PhD in Natural Resources with Emphasis in Water Resources

The Water Resources emphasis area is an interdisciplinary graduate degree program within the School of Natural Resources. It encompasses all fields of natural sciences represented in the School and, through collaboration, involves related expertise from throughout the University of Missouri and beyond. Participating faculty in the Water Resources emphasis area are engaged in both the scientific understanding of water resources (biological, chemical and physical) and its management, and the decision-making processes used to address competing societal values (social, economic and legal). The program has no geographic boundaries but the location of MU suggests most research will be directed to better understanding of water movement, biogeochemical cycling and biological processes of forested-agricultural and urban landscapes of the midcontinent. The lakes, rivers, streams, wetlands and subsurface waters of the region are prime areas for basic and applied research. One of the program's major global impacts is the training of highly qualified graduate professionals that are equipped to address many of the complex contemporary water resource problems around the world.

The Water Resources graduate emphasis area offers Ph.D. degree programs specializing in (but not limited to) the occurrence, circulation, distribution, chemical and physical properties, and environmental interaction of surface and subsurface waters, including groundwater. Specific areas of investigation could include lakes and reservoirs, floods and droughts, groundwater aquifers, water use, water quality, water contamination, plant water use, measurement methods, hydrologic modeling and international water resources.

Participating faculty in the Water Resources emphasis area are engaged in both scientific understanding of water resources (biological, chemical and physical) and its management, and the decision-making processes used to address competing societal values (social, economic and legal). The program has no geographic boundaries but benefits from a distinct midcontinent climate, and physiography. Multi-use watersheds (e.g., forest, agriculture, urban), streams, lakes, rivers, wetlands and subsurface waters are ideal areas for basic and applied research that is easily transferrable to other regions. One of the program's major global impacts is the training of highly qualified graduate professionals that are equipped to address many of the complex contemporary water resource problems around the world.

Water Resources program applicants must meet the general requirements set forth by the University of Missouri Office of Graduate Studies for the Ph.D. degree, and meet any additional application criteria of the Water Resources graduate emphasis area. Students often self-fund, apply for teaching assistantships, or are supported by grant-funded research assistantships. Other opportunities may be available to eligible students. Applicants should contact specific faculty to determine the availability of position(s) in the potential advisor's research program and assistantships or scholarships prior to applying. If encouraged to apply by Water Resources faculty, please apply through the University of Missouri's online application program.

Upon successful completion of the School of Natural Resources Water Resources graduate program, students will possess strong technical skills in water resources and related sub-disciplines. Graduates will have developed a holistic understanding of the hydrologic cycle related to ecosystem processes as and the interdisciplinary background necessary to understand and address contemporary water resources problems. Graduates will have an appreciation of the complex interactions of biophysical processes and tightly coupled socioeconomic interactions necessary to implement water resource policy.

Degree Requirements

- MU requires a minimum of 72 hrs beyond the Baccalaureate degree for the Ph.D.
- The committee may recommend that a certain number of credits be transferred from the Master’s degree toward the Ph.D.
- A maximum of 30 hours of post baccalaureate graduate credit from an accredited university can be transferred toward the Ph.D. degree program.
- The program must include a minimum of 15 hours of 8000 level course work, exclusive of problems, readings and research.

Must take at least 9 credit hours from the following:

### Aquatic Ecosystem Science
- F_W 8460 Wetland Ecology 3
- F_W 8520 Stream Ecology 3
- NAT_R 7001 Topics in Natural Resources 1-99
- NAT_R 7100 Lake Ecology 3
- FOREST 7390 Watershed Management and Water Quality 3
- F_W 8450 Advanced Limnology 3

### Climate and Climatology
- ATM_SC 7400 Micrometeorology 3
- ATM_SC 7590 Radar Meteorology 3
- ATM_SC 9300 Introduction to Chaos Theory 3
- ATM_SC 8400 Atmospheric General Circulation 3
- ATM_SC 8600 Advanced Climate Dynamics 3

### Environmental Chemistry
- ENV_SC 7318 Environmental Soil Chemistry 3
- F_W 7800 Environmental Toxicology 3

### Hydrologic Science and Water Quality
- ATM_SC 7550 Physical Meteorology 3
- ENV_SC 7320 Hydrologic and Water Quality Modeling 3
- ENV_SC 7305 Environmental Soil Physics 3
- ENV_SC 7306 Environmental Soil Physics Laboratory 2
- CV_ENG 7710 Soil and Water Conservation Engineering 3
- ENV_SC 8400 Solute Transport in the Vadose Zone 3
- GEOL 7130 Groundwater Modeling 3
- GEOL 8240 Hydrogeologic Processes 3
- GEOL 7100 Groundwater Hydrology 3

### Water Management Technology
- NAT_R 8290 Hydrologic Measurement and Synthesis 2
- ATM_SC 7510 Remote Sensing for Meteorology and Natural Resources 3
- ATM_SC 7590 Radar Meteorology 3
- ATM_SC 9590 Advanced Applications of Weather Radar 3

### Elective Courses
- AG_S_M 7420 Surface Water Management 3
- AG_S_M 7440 Water Quality and Pollution Control 3
- AG_S_M 7460 Irrigation and Drainage 3

**Must take at least 9 credit hours from the following:**

**Aquatic Ecosystem Science**
- F_W 8460 Wetland Ecology 3
- F_W 8520 Stream Ecology 3
- NAT_R 7001 Topics in Natural Resources 1-99
- NAT_R 7100 Lake Ecology 3
- FOREST 7390 Watershed Management and Water Quality 3
- F_W 8450 Advanced Limnology 3

**Climate and Climatology**
- ATM_SC 7400 Micrometeorology 3
- ATM_SC 7590 Radar Meteorology 3
- ATM_SC 9300 Introduction to Chaos Theory 3
- ATM_SC 8400 Atmospheric General Circulation 3
- ATM_SC 8600 Advanced Climate Dynamics 3

**Environmental Chemistry**
- ENV_SC 7318 Environmental Soil Chemistry 3
- F_W 7800 Environmental Toxicology 3

**Hydrologic Science and Water Quality**
- ATM_SC 7550 Physical Meteorology 3
- ENV_SC 7320 Hydrologic and Water Quality Modeling 3
- ENV_SC 7305 Environmental Soil Physics 3
- ENV_SC 7306 Environmental Soil Physics Laboratory 2
- CV_ENG 7710 Soil and Water Conservation Engineering 3
- ENV_SC 8400 Solute Transport in the Vadose Zone 3
- GEOL 7130 Groundwater Modeling 3
- GEOL 8240 Hydrogeologic Processes 3
- GEOL 7100 Groundwater Hydrology 3

**Water Management Technology**
- NAT_R 8290 Hydrologic Measurement and Synthesis 2
- ATM_SC 7510 Remote Sensing for Meteorology and Natural Resources 3
- ATM_SC 7590 Radar Meteorology 3
- ATM_SC 9590 Advanced Applications of Weather Radar 3

**Elective Courses**
- AG_S_M 7420 Surface Water Management 3
- AG_S_M 7440 Water Quality and Pollution Control 3
- AG_S_M 7460 Irrigation and Drainage 3
Qualifying Process

The qualifying examination determines whether the student's background is adequate to enter the Ph.D. program, as a candidate. It also is intended to ascertain if there are areas of weakness in which a candidate will be required to gain background through appropriate course work. Therefore, it is advisable that the student, in conjunction with advisor, selects a committee and completes the qualifying exam within the first 3 semesters.

D-1 Qualifying Examination Results and Doctoral Committee Approval Form

Submission of the D-1 form follows a meeting of the student’s graduate committee and approval by the committee of the student’s proposal and plan of research and coursework. This form is to be submitted to the Office of Graduate Studies no later than the end of the student's second semester of enrollment.

D-2 Plan of Study

The D-2 form accompanies the D-1, and is also to be submitted to the MU Office of Graduate Studies no later than the end of the student’s second semester of study.

Comprehensive Examination Process

Comprehensive exam must be take a minimum 6 months before dissertation defense. The comprehensive examination is taken following the completion of most if not all, the course work requirements established by the graduate committee.

The objectives of the comprehensive examination are twofold:
1. to determine if a student has acquired sufficient depth and breadth of knowledge in selected areas of concentration; and
2. to evaluate the candidate’s capacity to apply that knowledge in solving applied or theoretical problems.

D-3 Doctoral Comprehensive Exam Result Form

The D-3 forms should be completed and filed with the Office of Graduate Studies within one month of exam completion.

Dissertation Requirements

Every candidate should review the Dissertation & Thesis Guidelines (http://gradschool.missouri.edu/academics/thesis-dissertation/diss-thesis-guideline) from the Graduate School and should consult the Director of Graduate Studies for academic program style requirements.

Dissertation Defense Seminar

The final examination is directed toward, but not limited to, exploration of the dissertation research project.

The DGS must be informed of the dissertation defense seminar at least two weeks in advance of the seminar. It must be well advertised and open to the public.

D-4 Report of the Dissertation Defense Form

The D-4 form should be completed and filed with the Office of Graduate Studies as soon as possible after the defense.

Ph.D. Committee Meeting Minimum Requirements

The Ph.D. degree in the emphasis area is designed to prepare students for academic careers in research and teaching or other advanced scientific or professional careers. The student pursuing the doctoral degree is expected to pass a qualifying, comprehensive and final examination administered by the student's doctoral committee. This committee is structured at a minimum as defined by the MU Office of Graduate Studies and must consist of at least 4 members. An independent scholarly dissertation approved by the student's adviser and program committee must be completed in a form acceptable to the doctoral committee, and MU Office of Graduate Studies.

Admissions

Admission Contact Information

School of Natural Resources
Water Resources Emphasis Area
303L Anheuser-Busch Natural Resources Building
(573)-882-2832

Director of Graduate Studies:
Rebecca North, Ph.D.
Assistant Professor of Water Quality
School of Natural Resources
University of Missouri
303L Anheuser-Busch Natural Resources Building
Columbia, MO, 65211-7220
(573)-882-2832

Admission Requirements

• Bachelor's degree in a relevant discipline from an accredited institution
• Undergraduate GPA: 3.0 on a scale of 4.0 in last 60 hours
• Graduate Record Exam score (GRE)*
• Minimum TOEFL scores: 550 (paper-based test), 80 (Internet-based test), 6.5 (IELTS Academic)
• Experience in research or management of water resources. Practical skills are strongly considered.

* Students whose GPAs do not meet the requirements will be evaluated individually. Applicants will be reviewed on a case-by-case basis.

How to Apply
All application materials must be submitted through the university online application system (https://applygrad.missouri.edu/apply/), including:

- All application materials must be submitted to the online application system
- Statement of interest
- Résumé or CV
- GRE scores
- TOEFL scores (if applicable)
- A minimum of three letters of recommendation and the accompanying evaluation sheets from people who can attest to the candidate's scholastic and conservation fieldwork abilities
- Unofficial Transcripts—As part of the application submission process, all applicants are required to upload unofficial copies of all post-secondary transcripts to the online application. Official transcripts are only required if accepted by the academic program.
- Publications (optional)

Applicants are required to meet two sets of minimum qualifications for admission: the requirements of the PhD in Natural Resources with emphasis in Water Resources (https://gradstudies.missouri.edu/degreecategory/natural-resources) and the minimum requirements of the Office of Graduate Studies (http://gradstudies.missouri.edu/admissions/eligibility-process/minimum-requirements). Because requirements vary, you must refer to a degree program's graduate admission page to learn about specific admission criteria, application deadlines, eligibility and application process. Your application materials will be reviewed by both the Office of Graduate Studies and the degree program to which you've applied before official admission to the University of Missouri.

Applicants should contact specific faculty to determine the availability of potential advisors, available position(s) in the potential advisor's lab and of available research assistantships prior to applying.

**Application Deadlines**

We have a rolling application window.

**Financial Aid from the Program**

Funding is available, but assistantships are highly competitive. Prospective students must complete all the necessary application requirements to be considered for funding. Contact the graduate program emphasis coordinator for more details. Applicants should also contact the faculty they want to work with to determine the availability of possible graduate assistantship positions.

An applicant contemplating graduate work in water resources should have a strong background in physical sciences, including calculus, chemistry, and physics. Those considering interdisciplinary degrees should also have a background in biology, botany, zoology, ecology and other natural sciences. A background of 25 to 30 hours in physical sciences courses is desirable. Minor deficiencies may be remedied during the graduate program; major deficiencies may require preparatory coursework prior to consideration for admission. Applicants are required to meet two sets of minimum qualifications for admission: the requirements of the MS in Natural Resources with emphasis in Water Resources (https://gradstudies.missouri.edu/degreecategory/natural-resources) and the minimum requirements of the Office of Graduate Studies (http://gradstudies.missouri.edu/admissions/eligibility-process/minimum-requirements). Because requirements vary, you must refer to a degree program's graduate admission page to learn about specific admission criteria, application deadlines, eligibility and application process. Your application materials will be reviewed by both the Office of Graduate Studies and the degree program to which you've applied before official admission to the University of Missouri.