RESOLUTION TO APPROVE BACHELOR OF SCIENCE (B.S.) IN GEOGRAPHY DEGREE DESIGNATION

MATERIALS INCLUDED

- Resolution
- Overview of Proposal
- Degree Designation Proposal

RESOLUTION TO APPROVE BACHELOR OF SCIENCE (B.S.) IN GEOGRAPHY DEGREE DESIGNATION

Academic Area: College of Natural Resources and Environment

Requested initiation: Fall 2025

Virginia Tech currently offers the Bachelor of Arts (B.A.) in Geography degree program. As the field of geography has evolved, advancements in technologies including digital mapping and visualization, spatial analysis, and big data, and the integration of other disciplines (e.g., computer science), more technical focus areas have emerged (e.g., geographic information systems (GIS) and remote sensing). These areas align more closely with a B.S. degree designation than the B.A. degree designation.

The B.S. degree designation is needed to address the technical skills aligned with positions such as geographic information systems specialists, geospatial analysts, and remote sensing specialists.

Six SCHEV peer institutions offer both the B.A. and the B.S. in Geography. The addition of the B.S. degree designation would allow Virginia Tech to align with the six (6) institutions that offer both degree designations in the field of geography.

RECOMMENDATION:

That the resolution to approve a Bachelor of Science in Geography degree designation be approved and the proposal forwarded to the State Council of Higher Education for Virginia (SCHEV) for approval.

March 25, 2025

B.S. Degree Designation in Geography

Purpose: To prepare students with the knowledge and skills needed for entry-level positions in geography, cartography, geography information science, remote sensing, or graduate programs in physical or social sciences. The B.S. degree designation program has been developed to provide students with a focus and more rigorous courses in mathematics, geographic information systems, programming, and remote sensing.

Credits: 120 credits, 21 core curriculum, 4 Major Coursework, 16 GIST Option,18 Restricted Electives (9-12 Geospatial & 6-9 Geography), **59 credits in the B.S. Geography degree/major.**

Selected Courses (* required courses)

GEOG 2084*	Principles of Geographic Information Systems *(3 Lec, 3 Crd)*
GEOG 3314*	Cartography *(2 Lec, 3 Lab, 3 Crd)*
CS 1064*	Introduction to Programming in Python (*3 Lec, 3 Crd)*
GEOG 4084*	Modeling with GIS *(1 Lec, 6 Lab, 3 Crd)*
GEOG 4314*	Spatial Analysis in Geographic Information Systems *(2 Lec, 3 Lab, 3 Crd)*
GEOG 4324*	Algorithms in GIS *(3 Lec, 3 Lab, 4 Crd)*
GEOG 4354*	Introduction to Remote Sensing *(2 Lec, 3 Lab, 3 Crd)*
GEOG 4254	R Programming for Geospatial Applications *(3 Lec, 3 Crd)*
GEOG 4394	Introduction to Web Mapping *(3 Lec, 3 Crd)*
GEOG 4404	Geovisualization *(3 Lec, 3 Crd)*

COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
GEOGRAPHY
VIRGINIA TECH

Peer Institutions with BA/BS Geography

- Virginia: GMU, JMU, ODU, Radford
- SCHEV: Michigan State, Ohio State, Penn State, Florida, Minnesota, Wisconsin

Need and Demand

- More competitive for job placement via scientific specialization that is absent from the current B.A.
- Alumni have reported a strong need for the B.S. designation to produce students that are more competitive.
- GIS minors growth from 2 to 153 from 2016 to 2025 and 78 to 153 from 2020 to 2025.

Employment Skills

- Analyze the distribution of physical geographic features, natural resources, and ecosystems across different regions.
- Assess the impact of human population patterns, cultural practices, and economic activities on natural environments.
- Compile and integrate geographic data from various sources, including field observations, satellite imagery, and existing databases.
- Create and modify maps using GIS software and cartographic principles.
- Evaluate data using geospatial technologies (e.g., remote sensing).
- Develop reports and presentations to communicate complex geographical information to diverse audiences.
- Create ethical guidelines for the use of geospatial technologies and data.

No new resources; Projected enrollment of 100 in the combined BA/BS Geography degree

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Description of the Proposed Program

Program Background

Virginia Polytechnic Institute and State University (Virginia Tech) is requesting approval to add a Bachelor of Science (B.S.) in Geography degree designation to the existing Bachelor of Arts (B.A.) in Geography. The proposed B.A./B.S. degree program in Geography will be located in the College of Natural Resources and Environment, Department of Geography. The new degree designation would be initiated in Fall 2025.

The purpose of the proposed B.S. in Geography degree designation is to prepare students with the knowledge and skills needed for entry-level positions in geography, cartography, geography information science, remote sensing, or graduate programs in physical or social sciences. The B.S. degree designation program has been developed to provide students with a focus and more rigorous courses in mathematics, geographic information systems, programming, and remote sensing. Students will learn about the fundamentals of geographic theory, human impacts on the environment, and the analysis of geographic data. The curriculum will provide students with knowledge of the physical and human patterns and processes that shape the earth's surfaces, the living organisms (e.g., plants, animals, people) that inhabit a location, and the natural and built environments. Students will learn about how natural and human-made phenomena impact the environment in different types of landscapes across the planet. Coursework will also provide knowledge and skills related to the technical aspects of collecting geographic data (e.g., fieldwork, mapping) and the geospatial science theory and skills needed to organize, analyze, and identify trends, patterns, and relationships in the data. Students will learn how to use technologies such as global positioning systems (GPS), geographic information systems (GIS), satellite imagery, and remote sensing. Graduates of the program will be prepared to undertake projects that involve hypothesis testing and complex data analysis using spatial and geographic data. These projects support governments, businesses, academic research, or industry on topics like environmental sustainability, urban planning, geospatial data management and analysis, and public policy. Graduates with the proposed B.S. degree designation in Geography will be prepared to serve in roles such as geographers, cartographers, and GIS analysts in a wide variety of career paths such as academia, private firms, non-profit and non-governmental organizations, and state, local, and federal government agencies.

During the October 2, 2019 faculty meeting, the Department Chairperson initiated a discussion with the program faculty regarding adding a B.S. degree designation to the B.A. in Geography degree program. As part of this discussion, faculty reviewed the state of the geography field and other similar academic programs.

On January 18, 2020, the Department Chairperson directed the Geography Curriculum Committee to evaluate the need for the B.S. designation. The curriculum committee reviewed the current geography curriculum, SCHEV peer institution geography degree programs, and employment demand for a B.S. designation in Geography. On April 1, 2020, the Geography Curriculum Committee presented their research, including a recommendation to add the B.S. designation to the B.A. in Geography, to the program faculty and the department chairperson.

During this same time, the department conducted a systematic review of the degree program as part of the ongoing comprehensive review required by the institution every 5-6 years. As part of this review process, the program faculty produced a self-study report, the Academic Program Review Report Self-Study, that included an evaluation of the degree program's focus and purpose, curriculum, student learning outcomes, and program outcomes. On October 1, 2020, the Department submitted the Academic Program Review Report Self-Study to the college, the Institution's Academic Program Assessment office, and the Academic Program Review Committee. The Academic Program Review Committee consists of four external reviewers and the Associate Director of Institutional Effectiveness at Virginia Tech. The recommendation to add the B.S. designation to the degree program was included in the report.

Also during the fall 2020 semester, the Dean of the College of Natural Resources and Environment requested that departments create plans for the future of academic programming in their respective departments. On September 23, 2020, based on the results of the curriculum committee's review and the Academic Program Review Report Self-Study, the department chairperson submitted a comprehensive strategic plan to "enhance excellence of undergraduate programs" that included the addition of the B.S. Geography degree designation. The plan was approved by the Dean on September 21, 2020.

On January 14, 2021, the department chairperson held a meeting with the college dean, the academic associate dean, department heads, program faculty, and members of the dean's advisory council to discuss the plans to add the degree designation. During the meeting, participants asked questions and provided feedback on the designation addition. There was agreement amongst the participant that the B.S. designation was needed.

On March 26, 2021, the program faculty voted and unanimously approved the addition of the B.S. in Geography degree designation. No further action occurred until spring 2024 as the program faculty worked with the institution's Office of the University Registrar and Enrollment Management to discuss the internal requirements for a new degree designation, major, and option including internal steps and timeline as well as strategies for enrollment for the degree, designations, majors, and subareas. These discussions informed the program faculty to propose the new degree designation with the major and option as subareas.

On March 14, 2024, the department chairperson reinitiated the discussion to add the B.S. designation to the degree program. The faculty voted again to unanimously approve to the addition of the B.S. designation to the B.A. in Geography degree program.

On October 22, 2024, the College of Natural Science and Environment Curriculum Committee voted unanimously to propose the addition of the B.S. degree designation to the existing B.A. in Geography degree program.

Institutional Mission

The proposed B.S. degree program aligns well with the mission of Virginia Tech. The University's mission statement is:

> "Inspired by our land-grant identity and guided by our motto, *Ut Prosim* (That I May Serve), Virginia Tech is an inclusive community of knowledge, discovery, and creativity dedicated to improving the quality of life and the human condition within the Commonwealth of Virginia and throughout the world."

The proposed B.S. designation in Geography aligns with the institution's mission by creating an inclusive community to educate students in geographical concepts and technical skills to enhance human-environment systems and "improve that quality of life" in "Virginia and throughout the world." Students will be prepared to apply geographical techniques to collect, analyze, and interpret data to solve complex geographical challenges through "discovery and creativity."

Addition of Degree Designation

The table shows the curriculum requirements for the current B.A. degree designation and the proposed B.S. degree designation.

B.A. and B.S. in Geography Degree Designations

Current B.A. Curriculum	**Cr. Hrs**	**Proposed B.S. Curriculum**	**Cr. Hrs**
Pathways General Education – 42-45 credits		**Pathways General Education – 42-45 credits**	
Concept 1: Discourse – 9 credits		*Concept 1: Discourse – 9 credits*	
ENGL 1105: First-Year Writing Or COMM 1015: Communication Skills	3	ENGL 1105: First-Year Writing Or COMM 1015: Communication Skills	3
ENGL 1106: First-Year Writing Or COMM 1016: Communication Skills	3	ENGL 1106: First-Year Writing Or COMM 1016: Communication Skills	3
Additional Discourse Course	3	COMM 2004: Public Speaking Or ENGL 3764: Technical Writing Or ENGL 3844: Writing and Digital Media Or HIST 2624: Topics in the History of Data in Social Context	3
Concept 2: Critical Thinking in the Humanities – 6 credits	6	*Concept 2: Critical Thinking in the Humanities – 6 credits*	6
Concept 3: Reasoning in the Social Sciences – 6 credits	6	*Concept 3: Reasoning in the Social Sciences – 6 credits*	6
Concept 4: Reasoning in the Natural Sciences – 6 credits + 2 additional credits		*Concept 4: Reasoning in the Natural Sciences – 6 credits*	6
Reasoning in the Natural Sciences Lecture Courses	6		
Concept 5: Quantitative and Computational Thinking – 9 credits		*Concept 5: Quantitative and Computational Thinking – 9 credits*	
		MATH 1014: Precalculus with Transcendental Functions	3

		STAT 2004: Introductory Statistics Or STS 2604: Introduction to Data in Social Context	3
STAT 3604: Statistics for Social Science Or STAT 3615: Biological Statistics	3	STAT 3604: Statistics for Social Science Or STAT 3615: Biological Statistics	3
Additional Quantitative and Computational Thinking Courses	6		
Concept 6: Critique and Practice in Design and the Arts – 6 credits		*Concept 6: Critique and Practice in Design and the Arts – 6 credits*	
GEOG 3314: Cartography	3	GEOG 3314: Cartography	3
Additional Critique and Practice in Design and the Arts Course	3	Additional Critique and Practice in Design and the Arts Course	3
Concept 7: Critical Analysis of Identity and Equity in the United States – 0-3 credits	0-3	*Concept 7: Critical Analysis of Identity and Equity in the United States – 0-3 credits*	0-3
Additional Pathways General Education – 2 credits		**Additional Pathways General Education – 0 credits**	
Concept 4: Reasoning in the Natural Sciences			
Reasoning in the Natural Sciences Laboratory Courses (2 credits)	2		
Core Courses – 21 credits		**Core Courses – 21 credits**	
GEOG 1004: Introduction to Human Geography	3	GEOG 1004: Introduction to Human Geography	3
GEOG 1014: World Regions	3	GEOG 1014: World Regions	3
GEOG 1084/FREC 1004: Digital Planet	3	GEOG 1084/FREC 1004: Digital Planet	3
GEOG 1104: Introduction to Physical Geography	3	GEOG 1104: Introduction to Physical Geography	3
GEOG 2084: Principles of Geographic Information Systems	3	GEOG 2084: Principles of Geographic Information Systems	3
GEOG 2314: Maps and Mapping	3	GEOG 2314: Maps and Mapping	3
GEOG Field Experience *Select one of the following:* GEOG 3954: Study Abroad GEOG 4964: Field Study GEOG 4994: Undergraduate Research	3	GEOG Field Experience *Select one of the following:* GEOG 3954: Study Abroad GEOG 4964: Field Study GEOG 4994: Undergraduate Research	3
Major Required Courses – 3 credits		**Major Required Courses – 4 credits**	
		GEOG 1024: Survey of Geography	1
GEOG 3314: Cartography	3	GEOG 3314: Cartography*	0
		Option Required Courses – 16 credits	

		CS 1064: Introduction to Programming in Python	3
		GEOG/GEOS 4084: Modeling with Geographic Information Systems	3
		GEOG 4314: Spatial Analysis in Geographic Information Systems	3
		GEOG 4324: Algorithms in Geographic Information Systems	4
		GEOG/GEOS 4354: Introduction to Remote Sensing	3
Cognate Elective – 3 credits	3		
Restricted Electives – 18 credits	18	**Restricted Electives – 18 credits**	18
		Geospatial Electives	9-12
		Geography Electives	6-9
Free Electives – 28 credits	28	**Free Electives – 19-22 credits**	16
Total degree program: 120 credit hours		**Total degree program:** 120 credit hours	

*Double counted as part of the Pathways General Education requirements.

Curriculum

The B.A./B.S. in Geography degree program will require 120 credit hours. Experiential learning will be required.

The core coursework will provide students with a foundation in geography, including both human and physical aspects and technical skills of the field. Students will learn fundamental concepts such as space, place, regions, human communities, cultures, and economies and their interaction with the environment. Coursework will train students to use spatial perspective to understand and analyze global issues, environmental systems, and human activities across different regions. Students will learn how human societies are shaped by their geographic environments. Students will also be trained to develop proficiency in spatial analysis, geographic literacy, cartography, and use of geospatial technologies to interpret satellite imagery, and analyze, interpret and communicate complex geographic data effectively. Students will learn to apply geospatial methods to analyze and design solutions to contemporary problems facing Virginia and the world, such as mapping past climate variations for an area or analyzing the dispersion of air pollutants and identifying pollution sources.

All students enrolled in the B.S. degree designation will complete a semester of experiential learning through participation in a study abroad experience, field experience, or undergraduate research under the direct supervision of a faculty member. The experiential learning activity offers students practical experience to apply theoretical knowledge and gain a better understanding of geographic concepts and issues. This can be achieved through a research project or field study in a chosen topic area, selected with guidance from a faculty member, or through a practical project as part of a study abroad program. For example, students might use geographic information systems to analyze forest carbon storage, evaluate the impact of new developments on natural areas, or use remote sensing to assess natural disaster damage.

Program Requirements

New courses are denoted by an asterisk.

Pathways General Education Requirements: 42-45 credit hours
Concept 1: Discourse (9 credits)
ENGL 1105: First-Year Writing (3 credits)
Or COMM 1015: Communication Skills (3 credits)
ENGL 1106: First-Year Writing (3 credits)
Or COMM 1016: Communication Skills (3 credits)
COMM 2004: Public Speaking (3 credits)
Or ENGL 3764: Technical Writing (3 credits)
Or ENGL 3844: Writing and Digital Media (3 credits)
Or HIST 2624: Topics in the History of Data in Social Context (3 credits)
Concept 2: Critical Thinking in the Humanities (6 credits)
Concept 3: Reasoning in the Social Sciences (6 credits)
Concept 4: Reasoning in the Natural Sciences (6 credits)
Concept 5: Quantitative and Computational Thinking (9 credits)
MATH 1014: Precalculus with Transcendental Functions (3 credits) Students must take MATH 1014.
STAT 2004: Introductory Statistics (3 credits)
Or STS 2604: Introduction to Data in Social Context (3 credits)
STAT 3604: Statistics for Social Science (3 credits)
Or STAT 3615: Biological Statistics (3 credits)
Concept 6: Critique and Practice in Design and the Arts (6 credits)
GEOG 3314: Cartography (3 credits) Students must take GEOG 3314.
Additional Critique and Practice in Design and the Arts Course (3 credits)
Concept 7: Critical Analysis of Identity and Equity in the United States (0-3 credits) *(may be met by another core concept course)*

Core Courses: 21 credit hours
GEOG 1004: Introduction to Human Geography (3 credits)
GEOG 1014: World Regions (3 credits)
GEOG 1084/FREC 1004: Digital Planet (3 credits)
GEOG 1104: Introduction to Physical Geography (3 credits)
GEOG 2084: Principles of Geographic Information Systems (3 credits)
GEOG 2314: Maps and Mapping (3 credits)

Students select one of the following:
GEOG 3954: Study Abroad (3 credits)
GEOG 4964: Field Study (3 credits)
GEOG 4994: Undergraduate Research (3 credits)

Required Major Coursework: 1 credit hour
GEOG 1024: Survey of Geography (1 credit) *

Additional Required Major Course
One (1) major required course will be double-counted as part of the Pathways General Education requirements.
GEOG 3314: Cartography (3 credits)

Required Geographic Information Science and Technology Option Coursework: 16 credit hours
CS 1064: Introduction to Programming in Python (3 credits)
GEOG/GEOS 4084: Modeling with Geographic Information Systems (3 credits)
GEOG 4314: Spatial Analysis in Geographic Information Systems (3 credits)
GEOG 4324: Algorithms in Geographic Information Systems (4 credits)
GEOG/GEOS 4354: Introduction to Remote Sensing (3 credits)

Restricted Electives: 18 credit hours
Geospatial Electives
Students select 9-12 credits from the list of courses.

FREC 4214: Forest Photogrammetry and Spatial Data Processing (3 credits)
GEOG 4304: Geospatial Analysis of Mobility (3 credits)
GEOG 4334: Geospatial Information Technology for Land Change Modeling (3 credits)
GEOG 4254: R Programming for Geospatial Applications (3 credits)
GEOG 4374: Remote Sensing and Phenology (3 credits)
GEOG 4394: Introduction to Web Mapping (3 credits)
GEOG 4404: Geovisualization (3 credits)

Geography
Students select 6-9 credits from the list of courses.

GEOG 1524: Introduction to Earth's Climate (3 credits)
GEOG 2004: Water, Environment, and Society (3 credits)
GEOG 2014: Health and Place: Introduction to Health Geography (3 credits)
GEOG 2034: Geography of Global Conflict (3 credits)
GEOG 2054: Introduction to World Politics (3 credits)
GEOG/PSCI/IS 2064: The Global Economy and World Politics (3 credits)
GEOG 2074: COVID-19: Global Pandemic, Local Impacts (3 credits)
GEOG 2104: Introduction to Environmental Security (3 credits)
GEOG 2114: Introduction to Coastal Regions (3 credits)
GEOG 2134: Geography of the Global Economy (3 credits)
GEOG 2214: Geography of North America (3 credits)
GEOG 2224: Geography of Europe (3 credits)
GEOG 2244: Sustainable Urbanization (3 credits)
GEOG 2505: Weather Analysis I (3 credits)
GEOG 2784: Geography of Tea (3 credits)
GEOG 3034: The CIA: Its Capabilities in Today's Geo-Political World (3 credits)
GEOG 3104: Environmental Problems, Population, and Development (3 credits)
GEOG 3214: Africa Together (3 credits)

GEOG 3224: Geography of Appalachia (3 credits)
GEOG 3234: Geography of Virginia (3 credits)
GEOG 3244: The U.S. City (3 credits)
GEOG 3254: Geography of East Asia (3 credits)
GEOG 3274: Polar Environments (3 credits)
GEOG 3304: Geomorphology (3 credits)
GEOG 3404: Mountain Geography (3 credits)
GEOG/AHRM/APS/HD/HUM/SOC/UAP 3464: Appalachian Communities (3 credits)
GEOG 3504: Severe Weather (3 credits)
GEOG 4044: Biogeography (3 credits)
GEOG 4054: Geography of Wine (3 credits)
GEOG 4074: Medical Geography of Infectious Diseases (3 credits)
GEOG 4134: Interdisciplinary Issues and Ethics in Water Resources (3 credits)
GEOG 4204: Geography of Resources (3 credits)
GEOG 4214: Gender, Environment, and International Development (3 credits)
GEOG 4224: Tracking Environmental Change (3 credits)
GEOG 4284: Human Dimensions of Coastal Social-Ecological Systems (3 credits)
GEOG 4414: Climate Change and Societal Impacts (3 credits)
GEOG 4764: International Development Policy and Planning (3 credits)

Free Elective Courses: 19-22 credit hours

Total Credit Hours: 120 credit hours

See Appendix A for sample plan of study.
See Appendix B for course descriptions.

Faculty Resources

Faculty in the Department of Geography will teach core and required courses in the proposed B.S. degree designation. Twelve (12) faculty will teach core and required courses. All faculty members possess a doctorate degree in geography or a physical science. The faculty have been teaching for a minimum of five years in higher education. The faculty are published and conducting research in geography or a physical science.

No adjunct faculty will be needed to initiate and sustain the proposed B.S. degree designation.

Student Learning Assessment

Student learning for the proposed B.S. degree designation will be assessed throughout the program through a variety of assessment measures, formative and summative. Some of these measures will include, but are not limited to, assignments, examinations and individual and team-based projects assigned during classroom instruction.

All students will be required to complete at least one semester of experiential learning in a study abroad, field study, or undergraduate research course. The Department of Geography has developed a rubric that the faculty will use to assess students' abilities to apply geographical

knowledge and skills while conducting research, field study, or study abroad projects through deliverables including reports, reflections, and oral presentations. At the end of each semester, the faculty members will use the rubric to score students on their abilities.

Student Learning Outcomes
All students will be able to:

- Interpret the arrangement of major physical and human geographic features on a world map or regional maps.
- Describe the Earth's human and physical characteristics and processes and human-environment interactions.
- Identify the various geospatial tools used in geographical analysis including Geographic Information Systems (GIS), remote sensing, GPS, geovisualization, spatial data coding, and spatial analysis.
- Evaluate the concept of "region" and its importance in understanding world affairs.
- Demonstrate the appropriate use of map projections.
- Name and discuss the techniques, terms and applications of GIS in an informed way.
- Operate contemporary geospatial software in an effective manner.
- Compare and contrast alternative data models used for spatial data representation.
- Apply specialized geographic knowledge in a real-world context.

Students will acquire additional competencies in the Geographic Information Science and Technology Option. Geography Information Science and Technology Option students will be able to:

- Evaluate the relative merits and drawbacks of different secondary geospatial datasets that are commonly used in the geospatial industry.
- Apply and interpret relevant spatial analysis methods and results (e.g., auto correlation/hot spot analysis, spatial regression, areal interpolation, point in polygon/buffer analysis, spatial statistical analysis) to answer a variety of spatial problems.
- Design and manage a geospatial project using an understanding of appropriate techniques and technologies.
- Create and use spatial models to support solutions to real world problems.
- Demonstrate knowledge of sensors and image acquisition methods, basics of the electromagnetic spectrum, characteristics of remote sensing imagery and the ability to apply this knowledge through an application.
- Apply mathematical concepts, including statistical methods, to data to be used in geospatial analysis.
- Express and apply coding skills using a current computing language platform.
- Demonstrate the ability to collect, assemble and evaluate primary and secondary data.
- Analyze spatial data to support meaningful conclusions to geographic questions.

Curriculum map for B.S. degree designation in Geography

Learning Outcomes	**Core and Required Courses**	**Assessment Measures**

Interpret the arrangement of major physical and human geographic features on a world map or regional maps.	GEOG 1014: World Regions GEOG 1104: Introduction Physical Geography	Formative: Class assignments (for example, diagram the atmospheric pressure zones association with the South Asian monsoon) Summative: Course exams (for example, exam question to discuss the spatial organization of population density patterns in China)
Describe the Earth's human and physical characteristics and processes and human-environment interactions.	GEOG 1004: Introduction to Human Geography GEOG 1104: Introduction to Physical Geography	Formative: Class assignments (for example, describe characteristics of climate types in the Köppen classification system) Summative: Course exams (for example, exam question to diagram and describe the Urban Heat Island effect)
Identify the various geospatial tools used in geographical analysis including GIS, remote sensing, GPS, geovisualization, spatial data coding, and spatial analysis.	GEOG 1084/FREC 1004: Digital Planet	Formative: Class assignments (for example, identify examples found on the web that use Google Map Application Program Interface (API) to display spatial data patterns) Summative: Course exams (for example, exam question listing three geospatial software/tools that are commonly used to visualize spatial data)
Evaluate the concept of "region" and its importance in understanding world affairs.	GEOG 1004: Introduction to Human Geography GEOG 1014: World Regions	Formative: Class assignments (for example, in class assignment to define and provide an example of a vernacular region from a non-US country)

		Summative: Course exams (for example, exam question to compare and contrast the explanatory utility of the concentric zone versus multiple nuclei models of US metropolitan urban structure)
Interpret current events in terms of the geographical and historical context.	GEOG 1004: Introduction to Human Geography GEOG 1014: World Regions	Formative: Class assignments (for example, in class discussion to define and provide an example of a stateless nation) Summative: Course exams (for example, exam question related to explaining how historical and socio-economic characteristics contribute to Black migration patterns in the 20th century)
Demonstrate the appropriate use of map projections.	GEOG 2084: Principles of Geographic Information Systems GEOG 2314: Maps and Mapping	Formative: Class assignments (for example, homework assignment identifying the type of map projection employed from information on a map) Summative: Lab assignments (for example, assignment to convert data from latitude/longitude to a Cartesian coordinate system designed to preserve the property of equal area measurement)
Name and discuss the techniques, terms and applications of GIS in an informed way.	GEOG 2084: Principles of Geographic Information Systems	Formative: Class assignments (for example, identify the different types of vector overlay methods for points, lines, and polygons and the

		types of output that are yielded) Summative: Course exams (for example, exam question to discuss how a raster combine function applied to a time series of gridded land cover data can be used to identify and map patterns of land cover change)
Operate contemporary geospatial software in an effective manner.	GEOG 2084: Principles of Geographic Information Systems	Formative: Class assignments (for example, use ArcGIS Pro software to create a vector data layer stored in a file geodatabase) Summative: Lab exams (for example, demonstrate use of ArcGIS Pro software to perform spatial data queries using Boolean logic to answer a site suitability question)
Compare and contrast alternative data models used for spatial data representation.	GEOG 2084: Principle of Geographic Information Systems	Formative: Class assignments (for example, homework assignment to define the differing characteristics of vector vs raster spatial data) Summative: Course exams (for example, question to discuss the issues involved in representing human population data using discrete features versus continuous fields)
Apply specialized geographic knowledge in a real-world context.	GEOG 3954: Study Abroad GEOG 4964: Field Study GEOG 4994: Undergraduate Research	Formative: Project assignments (for example, creating digital spatial features of traffic accident locations)

		Summative: Final report (for example, document and summarizing an analysis of traffic accident patterns)

Employment Skills

Graduates of the proposed B.S. in Geography degree designation will be able to:

- Analyze the distribution of physical geographic features (e.g., land, sea, and air masses), natural resources, and ecosystems across different regions.
- Assess the impact of human population patterns, cultural practices, and economic activities on natural environments.
- Compile and integrate geographic data from various sources, including field observations, satellite imagery, and existing databases.
- Create and modify maps using GIS software and cartographic principles.
- Evaluate data using geospatial technologies (e.g., remote sensing).
- Develop reports and presentations to communicate complex geographical information to diverse audiences.
- Create ethical guidelines for the use of geospatial technologies and data.

Justification for the Proposed Program

Rationale for the Program

The proposed addition of the B.S. degree designation is needed for three reasons: 1) evolution of the geography field and discipline, 2) address student needs and career goals, and 3) alignment with peer institutions.

Evolution of the Geography Field and Discipline

Geography is an interdisciplinary field that bridges the natural and social sciences, encompassing everything from physical landforms and climate patterns to human cultures and political systems. Virginia Tech's Bachelor of Arts (B.A.) degree program in Geography was established in 1975. Since the 1970s, the field of geography has evolved. With the advancements in technologies including digital mapping and visualization, spatial analysis, and big data, and the integration of other disciplines (e.g., computer science), more technical focus areas have emerged (e.g., geographic information systems (GIS) and remote sensing) that align more closely with a B.S. degree designation than the B.A. degree designation. Today, both B.A. and B.S. degree designations are needed at Virginia Tech to accommodate the diverse nature of the field.

The current B.A. degree designation allows for a broad exploration of topics in geography including human geography, cultural studies, urban planning, or policy-related work. The proposed B.S. in Geography degree designation will target the technical aspects of the geography field including geographical information science and remote sensing.

Address Student Needs and Career Goals

The proposed B.S. in Geography degree designation will make graduates more competitive for job placement. The proposed B.S. Geography designation will provide evidence of a scientific specialization that enhances employment marketability that is absent from the current B.A. in Geography. Multiple students have reported being unsuccessful on employment applications due to the absence of a B.S. designation and associated specialization. Alumni have reported a strong need for the B.S. designation to produce students that are more competitive. During informal conversations with graduating seniors and recent graduates, students reported that employer feedback when they applied for positions such as geographic information systems specialists, geospatial analysts and remote sensing specialists was that the organizations were looking for students with a B.S in Geography, rather than a B.A. in Geography.

The B.S. degree designation would serve students interested in areas of geography such as Geographic Information Systems (GIS) and remote sensing, preparing them for careers in technical and data-driven fields. The proposed B.S. degree designation in Geography would allow Virginia Tech to offer the curricular requirements for the focus area of Geographic Information Science and Technology

Peer Institutions

In Spring 2024, the geography faculty examined baccalaureate degree programs in the field of geography offered by Virginia Tech's State Council of Higher Education for Virginia (SCHEV) peer institutions. Of the 25 SCHEV peer institutions, 16 institutions offer a baccalaureate degree program in the field of geography. Seven (7) institutions offer a Bachelor of Arts (B.A.) in Geography degree program. Six (6) institutions offer both degree designations, the Bachelor of Arts (B.A.) and the Bachelor of Science (B.S.) degree programs in Geography. One (1) institution offers a Bachelor of Science (B.S.) in Geography, one (1) institution offers a Bachelor of Science (B.S.) in Geological Sciences, and one (1) institution offers a Bachelor of Arts in Liberal Arts and Sciences/Bachelor of Science in Liberal Arts and Sciences (B.A.L.A.S./B.S.L.A.S.) in Geography and Geographic Information Science.

In addition, the geography faculty examined the curriculum of the degree programs at the SCHEV peer institutions. Based on the research, faculty determined that the core and required curriculum for the Bachelor of Science (B.S.) degree designation is typically similar to the B.A. designation at institutions where both the B.S. and the B.A. degree designations are offered. Further, most Geography degree programs include subareas (e.g., majors, concentrations, tracks, interest areas) that are aligned with the degree designation and the curricular requirements are different based on the subarea. For example, the B.A. in Geography degree designation most often emphasizes the social and behavioral aspects of field of geography while the B.S. degree designation focuses on the discipline's environmental and technical perspectives. Students enrolled in the B.S. degree designation in Geography and the geographic information systems subarea are required to take coursework in geographic information systems and spatial analysis, and coursework in computer programming, data analysis, or statistics. Whereas students enrolled in the B.A. degree designation in Geography and the social and environmental geography subarea would be required to take coursework in economic and social geography and cities and their global spaces.

The addition of the Bachelor of Science (B.S.) degree designation in Geography to the existing Bachelor of Arts (B.A.) degree program in Geography would allow Virginia Tech to align with the six (6) institutions that offer both degree designations in the field of geography.

See Appendix C for a list of degree programs at peer institutions.

Student Demand

Student enrollment in the proposed B.S. degree designation is not expected to increase enrollment in the existing B.A. in Geography degree program. It is expected that total student enrollment will remain about the same as the current total student enrollment in the existing degree program. Faculty teaching in the existing degree program will remain the same for the proposed addition of the B.S. degree designation. It is expected that student enrollment in the proposed B.A./B.S. degree program in Geography will remain at a level appropriate to faculty resources.

No student demand evidence was obtained to add the proposed B.S. degree designation. However, student demand for a B.S. degree designation in Geography is evident from the robust enrollment of the existing Geographic Information Science (GIS) minor. Enrollment in the GIS minor was ranked 14th out of 175 Virginia Tech minors 2019-2023. Enrollments by year are: 78 (2019), 96 (2020), 118 (2021), 103 (2022), and 112 (2023), and 153 (2024). During the five-year period from 2019 to 2023, 129 of the total enrolled 507 minors came from the B.A. in Geography degree program. We project that students who would enroll in the GIS minor in the absence of a B.S. in Geography will opt to enroll in the B.S. in Geography degree designation with its required coursework in GIS.

State Council of Higher Education for Virginia
Summary of Projected Enrollments in Proposed Program

Year 1		Year 2		Year 3		Year 4 **Target Year (2-year institutions)**			Year 5 **Target Year (4-year institutions)**		
2025 - 2026		2026 - 2027		2027 - 2028		2028 - 2029			2029 - 2030		
HDCT 100	FTES 100	HDCT 100	FTES 100	HDCT 100	FTES 100	HDCT 100	FTES 100	GRAD _____	HDCT 100	FTES 100	GRAD 35

Assumptions:
Retention percentage: 90%
Full-time students 100%
Full-time students credit hours per semester: 15-16
Full-time students graduate in 4 years

Projected Resource Needs for the Proposed Program

Resource Needs

Virginia Tech and the Department of Geography have the resources needed to initiate and sustain the proposed B.S. degree designation in Geography. The addition of a B.S. degree designation will not require any additional resources. Virginia Tech anticipates no need to increase the number of full-time, part-time, or adjunct faculty to accommodate the new B.S. degree designation in Geography. The proposed program allocates 1.0 FTE of instructional effort for every 24.0 FTE of enrollment in lower division courses and 1.0 FTE of instructional effort for 18.0 FTE of enrollment in upper division courses. The proposed program will therefore require a total of 4.76 FTE of instructional effort in 2025-2026, which will remain constant through the target year 2029-2030.

It expected that student enrollment in the proposed B.S. degree designation will not increase to a level that cannot be sustained by existing faculty resources. It is expected that student enrollment will remain about the same as student enrollment in the existing B.A. in Geography degree program. It is expected that student enrollment in the B.A./B.S. degree program will remain at a level appropriate to faculty resources.

Full-time Faculty
Faculty in the Department of Geography will teach core and required courses in the proposed added degree designation. One (1) faculty member will dedicate 100% (1 FTE) of their teaching time to the proposed added degree designation. Five (5) faculty members will dedicate 50% (0.50 FTE) each, for a total of 2.5 FTE of their teaching time to the proposed added degree

designation. The program will require 3.5 FTE of faculty instruction to initiate, and this level of effort is expected to remain constant through the target year of 2029-2030.

Part-time Faculty
Six (6) faculty in the Department of Geography will dedicate 25% (0.25 FTE) each, for a total of 1.5 FTE of their teaching time to the proposed added degree designation. The program will require 1.5 FTE of faculty instruction to initiate, and this level of effort is expected to remain constant through the target year of 2029-2030.

Adjunct Faculty
No adjunct faculty will be required to initiate or sustain the proposed added degree designation.

Graduate Assistants
No new graduate assistantships will be needed to initiate and sustain the proposed added degree designation.

Classified Positions
No new classified positions will be needed to initiate and sustain the proposed added degree designation.

Equipment (including computers)
No new equipment, including computers, is needed to initiate and sustain the proposed added degree designation. The equipment available, including computers, is sufficient for the proposed added degree designation.

Library
No new resources are needed to initiate or sustain the proposed added degree designation. The library resources, such as books, journals, and online access are sufficient to support coursework in the proposed added degree designation.

Telecommunications
No new or additional resources are required to initiate or sustain the proposed added degree designation.

Space
No additional space is needed to initiate or sustain the proposed added degree designation.

Targeted Financial Aid
No targeted financial aid will be offered to initiate and sustain the proposed added degree designation.

Special Tuition or fee charges
No special tuition or fee charges will be utilized or instituted to initiate or sustain the proposed degree designation.

Other Resources (specify)
No additional resources are needed to initiate or sustain the proposed added degree designation. No resources are needed for advertising and promotion of the proposed added degree designation.

Funds to Initiate and Operate the Degree Program

Figures provided in the table below will be compared to SCHEV funding estimates using the current base adequacy model. This comparison will serve as a reference for the estimated costs. If there are large discrepancies, SCHEV may request additional clarification to ensure the institution's assumptions are correct, or require modifications as a condition of approval.

Note: Institutions must use the recommended student-faculty ratio when estimating FTES enrollments and required faculty FTEs.

Cost and Funding Sources to Initiate and Operate the Program			
Informational Category		**Program Initiation Year**	**Program Target Year**
		20 25 - 20 26	**20 29 - 20 30**
1.	Projected Enrollment (Headcount)	100	100
2.	Projected Enrollment (FTES)	100	100
3.	Projected Enrollment Headcount of In-State Students	85	85
4.	Projected Enrollment Headcount of Out-of-State Students	15	15
5.	Estimated Annual Tuition and E&G Fees for In-State Students in the Proposed Program	$13,266	$13,266
6.	**Revenue** from Tuition and E&G Fees for In-State Students Due to the Proposed Program	$1,127,610	$1,127,610
7.	Estimated Annual Tuition and E&G Fees for Out-of-State Students in the Proposed Program	$35,093	$35,093
8.	**Revenue** from Tuition and E&G Fees for Out-of-State Students Due to the Proposed Program	$526,395	$526,395
9.	**Projected Revenue Total from Tuition and E&G Fees Due to the Proposed Program**	**$1,654,005**	**$1,654,005**
10.	Other Funding Sources Dedicated to the Proposed Program (e.g., grant, business, private sources, university funds)	$0	$0
11.	**Total Funding**	**$1,654,005**	**$1,654,005**

iv) Certification Statements

1. A request of any kind has been or will be submitted to the Virginia General Assembly for funds to initiate and/or maintain the technical change for the academic program.

   Yes ☐

   No ☒

   If "Yes" is checked, include narrative text to describe: when the request will be made, how much will be requested, what the funds will be used for, and what will be done if the request is not fulfilled. Additional information may be required.

2. If governing board approval is required, the governing board has been provided information regarding: credit hour change (if applicable), curriculum changes (if applicable), and duplication (if applicable) as part of its approval action.

   Yes ☒

   No ☐

   If "No" is checked, include narrative text to explain why the governing board has not been provided the information.

The institution's Chief Academic Officer attests to the accuracy of the above statements.

Cyril R. Clarke	
Name (Printed)	
	March XX, 2025
Signature	Date

Appendices

Appendix A: Sample Plan of Study

Full-Time Student

Freshman Fall	**Credits**	**Freshman Spring**	**Credits**
GEOG 1004: Introduction to Human Geography	3	GEOG 1014: World Regions	3
GEOG 1104: Introduction to Physical Geography	3	GEOG 1084/FREC 1004: Digital Planet	3
General Education Course: Discourse	3	General Education Course: Discourse	3
General Education Course: Reasoning in the Social Sciences	3	General Education Course: Critical Thinking in the Humanities	3
MATH 1014: Precalculus with Transcendental Functions	3	General Education Course: Quantitative and Computational Thinking	3
GEOG 1027: Survey of Geography	1		
Total	**16**	**Total**	**15**
Sophomore Fall	**Credits**	**Sophomore Spring**	**Credits**
GEOG 2084: Principles of Geographic Information Systems	3	CS 1064: Introduction to Programming in Python	3
GEOG 2314: Maps and Mapping	3	General Education Course: Critical Thinking in the Humanities	3
GEOG/GEOS 4354: Introduction to Remote Sensing	3	General Education Course: Reasoning in the Natural Sciences	3
General Education Course: Reasoning in the Natural Sciences	3	General Education Course: Critical Analysis of Identity and Equity in the United States	3
General Education Course: Reasoning in the Social Sciences	3	Restricted Elective	3
Total	**15**	**Total**	**15**
Junior Fall	**Credits**	**Junior Spring**	**Credits**
GEOG 3314: Cartography	3	General Education Course: Critique and Practice in Design and the Arts	3
General Education Course: Quantitative and Computational Thinking	3	GEOG 4314: Spatial Analysis in Geographic Information Systems	3
GEOG/GEOS 4084: Modeling with Geographic Information Systems	3	Restricted Elective	3
Restricted Elective	3	Restricted Elective	3
Restricted Elective	3	Free Elective	3
Total	**15**	**Total**	**15**

Senior Fall	Credits	Senior Spring	Credits
GEOG 4994: Undergraduate Research	3	Free Elective	3
General Education Course: Discourse	3	Free Elective	3
GEOG 4324: Algorithms in Geographic Information Science	4	Free Elective	3
Restricted Elective	3	Free Elective	3
Free Elective	3	Free Elective	1
Total	**16**	**Total**	**13**

Full-Time Students

Credit Hours – Freshman – Fall Term	16
Credit Hours – Freshman – Spring Term	15
Credit Hours – Sophomore – Fall Term	15
Credit Hours – Sophomore – Spring Term	15
Credit Hours – Junior – Fall Term	15
Credit Hours – Junior – Spring Term	15
Credit Hours – Senior – Fall Term	16
Credit Hours – Senior – Spring Term	13
Total Credit Hours	**120**

Appendix B: Course Descriptions

General Education Pathway Required Courses

GEOG 3314: Cartography (3 credits)
Science and art of cartography including the conceptual framework of the cartographic method. Development of the skills necessary to create maps to be used in the analysis of spatial phenomena. Emphasis on thematic and ethical cartography.

MATH 1014: Precalculus with Transcendental Functions (3 credits)
Precalculus college algebra, basic functions (algebraic, exponential, logarithmic, and trigonometric), conic sections, graphing techniques, basic probability. Usage of mathematical models, analytical calculations, and graphical or numerical representations of data to analyze problems from multiple disciplines that address intercultural and global challenges in areas such as chemistry, environmental science, the life sciences, finance, and statistics. Use of spreadsheet software. Two units of high school algebra and one of plane geometry are required.

Core Courses

GEOG/FREC 1004: Introduction to Human Geography (3 credits)
Introduction to geography as a social science. Development of a conceptual framework for studying and evaluating human-environment relationships. Through examination of selected regional and global issues and through exploring basic concepts like regions, place, location, human-environment interaction, movement, and accessibility, students will discover how power is spatially expressed and explore how culture shapes the production of space and vice versa. Students will also discover and describe how ethical issues manifest spatially.

GEOG 1014: World Regions (3 credits)
Human and physical patterns and characteristics of major regions of the world including political systems, religions, economies, and physical settings. Concepts and perspectives of geography as a social science; linkages and interdependence of nations and regions; analysis of media coverage of events or global issues; engagement with current and historical global affairs.

GEOG 1084/FREC 1004: Digital Planet (3 credits)
Exploration of innovative geospatial technologies and their impact on the world around us, including how humans interact with the environment and each other. Roles of location-based services, global positioning systems, geographic information systems, remote sensing, virtual globes and web-based mapping for environmental applications. Skills and techniques for spatial thinking and environmental decision-making. Ethical implications of the use of geospatial technologies, data, and computational approaches.

GEOG 1104: Introduction to Physical Geography (3 credits)
Integrated study of major subsystems of the natural environment: the nature, distribution, and interrelationships of landforms, climate and vegetation.

GEOG 2084: Principles of Geographic Information Systems (3 credits)
Principles and diverse applications of Geographic Information Systems, geographic coordinate systems, Cartesian map projections, spatial data sources, GIS databases, map representations,

and illustrated spatial applications of GIS. Requires regular use of computer systems for geographic data analysis.

GEOG 2314: Maps and Mapping (3 credits)
Introduction to maps. Fundamentals of reading, analysis, and interpretation of hard copy and digital maps, as they are required to illuminate spatial problems. Influences of maps on attitudes toward and images of the geographic environment.

GEOG 3954: Study Abroad (1-19 credits)
No course description listed in catalog.

GEOG 4964: Field Study (1-19 credits)
No course description listed in catalog.

GEOG 4994: Undergraduate Research (1-19 credits)
No course description listed in catalog.

Major Coursework: 4 credit hours
GEOG 1024: Survey of Geography (1 credit)
Foundations of geography and subdisciplines. Career pathways for geography-interested students in various workforce sectors and sub-disciplinary specialization areas, including physical geography, GIScience, and human geography. Introduction to campus academic and geography-related career resources to enhance the undergraduate experience. Professional goal reflection and development.

GEOG 3314: Cartography (3 credits)
Science and art of cartography including the conceptual framework of the cartographic method. Development of the skills necessary to create maps to be used in the analysis of spatial phenomena. Emphasis on thematic and ethical cartography.

Geographic Information Science and Technology Option Coursework: 16 credit hours
CS 1064: Introduction to Programming in Python (3 credits)
Introduction to programming in Python contextualized with scientific and engineering problems. Computational problem-solving skills and software solutions in addition to Python language fundamentals. The basics of control flow with loops and conditionals, state tracing and manipulation, simple and complex types, organization of code using functional and object-oriented coding strategies, and data processing. Create, interpret, and debug programs. Ethically debate important issues in computing culture.

GEOG/GEOS 4084: Modeling with Geographic Information Systems (3 credits)
Use of automated systems for geographic data collection, digitization, storage, display, modeling and analysis. Basic data flow in GIS modeling applications. Development of proficiency in the use of current GIS software. Senior Standing.

GEOG 4314: Spatial Analysis in Geographic Information Systems (3 credits)
Theory and application of Geographic Information Systems, with special emphasis on analytical operations, database design, cartographic modeling, and raster GIS. Spatial data handling and analysis to facilitate decision-making through the communication of geographically referenced data.

GEOG 4324: Algorithms in Geographic Information Systems (4 credits)
Computational methods in automated mapping and map analysis. Visual Basic programming and algorithm design for spatial display and analysis under both raster and vector data models. Requires regular use of the departmental microcomputer and UNIX workstation laboratory. Prerequisite(s): GEOG 4084 and CS 1064

GEOG/GEOS 4354: Introduction to Remote Sensing (3 credits)
Theory and methods of remote sensing. Practical exercises in interpretation of aerial photography, satellite, radar, and thermal infrared imagery. Digital analysis, image classification, and evaluation. Applications in earth sciences, hydrology, plant sciences, and land use studies.

Appendix C: Degree Programs at Peer Institutions

	Institution	Degree
1	Cornell University	
2	Iowa State University	
3	Michigan State University	B.A./B.S. in Geography
4	North Carolina State University at Raleigh	
5	Ohio State University – Main Campus	B.A./B.S. in Geography
6	Pennsylvania State University – Main Campus	B.A./B.S. in Geography
7	Purdue University – Main Campus	
8	Rutgers University-New Brunswick/Piscataway	B.A. in Geography
9	Stony Brook University	
10	SUNY at Buffalo	B.A. in Geography
11	Texas A & M University	B.S. in Geography
12	The University of Texas at Austin	B.A. in Geography
13	University of California, Berkeley	B.A. in Geography
14	University of California, Davis	
15	University of Colorado, Boulder	B.A. in Geography
16	University of Florida	B.A./B.S. in Geography
17	University of Illinois at Urbana-Champaign	B.A.L.A.S./B.S.L.A.S.* in Geography & Geographic Information Science
18	University of Maryland, College Park	B.S. in Geographical Sciences
19	University of Michigan, Ann Arbor	
20	University of Minnesota – Twin Cities	B.A./B.S. in Geography
21	University of Missouri – Columbia	B.A. in Geography
22	University of Pittsburgh	
23	University of Southern California	
24	University of Washington-Seattle Campus	B.A. in Geography
25	University of Wisconsin-Madison	B.A./B.S. in Geography

*B.A.L.A.S./B.S.L.A.S.: Bachelor of Arts in Liberal Arts and Sciences/Bachelor of Science in Liberal Arts and Sciences