GIS and Spatial Analysis, M.S.

Degree Offered
• Master of Science

Nature of the Program
The Master’s in Geographic Information Science and Spatial Analysis is a fully online program that offers training in a variety of spatial analysis, quantitative analysis, remote sensing, computational, and spatial programming techniques to investigate problems with a spatial component. Ideal for new students seeking a master’s level degree or working professionals hoping to expand their credentials, the major offers a strong focus on the applications of geospatial science in the environmental sciences and resource management as well as applications for spatial analytics, geocomputation and coding, and digital cartography. The program is completed with a combination of required coursework electives, and a professional level project. Students who remain in good standing and continue to make degree progress may be able to complete the degree in four semesters.

Admissions

MS IN GEOGRAPHIC INFORMATION SCIENCE (GIS) AND SPATIAL ANALYSIS
All applicants must meet West Virginia University’s general admission requirements (http://catalog.wvu.edu/graduate/graduateeducationatwestvirginiauniversity/#classificationtext). In addition, the graduate application will ask students to supply a personal statement. The personal statement should consist of at least 500 words, and should describe the applicant’s reasons for pursuing an MS in GIS and Spatial Analysis at WVU, reasons for pursuing graduate study, and career goals. Applicants will supply three letters of recommendation that should be written by persons acquainted with the applicant’s professional work, experience, or academic background and should provide a resume or curriculum vitae. The GRE is not required for admission.

LIST OF ADMISSION REQUIREMENTS:
• See the steps to apply for admission and access the application here (https://graduateadmissions.wvu.edu/how-to-apply/)
• Transcripts from all institutions attended (note: official transcripts are required to receive an offer of admission to the graduate program)
• Three letters of recommendation
• Resume or curriculum vitae
• Statement of Purpose

APPLICATION DEADLINES:
• The MS admits students for all semesters
• The deadline for Fall semester admission is January 15th
• The deadline for the Summer term is March 15th
• The deadline for Spring semester admissions is October 1st
• All application materials, including completed recommendation letters, must be submitted by the deadline in order to ensure full consideration
• In exceptional circumstances, we will review applicants received after the January 15th and October 1st deadlines on space-available basis.

Admission Requirements 2023-2024
The Admission Requirements above will be the same for the 2023-2024 Academic Year.

Major Code: 14E9

Degree Requirements
• Credit Hours: Students must complete 31 hours of coursework, including a minimum of 3 credits in Resource Management.
• Grade Point Average: Students must earn a minimum cumulative GPA of 2.75, and a GPA of 3.00 in all courses applied to the graduate program.
• Graduation Requirement: In addition to completing the required coursework, students must complete a graduation project. This may include a written report or deliverables/products, such as data, software, maps, web maps, code, and/or web apps. An oral defense of the work is not required.
  
  Note: Certificate students who have completed RESM 585: GIS and Spatial Analysis Project, must complete a new project and register for Geography 797: Research.

CORE COURSES:
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>GEOG 550</td>
<td>Geographic Information Science</td>
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Select two of the following:

- GEOG 651 Geographic Information Science: Technical Issues
- GEOG 655 Remote Sensing Principles
- RESM 540 Geospatial Modeling

**ELECTIVES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>GEOG 462</td>
<td>Digital Cartography</td>
</tr>
<tr>
<td>GEOG 651</td>
<td>Geographic Information Science: Technical Issues</td>
</tr>
<tr>
<td>GEOG 654</td>
<td>Environmental Geographic Information Systems Modeling</td>
</tr>
<tr>
<td>GEOG 655</td>
<td>Remote Sensing Principles</td>
</tr>
<tr>
<td>GEOG 657</td>
<td>Open-Source Spatial Analytics</td>
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<tr>
<td>RESM 540</td>
<td>Geospatial Modeling</td>
</tr>
<tr>
<td>RESM 545</td>
<td>Spatial Hydrology and Watershed Analysis</td>
</tr>
<tr>
<td>RESM 575</td>
<td>Spatial Analysis for Resource Management</td>
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**Total Hours:** 31

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**Degree Progress**

All students will receive at least one annual evaluation. Students experiencing difficulty meeting benchmarks or facing academic consequences may receive more frequent communication.

In order to stay in good academic standing, students should maintain cumulative GPA of 2.75, and a GPA of 3.00 in all courses applied to the graduate programs.

By the end of the first semester, students should have completed at least 9 hours of coursework towards degree completion.

By the end of the second semester, students should have completed at least 18 hours of coursework towards degree completion.

By the end of the third semester students should have completed at least 24 hours of coursework towards degree completion, formed a project advisory committee, and have submitted a project proposal and gained approval from his or her committee to undertake the project in the last term of attendance.

In addition to coursework, students must complete a graduate project. The graduation project must be completed before the end of the last semester of attendance.

**Major Learning Goals**

**GIS AND SPATIAL ANALYSIS**

The educational goals and objectives:

1. Design, execute, and defend a professional project that effectively addresses a need, problem, or research question with a spatial component.
2. Collect, create, use, and manage data to address a spatial problem.
3. Apply a variety of spatial analysis, quantitative analysis, remote sensing, computational, and spatial programming techniques to investigate a problem that has a spatial component.
4. Critique and compare a variety of spatial analysis and quantitative analysis techniques to solve a problem.
5. Make recommendations as to the best data and methods for investigating a question with a spatial component.
6. Construct multi-part and complex analyses to address a question or problem.
7. Produce written reports that effectively communicate the methods and results of an analysis.
8. Design and create maps and graphics that effectively communicate findings and data.

**GEOG 520. Methods for Open Science. 3 Hours.**

New approaches in data science are enabling collaboration and discovery at unprecedented rates and scales. Students will learn how to rapidly download data; use the terminal to search, organize, and edit large numbers of files; develop a workflow, functions, and loops in open programming language (Unix-like and R); and use version control software (GitHub) to enable collaboration and reproducibility.

**GEOG 550. Geographic Information Science. 4 Hours.**

PR: Corequisite of GEOG 550L. Principles and practice of geographical information science. Geospatial data handling for research, planning and decision-making. Spatial analysis, information production, and display.

**GEOG 550L. Geographic Information Science Laboratory. 0 Hours.**

PR: Corequisite of GEOG 550. Geographic Information Science - GEOG 550 Laboratory.
GEOG 551. Open-Source GIScience. 3 Hours.
PR: GEOG 550 or students must complete an equivalent course or undergraduate GIS coursework and obtained instructor permission. The goal of this course is to introduce students to open-source software tools and standards for working with spatial data and undertaking spatial analysis. Topics explored include open data standards, open metadata standards, open licensing options, and undertaking geospatial data science in currently available open source environments including QGIS, GRASS, SAGA, Orfeo Toolbox, and WhiteboxTools.

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

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

GEOG 594. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.

GEOG 600. Geography Research Colloquium. 1 Hour.
PR: Consent. Lectures and presentation on recent and current research by resident and visiting scholars.

GEOG 601. Geographic Thought. 3 Hours.
This seminar explores formative theories and ideas in contemporary geographic thought. It covers some of the essential history of geographic thought, but the course is not a comprehensive survey of the “traditions” of the Geographic discipline. Rather, we examine the key epistemologies that have animated our discipline since mid 20th century.

GEOG 602. Geographic Research-Design. 3 Hours.
PR: GEOG 300 and GEOG 601. Choosing, preparing, and developing research problems of geographic interest. Emphasizes proposal writing and research design alternatives.

GEOG 603. Qualitative Research in Geography. 3 Hours.
PR: GEOG 601. Analysis of qualitative research in geography and related fields. Examine methodological approaches and techniques that explore and interpret issues in the development of geographical research projects.

GEOG 612. Gender, Society and Space. 3 Hours.
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 640. Geopolitical Perspectives. 3 Hours.
This course uses geopolitical perspectives to critically examine the linkages between power and places. Seminal literatures in the sub-field of geopolitics are read and critiqued, including critical geopolitics, feminist geopolitics and post-colonial theory.

GEOG 650. Political Ecology Seminar. 3 Hours.
Critical examination of some of the world’s most pressing social-ecological challenges, including the impacts of and responses to climate change and issues of environmental justice, based on scholarship from the social and biophysical sciences. Students will explore foundational texts, core themes and debates, and future trajectories in political ecology.

GEOG 651. Geographic Information Science: Technical Issues. 3 Hours.
PR: GEOG 350. Current issues in GIS research. Technical aspects of GIS operations, algorithms, theory of geographical data structures, and error handlings. Labs focus on tools, data structures, database languages and macros. (2 hr. lec., 1 hr. lab.).

GEOG 654. Environmental Geographic Information Systems Modeling. 3 Hours.
Provides background and hands-on experience needed to answer scientific questions about the environment within a raster-based GIS Framework. Students should have introductory level GIS background.

GEOG 655. Remote Sensing Principles. 3 Hours.
PR: Corequisite of GEOG 655L. Mapping of earth features using aerial and satellite-borne sensors, image enhancement, geo-referencing, and classification. (Also listed as GEOL 655).

GEOG 655L. Remote Sensing Principles Laboratory. 0 Hours.

GEOG 657. Open-Source Spatial Analytics. 3 Hours.
PR: GEOG 550. Prepare, analyze, and model geospatial data using the R language and computational environment. Topics covered include coding in R, data wrangling, data visualization and mapping, vector- and raster-based spatial analysis, spatial predictive modeling using machine learning, and presenting results.

GEOG 662. Digital Cartography. 3 Hours.
PR: GEOG 550. Use cartographic principles, geographic information systems (GIS), graphic design software, and digital data to generate reference and thematic maps appropriate for an intended audience. Learn to generate effective maps and visualizations by exploring cartographic standards, geospatial datums and projections, data visualization techniques, scale and generalization, typology and labeling, use of color, and parameterization of symbols.
GEOG 663. Client-Side Web GIS. 3 Hours.
PR: GEOG 550. Explore client-side web technologies and tools for serving data and developing web maps and applications. Define web content using hypertext markup language (HTML), style web content using cascading style sheets (CSS) and Bootstrap, and add functionality to a website using JavaScript, jQuery, and web mapping APIs.

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

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

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

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

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

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

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

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

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

GEOG 701. Quantitative Spatial Analysis. 3 Hours.
This course covers methodological issues in the use of statistics for analysis of geographical data, such as sampling, inference, and the modifiable areal unit problem. It also covers a series of specific quantitative techniques tailored to student needs, such as spatial regression, measures of spatial autocorrelation, and geostatistical interpolation.

GEOG 753. Exploratory Spatial Data Analysis. 3 Hours.
Develop expertise in spatial analytical techniques for use in geographical data analysis and GIS.

GEOG 755. Advanced Remote Sensing. 3 Hours.
PR: (GEOG 655 or GEOL 655) and Coreq: GEOG 755L or consent. Collection, processing, and classification of remotely sensed data, including optical, thermal, radar, and topographic information. (Also listed as GEOL 755.).

GEOG 780. Non-Thesis Project. 3 Hours.
Research activities leading to a non-thesis project report.

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

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

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

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