses, additional courses may be required at the undergraduate level. Undergraduate courses will not be counted as part of the student's graduate program.

Students in the Plant Science specialization are required to have one semester each of 400-level biochemistry, plant physiology, and statistics. Students in the Soil Science specialization are required to have 12 credits of 400-level or higher soil science courses. The 12 credits must be earned in any four of the following five areas: soil chemistry, soil physics, soil pedology, soil microbiology, soil fertility. Credits for these soils courses may be earned as part of a B.S. or M.S. degree program. Details concerning course/credit requirements are summarized in the appended summary of requirements.

Graduate Seminar: All students must register for seminar (798) twice during their M.S. program. They are expected to attend seminar regularly regardless of enrollment for credit. (The Graduate Seminar requirement is further discussed in Appendix 1.)

Thesis Requirement: A thesis is required for the M.S. degree (thesis option). Directions for the preparation of the thesis are printed in the publication titled *Style and Policy Manual for Master's Theses and Doctoral Dissertations* which is available from the Graduate School. These directions must be strictly observed.

Final Oral Examination: A final oral examination on the thesis must be held when the thesis is complete and has been approved by the Advisor, and provided that all other degree requirements have been met. The Examining Committee is appointed by the Dean of the Graduate School following nomination by the student's Advisor. In most circumstances, the Advisory Committee is nominated as the Examining Committee. The form for nomination of the Examining Committee can be obtained from the Graduate School, and must be submitted, with the Advisor's and Graduate Coordinator's signatures, at least two months prior to the date on which the oral examination is scheduled.

The Examining Committee, with a minimum of three members, conducts the oral examination on the thesis. An additional comprehensive examination (oral or written) may be required at the option of the Committee. The Advisor serves as the Chair of the Examining Committee, and is responsible for scheduling the examination and notifying the members of the Committee of location and time. Members of the Committee must be given a minimum of seven working days in which to read the thesis prior to the examination.

Following the examination, the Committee reports its findings to the Graduate School on the "Report of Examining Committee". In addition to this report, the Department requires a report for the departmental file on the outcome of the examination.

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE (Non-thesis Option)

The non-thesis option is intended for students whose career objectives require supplementary and facultative knowledge of natural resource sciences. This option is particularly useful to those requiring broad training. The major difference between the thesis and non-thesis M.S. is in the requirement of additional course work instead of research and writing of a thesis.

Course requirements: Non-thesis option M.S. students are required to complete a minimum of 30 credit hours of course work beyond the B.S. degree. At least 18 credit hours must be at the 600 level or above, including two credits of seminar (798). Only one credit of NRSC 608T (Teaching Methods) may be applied toward this requirement. Non-thesis M.S. students must also have a minimum of 15 credit hours in a major area.

Seminar Papers: Non-thesis M.S. students are required to write two scholarly papers in partial fulfillment of the degree requirements, and to present each in a separate seminar based on the content of each paper. These seminars should be scheduled and presented during a regularly scheduled graduate seminar period. Both seminars must be scheduled before the final written and oral examinations.

The scholarly papers are independent and in excess of requirements for other graduate level courses. Subjects for scholarly papers should be selected by the graduate student with the help of the Advisor and subject to approval by the student's Advisory Committee. Subjects should be decided early in the student's program to allow time for thorough library research, writing, and revision as required. Each paper will consist of an organized comprehensive review of the literature and should include:

1. an introductory section which describes the purpose of the paper and delineates the subject area to be covered
2. the main body of the paper which consists of the review of literature
3. a critical analysis or discussion of the material covered
4. a summary or conclusion section
5. a bibliography

Citations in the text and bibliographic listings should follow the style used in a recognized scientific journal. Upon completion, copies will be furnished to members of the Committee at least 5 school days prior to the final examination. One departmental copy will be bound in a hard cover and will be given to the Graduate Coordinator and one final unbound or bound copy (at the Advisor's discretion) will be given to the Advisor. The cost of binding and printing will be the student's responsibility.

Final Examinations: The Graduate School requires that all non-thesis M.S. students pass a written comprehensive final examination on their knowledge of the discipline. In addition, the Department requires an oral examination, at least part of which is devoted to the contents of the two seminar papers. The student's Advisor is responsible for selecting the Examining Committee, and for scheduling the final written and oral examinations. The Advisory Committee is ordinarily appointed as the Examining Committee. At the conclusion of the oral examination (which must be scheduled after the written examination), the Committee reports its findings to the Graduate School via a form which goes to the Dean of Graduate Studies. An additional departmental report is retained by the Graduate Coordinator.

REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE

All students entering the Ph.D. program in Natural Resource Sciences must first have completed the M.S. degree in natural resource sciences or a related discipline. It may be necessary for some students with certain course deficiencies to make them up during the Ph.D. program. At a minimum, the Ph.D. student will need to complete course work equivalent to what is normally expected of an M.S. student in Natural Resource Sciences at the University of Maryland before completion of the Ph.D. program.

Course Requirements: Course requirements for the Ph.D. degree are outlined in the appended summary of requirements. The Graduate School requires 12 credits of dissertation research (899) for the Ph.D. degree. The group of courses selected must form a logical and coherent whole that will provide the student with sufficient depth in the area of study to carry out the independent planned research. Course selection must be made in consultation with the Advisor and Advisory Committee.

All students must register for seminar (798) twice during their Ph.D. program. They are expected to attend seminar regularly regardless of enrollment for credit. Students in the Plant Science specialization are required to have a second semester of 400-level biochemistry or a 400-level (or higher) statistics course. Students in the Soil Science specialization must have one semester of physical chemistry or biochemistry (400 level) and at least one additional course at the 400 level (or higher) in physical chemistry, biochemistry, mathematics, engineering, or computer science.

Teaching: Classroom teaching experience is a valuable and broadening experience for any graduate student. The Department views preparation for teaching as an important part of graduate training. All graduate students are encouraged to participate in formal instruction at some time during their graduate studies. Experience in college teaching can be accomplished in two ways: as a graduate teaching assistant and by enrollment in NRSC 608T (Teaching Methods).

Candidacy Examination: A written examination followed by a comprehensive oral examination is required towards the end of the student's course program. To be eligible to take the candidacy written and oral examinations, the student must have submitted a research proposal and had it approved by his/her Advisor and Advisory Committee. In addition, the student must have presented an entrance seminar covering the approved research proposal. The examinations must be scheduled within a two-month period, and must be passed prior to advancement to candidacy for the Ph.D. The Advisory Committee typically conducts these two examinations, and then informs the Graduate School and Department of the results. The Examining Committee must have one member who is a regular member of the Graduate Faculty and is outside of the Department. Students failing either of the examinations may retake it one time after a period of six months of the date of the first examination. A second failure will result in termination of the student's program. A Ph.D. student must be advanced to candidacy after five years of admission to the doctoral program and at least one academic year before the date on which the degree will be conferred. Forms necessary for application for advancement to candidacy are available from the Graduate School.

Dissertation Requirement: A dissertation based on original research is required for the Ph.D. degree. Directions for the preparation of the dissertation are printed in the publication titled *Style and Policy Manual for Master's Theses and Doctoral Dissertations* which is available from the Graduate School. These directions must be strictly observed.

Final Oral Examination: The final oral defense of the dissertation is conducted by a committee of the Graduate Faculty appointed by the Dean for Graduate Studies. Nominations for membership on the committee, which will typically have been the student's Advisory Committee, are submitted by the Advisor through the Graduate Coordinator to the Graduate School at least three months prior to the date

on which the oral examination is scheduled. The form for nomination of the Examining Committee can be obtained from the Graduate School. This form also lists the regulations for forming the Examining Committee, which will consist of a minimum of five members, at least three of whom must be regular members of the University of Maryland Graduate Faculty. Ordinarily, the Advisor will serve as Chair of the Examining Committee. One member of the Committee, not from the candidate's home department, is appointed as a representative of the Dean for Graduate Studies. This person serves as an examiner, but also has the additional responsibility of assuring that the examination is conducted according to established procedures.

The Advisor, in the capacity of Chair of the Examining Committee, is responsible for scheduling the examination and notifying the members of the Committee and all Graduate Faculty members in the Department. Members of the Committee must be given a minimum of ten working days in which to read the dissertation prior to the examination.

Following the examination, the Committee reports its findings to the candidate and to the Graduate School on the "Report of Examining Committee" form provided to the Advisor at the time the Examining Committee is appointed. In addition to this report, the Department requires a report for the departmental file on the outcome of the examination.

Appendix 1. Graduate Seminar (NRSC 798) Requirements

All students must schedule seminar (NRSC 798) for credit at least **twice for each degree**. All graduate students are expected to attend all seminars and participate in the discussions even when they are not enrolled for credit.

For Ph.D. students and M.S. thesis students

1. The first seminar must be scheduled during the first year of the student's program for each degree. This seminar should present an overview of the student's **Research Plan** and a description of the planned experimental approach.

2. The second seminar should be scheduled toward the end of the student's program and must be presented within one year of graduation. This seminar is intended to be the exiting or final research seminar. **This seminar must be given prior to the final oral examination**. Questions and discussion of the research following the presentation will help the student prepare the thesis or dissertation. It is suggested, therefore, that the seminar be scheduled far enough in advance of the oral examination so that suggestions issuing from the seminar discussion may be incorporated into the thesis or dissertation.

For non-thesis M.S. students

1. Non-thesis M.S. students are required to write two scholarly papers in partial fulfillment of the degree requirements, and to present a seminar on the topic of each paper. These seminars should be scheduled and presented during the regular schedule of NRSC 798.

2. These two seminars must be scheduled during two different semesters. **Both seminars must be given prior to the final written and oral examination.** Questions and discussion following each presentation will help the student prepare the scholarly papers. It is suggested, therefore, that the seminars be scheduled far enough in advance of the written and oral exams so that suggestions issuing from the seminar discussion may be incorporated into the final text of the scholarly papers.

Appendix 2. Summary of Requirements: M.S. and Ph.D.

NATURAL RESOURCE SCIENCES (NRSC) GRADUATE STUDIES REQUIREMENTS

Program Areas: Soil Science and Plant Science
Degrees: M.S. (thesis option), M.S. (non-thesis option), Ph.D.

Soil Science Areas of Specialization

a. Biology and Ecology of Soils
b. Bioremediation
c. Chemistry and Biochemistry
d. Fertility and Nutrient Management
e. Land Management and Conservation
f. Mineralogy
g. Pedology
h. Physics

Plant Science Areas of Specialization

a. Breeding and Genetic Engineering
b. Crop Management and Protection
c. Ecology and Environmental Physiology
d. Physiology and Molecular Biology

Admission Course Requirements for Full Admission Status

1. Master of Science
   a. One semester calculus I
   b. Sixteen credits of basic science courses in Chemistry, Biochemistry, Physics, or Mathematics beyond calculus I
   (a. and b. are considered a basic science requirement package)
   (Provisional admit if lacking some of the requirements above. Deficiencies should be made up during the first year of study.)

2. Doctor of Philosophy
   M.S. degree and NRSC M.S. requirements including the basic science package
   (Provisional admit if lacking some of the requirements above. Deficiencies should be made up during the first year of study. Must have a M.S. degree in plant science, soil science, or a related discipline.)

Degree course requirements

1. Soil Science
   M.S.
   CORE requirements follow:
   Basic science requirement (see previous page)
   12 credits of 400+ level soil science courses earned during B.S. or M.S.
      The 12 credits must be earned in any four of the following five areas: soil chemistry, soil physics, soil pedology, soil microbiology, soil fertility.
   2 credits seminar (entrance and exit) (798)

12 credits 600+ level courses*
6 credits research* (799)

24 total credits for degree (minimum)* (Thesis option)

Non-thesis option - 6 additional credits of course work; 6 credits research are not required

Ph.D.

M.S. degree and all NRSC M.S. requirements
CORE requirements follow:
a.) One course of physical chemistry or biochemistry (400+ level)
b.) At least one additional course 400+ level in physical chemistry, biochemistry, mathematics, engineering, or computer science
2 credits seminar (entrance and exit) (798)

12 credits research*(899)

Course selection must be made in consultation with student's advisory committee

2. Plant Science

M.S.

CORE requirements follow:
Basic science requirement (see previous page)
One course each of 400+level biochemistry, plant physiology, and statistics
2 credits seminar (entrance and exit) (798)

12 credits 600+ level courses*
6 credits research* (799)

24 total credits for degree (minimum)* (Thesis option)

Non-thesis option - 6 additional credits of course work; 6 credits research are not required

Ph.D.

M.S. degree and all NRSC M.S. requirements
CORE requirements follow:
2 credits seminar (entrance and exit) (798)
One additional course of 400+ level biochemistry or statistics

12 credits research* (899)

Course selection must be made in consultation with student's advisory committee

*Graduate school requirement

Appendix 3. Graduate Faculty

DEPARTMENT OF NATURAL RESOURCE SCIENCES AND LANDSCAPE ARCHITECTURE
FACULTY RESEARCH LIST

J.S. Angle, Professor; Ph.D., Missouri, 1981. Applied molecular biology; non-point pollution; microbial ecology.

C.E. Beste, Associate Professor; Ph.D., Purdue, 1971. Herbicide physiology, limited tillage, sustainable agriculture, weed-crop interactions, weed control in vegetable and small fruit.

J.C. Bouwkamp; Associate Professor; Ph.D., Michigan, 1969. Breeding, productivity, stress tolerance and physiology of vegetables; alternative crop production; use of composts in flower and vegetable production.

J.F. Buriel, Instructor; M.S., Duke, 1979. Soil testing; plant and manure analysis.

M.J. Carroll, Associate Professor; Ph.D., Cornell, 1989. Turfgrass management, erosion control; fate of nutrients and pesticides applied to turf.

S. Chang, Assistant Professor; Ph.D., California, Berkeley, 2000. Environmental planning; emphasis on urban landscape design.

F.J. Coale, Professor; Ph.D., Kentucky, 1986. Soil fertility; nutrient management; nutrient fate in agroecosystems.

G.D. Coleman, Associate Professor; Ph.D., Nebraska, 1989. Physiology, genetics and molecular biology of seasonal growth transitions in woody plants. Focus on the physiology and molecular biology of seasonal nitrogen cycling, cold hardiness, and dormancy.

J.M. Costa, Associate Professor; Ph.D., Oregon State, 1990. Small grains cereal breeding for quality improvement and disease resistance; molecular characterization of genes determining morphological traits in cereals.

P.B. Cregan, Adjunct Associate Professor; Ph.D., North Dakota State, 1977. Molecular genetic marker development and the application of molecular marker technology for the genetic improvement and characterization of soybean and wheat.

C.S.T. Daughtry, Adjunct Associate Professor; Ph.D., Purdue, 1976. Remote sensing for crop condition and yield assessment; measuring and modeling radiation interactions in vegetation.

G.F. Deitzer, Associate Professor; Ph.D., Georgia, 1971. Physiology, biochemistry, and molecular biology of flowering and other responses regulated by light; rhythmic stomatal behavior and photosynthesis; controlled environmental agriculture.

P.H. Dernoeden, Professor; Ph.D., Rhode Island, 1980. Weed and disease management in turfgrasses; integrated pest management; disease etiology and biology; turfgrass management.

E.K. Dzantor, Assistant Professor; Ph.D., Wisconsin, 1980. Bioremediation of soils contaminated with wastes from agricultural, manufacturing, and defense industry sources.

K.L. Everts, Associate Professor; Ph.D., Michigan State, 1989. Epidemiology and control of vegetable crop diseases, pathogen population response to production practices and disease control, weather-based fungicide application models.

T.A. Fretz, Professor; Ph.D., Delaware, 1970. Floriculture.

D.S. Glenn, Associate Professor; Ph.D., Kentucky, 1980. Weed control in agronomic crops; physiological effects of herbicides in plants; cell and tissue culture; absorption, translocation, and metabolism of herbicides; allelopathy.

A.P. Grybauskas, Associate Professor; Ph.D., Oregon State, 1983. Agronomic crops pathology; epidemiology; plant disease management; crop loss assessment.

M. Hill, Associate Professor; B.S.L.A., M.S.C.D., California, Davis, 1989. Cross-cultural design, sustainable community design, international development, neighborhood and urban design, participatory design theory and methods, social and behavioral factors.

R.L. Hill, Professor; Ph.D., Iowa State, 1984. Non-point pollution, conservation management systems, spatial variability, solute transport.

B.R. James, Professor; Ph.D., Vermont, 1981. Soil chemistry with applications of basic colloid chemistry to environmental quality (waste disposal and groundwater) and agriculture.

W.J. Kenworthy, Professor; Ph.D., North Carolina State, 1976. Soybean germplasm improvement utilizing molecular markers and traditional breeding methodology; soybean production systems.

R.J. Kratochvil, Assistant Professor; Ph.D., Maryland, 1994. Agronomic crop production systems; alternative and value added crops.

J.D. Lea-Cox, Associate Professor; Ph.D., Florida, 1993. Nutritional physiology, plant growth, and development of wood perennial and herbaceous plants. Nutrient use-efficiency, environmental nutrient fluxes, and closed agricultural systems. Environmental plant stress factors. Educational technology; sensor technology.

E.H. Lee, Adjunct Professor; Ph.D., Oklahoma, 1969. Effects of air pollutants on the physiology and biochemistry of plant cells.

M.S. McIntosh, Professor; Ph.D., Illinois, 1978. Germplasm conservation and improvement; application of statistical procedures to the analysis of biological data; effect of composted sewage sludge on tree growth.

J.J. Meisinger, Adjunct Associate Professor; Ph.D., Cornell, 1976. Use of N-15 to trace fertilizer N in soil/plant/water systems; estimates of dinitrogen fixation in field conditions; effects of no-till on soil nitrogen cycle.

R.J. Miller, Professor; Ph.D., Purdue, 1962. Geographic information systems-productivity analysis and regional research systems; science systems in other countries.

H.G. Mityga, Lecturer; Ph.D., Maryland, 1976. Agricultural education, culture and management of ornamental plants, woody plant taxonomy.

B. Momen, Assistant Professor; Ph.D., California, Berkeley, 1993. Biostatistics, ecosystem ecology, eco-physiology.

C.L. Mulchi, Professor; Ph.D., North Carolina State, 1970. Environmental sciences with emphasis on air and soil pollution effects on crop productivity and quality; crop physiology as influenced by interactions with air quality and drought stress; remote sensing.

D.A. Myers, Assistant Professor, M.L.A., 1984; Ph.D., Georgia, 1994. Metropolitan vegetation assessment, environmental design, GIS planning and design.

B.A. Needelman, Assistant Professor; Ph.D., Penn State, 2002. Soil landscape analysis and information systems, geostatistics, water quality, contaminant transport, hydrology.

T.J. Ng, Professor; Ph.D., Purdue, 1976. Breeding and genetic studies of vegetables, investigation of genetic control of seed germination, post-harvest physiology, and environmental and pathogen stress tolerance.

M.R. Pooler, Adjunct Assistant Professor; Ph.D., Wisconsin, 1991. Woody plant genetics**.**

B. Quebedeaux, Professor; Ph.D., Cornell, 1968. 0_2 regulation of reproductive growth, nitrogen fixation, water stress and crop physiology, photosynthate partitioning and growth regulating chemicals in fruits and vegetables. Plant genomes and genetic resources.

M.C. Rabenhorst, Professor; Ph.D., Texas A&M, 1983. Soil genesis, morphology, and classification; soil geomorphology and landscape relations; hydric soils and wetlands; soil micromorphology.

R.L. Ritter, Associate Professor; Ph.D., North Carolina State, 1979. Weed control in no-tillage corn and in no-tillage full-season and double-cropped soybeans; weed management systems for triazine-resistant weeds; control of large-seed broadleaf weeds in soybeans.

L.H. Slaughter, Associate Professor; Ph.D., Maryland, 1987. Crop ecology and physiology; environmental effects on plant growth and development, and carbohydrate metabolism.

T. Solomos, Professor; Ph.D., Cambridge, U.K., 1962. Physiological, biochemical, and molecular changes associated with plant senescence in general and fruit crops in particular, interactions between 0_2 and C_2H_4 during fruit ripening.

J.B. Sullivan, Assistant Professor; M.L.A., Virginia, 1980. Urban design, history of landscape architecture, site planning and design, site engineering, historic preservation.

J.H. Sullivan, Associate Professor; Ph.D., Clemson, 1985. Urban forestry, physiological ecology, environmental horticulture, photobiology, stress physiology, UV-B radiation, water relations.

H.J. Swartz, Associate Professor; Ph.D., Cornell, 1979. Breeding of Rubus and other woody species including the use of tissue culture for mutagenesis; organogenesis and transformation; forest and wetland plant and eastern native grass germplasm preservation and culture.

P. Tamboli, Adjunct Professor; Ph.D., Iowa State, 1961. Global issues on natural resource management.

D.E. Terlizzi, Affiliate Professor; Ph.D., Maryland, 1981. Aquatic botany**.**

M.L. Tucker, Adjunct Associate Professor; Ph.D., UCLA, 1984. Molecular biology of abscission (organ separation), senescence and ethylene action.

T.R. Turner, Associate Professor; Ph.D., Penn State, 1980. Management of turfgrass; soil testing and fertility recommendations for cool- and warm-season turfgrass; cultivar evaluation and selection.

P. van Berkum, Adjunct Associate Professor; Ph.D., London, U.K. Host-plant-microbe interaction of legume-rhizobial symbioses; taxonomy of Rhizobiaceae; curator USDA National Rhizobium Culture Collection.

L.R. Vough, Associate Professor; Ph.D., Purdue, 1972. Integrated alfalfa management systems; pasture and grazing management; forage quality and utilization; biosolids utilization with forage crops; forage crops for bioremediation of contaminated soils.

C.S. Walsh, Professor; Ph.D., Cornell, 1980. Laboratory studies on the physiology of horticulturally significant plants. Field studies on the effects of rootstock and orchard management factors on fruit tree performance.

R.R. Weil, Professor; Ph.D., VPI & SU, 1977. Soil quality and organic matter management; soil fertility and sustainable farming systems; nutrient cycling processes and impacts on water quality; tropical soils and sustainable development.

R.A. Weismiller, Professor; Ph.D., Michigan State, 1969. Non-point pollution from agricultural lands; remote sensing as applied to soil and land inventories; land degradation.

Appendix 4. NRSC Graduate Studies Program Dual Level and Graduate Level Courses

Dual Level Courses

LARC 450	Environmental Resources
LARC 451	Sustainable Community Development
NRSC 402	Landscape Ecology
NRSC 410	Principles of Plant Pathology
NRSC 411	Principles of Soil Fertility
NRSC 413	Soil and Water Conservation and Management
NRSC 414	Soil Morphology, Genesis, and Classification
NRSC 415	Soil Survey and Land Use
NRSC 417	Soil Hydrology and Physics
NRSC 421	Soil Chemistry
NRSC 422	Soil Microbiology
NRSC 423	Soil-Water Pollution
NRSC 424	Field Studies in Soil Morphology
NRSC 425	Terrestrial Bioremediation
NRSC 440	Crops, Soils, and Civilization
NRSC 441	Sustainable Agriculture
NRSC 444	Remote Sensing of Agriculture and Natural Resources
NRSC 454	Environmental Issues in Plant and Soil Sciences
NRSC 461	Hydric and Hydromorphic Soils
NRSC 471	Forest Ecology
NRSC 472	Capstone - Urban Forest Project Management
NRSC 484	Environmental Plant Physiology
NRSC 499	Special Topics in Natural Resource Sciences
NRSC 499A	Agroecology
PLSC 400	Nursery and Greenhouse Nutrient Management Planning
PLSC 401	Pest Management Strategies for Turfgrass
PLSC 402	Sports Turf Management
PLSC 403	Crop Breeding
PLSC 406	Forage Crops
PLSC 407	Cereal and Oil Crops
PLSC 410	Commercial Turf Maintenance and Production
PLSC 432	Greenhouse Crop Production
PLSC 433	Technology of Fruit and Vegetable Production
PLSC 452	Principles of Landscape Establishment and Maintenance
PLSC 453	Weed Science
PLSC 456	Nursery Crop Production
PLSC 472	Advanced Plant Propagation
PLSC 474	Physiology of Maturation and Storage of Horticultural Crops

Graduate Level Courses

NRSC 601	Advanced Plant Genetics & Breeding I
NRSC 602	Advanced Plant Genetics & Breeding II
NRSC 608	Research Methods
NRSC 608T	Teaching Methods
NRSC 672	Advanced Plant Propagation
NRSC 682	Methods of Plant Science Research
NRSC 683	Light and Plant Development
NRSC 684	Woody Plant Physiology
NRSC 685	Advanced Plant Ecophysiology
NRSC 689	Special Topics
NRSC 711	Advanced Plant-Soil Chemistry
NRSC 722	Advanced Soil Chemistry
NRSC 761	Methods in Pedological Investigation
NRSC 782	Physiology, Biochemical, and Molecular Biology of Herbicides and Plant Growth Regulators
NRSC 783	Molecular Aspects of Plant-Environment Interactions
NRSC 785	Advanced Post-Harvest Physiology
NRSC 789	Advances in Research
NRSC 798	Graduate Seminar
NRSC 799	Master's Thesis Research
NRSC 802	Epidemiology and Plant Disease Management
NRSC 805	Advanced Crop Physiology
NRSC 821	Advanced Methods of Soil Investigation
NRSC 831	Soil Mineralogy
NRSC 832	Advanced Soil Physics
NRSC 899	Doctoral Dissertation Research

Graduate Student and Advisor Checklist
MASTER OF SCIENCE PROGRAM

___ 1. Advisory Committee formed (by end of 2nd semester)
___ 2. Admission conditions (if any) satisfied
___ 3. Advisory Committee meetings held annually
___ 4. Proposed Plan of Study and Research Proposal filed with Department (by end of 2nd semester)
___ 5. Course requirements completed:
- ___ a. 24 graduate credits (30 credits non-thesis)
- ___ b. 6 credits of 799 (thesis option)
- ___ c. 12 credits 600+ level (18 credits non-thesis)
- ___ d. Entrance Seminar (798)
- ___ e. Exit Seminar (798)
- ___ f. Plant Science **OR** Soil Science

Plant Science	**OR**	Soil Science
400-level course in		___ 12 credits
___ Biochemistry		(400-level)
___ Plant physiology		soil science
___ Statistics		

___ 6. "Application for Diploma" form submitted to Graduate School (last semester by deadline)

Thesis Option
___ 7. Thesis completed
___ 8. "Request for Appointment of Master's Thesis Examining Committee" form submitted to Graduate School
___ 9. "Approved Program for the Degree of Master of Science" form submitted to Graduate School
___ 10. Final examination held
___ 11. "Report of Examining Committee" form submitted to Graduate School; Form A returned to Department
___ 12. Signed thesis submitted to Graduate School
___ 13. Copy of thesis deposited with Department Graduate Coordinator

Non-Thesis Option
___ 7. Scholarly papers (2) completed
___ 8. Written examination held
___ 9. Oral examination held; Form A returned to Department
___ 10. "Approved Program for the Degree of Master of Science" form submitted to Graduate School
___ 11. "Certification of Completion of Master's Degree Without Thesis" form submitted to Graduate School
___ 12. Scholarly papers deposited with Department Graduate Coordinator

Graduate Student and Advisor Checklist
DOCTOR OF PHILOSOPHY PROGRAM

___ 1. Advisory Committee formed (by end of 2nd semester)
___ 2. Admission conditions (if any) satisfied
___ 3. Advisory Committee meetings held annually
___ 4. Proposed Plan of Study and Research Proposal filed with Graduate Coordinator (by end of 2nd semester)
___ 5. Preliminary examination held (within 5 years of admission to doctorate program)
___ 6. "Application for Admission to Candidacy for the Degree of Doctor of Philosophy" form submitted to Graduate School
___ 7. Admission to candidacy approved by the Graduate School. Must register each semester after candidacy approved.
___ 8. Course requirements completed:
- ___ a. 12 credits 899
- ___ b. Entrance Seminar (798)
- ___ c. Exit Seminar (798)
- ___ d. Plant Science **OR** Soil Science

Plant Science	**OR**	Soil Science
___ M.S. courses		___ M.S. courses
second course in:		___ Phys. Chem.
___ Biochemistry		**or**
or		___ Biochemistry
___ Statistics		___ other science

___ 9. "Application for Diploma" form submitted to Graduate School (early in the semester in which the student expects to complete degree requirements by published deadline)
___ 10. "Request for Appointment of Doctoral Examining Committee" form submitted to Graduate School (at least 3 months prior to final examination and before deadline). Attach curriculum vitae for all members who do not have graduate faculty status.
___ 11. Dissertation completed
___ 12. Final examination held
___ 13. "Report of Examining Committee" form submitted to Graduate School; Form B returned to Department
___ 14. Signed dissertation submitted to Graduate School
___ 15. Copy of dissertation deposited with Department Graduate Coordinator

NOTE: Carefully check current deadline dates as published by the Graduate School in "Deadlines for Graduate Students" or in the current Schedule of Classes.