Viewing: **Introduction to Geographic Information Systems and Cartography**

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History

1. Oct 4, 2021 by Steve Hanna (shanna)

Associated Course	GEOG 250:Introduction to Geographic Information Systems and Cartography

Faculty Name	Stephen Hanna	Email	shanna@umw.edu
Department	Geography		
College	College of Arts and Sciences		
Request Type	Digital Intensive		
Title	Introduction to Geographic Information Systems and Cartography		
Associated Course	GEOG 250 - Introduction to Geographic Information Systems and Cartography		

Semester/Term Proposed for First Offering:	Spring 2022
Frequency of Offering	Every Semester

Digital Intensive designation requested for:	The course and the faculty member teaching this course (other faculty who teach the course will not have their courses designated automatically; other faculty will need to apply for designation independently.)

If the course is being proposed so that it receives Digital Intensive designation, Department Chairs should complete the following section:

How will the department help prepare new instructors to teach this course as DI?	
How often will the course be taught?	

Digital Intensive SLOs - Using the form below, address each of the three Student Learning Outcomes.

Using the form below, address each of three of the learning outcome of the Digital Intensive program and indicate the assignments or other structured activities that will be used to meet each SLO. Typically, these outcomes will be the focus of three different assignments, but in some cases a single assignment or activity could address multiple areas. Whatever the arrangement cases, please complete each section with the assignment or activity that best demonstrates the course's attention to each goal, respectively.

SLO:	Uses digital tools to safely, ethically, and effectively produce and exchange information and ideas
Assignment Name:	Making a choropleth map
Assignment Description:	This is the fifth of eight laboratory assignments in the course. The objective of this assignment is for students to create a classed choropleth map visualizing recent election results at the county level in Virginia and, more importantly, to understand that choices they make in data processing, data classification, and in cartographic design affect people's abilities to effectively and ethically use a map (as a data visualization tool) to either generate new geographic questions or to communicate a geographic patterns to others. The social and political context of mapping elections, included how maps of election results can distort our understandings of political geography in ways that can discourage civic engagement, is described in the lab assignments and discussed in class. In order to accomplish this task, students must correctly apply knowledge and skills built in previous graded and ungraded assignment including their ability to conceptualize geographic phenomena as objects that be coded into vector or raster data and to edit such data so they are suitable for use to solve a particular problem. Then they must master new skills including the creation of a new geodatabase table to hold the county-level election results, methods to join that table to the vector data representing Virginia's counties, the correct method to process the raw data provided so that it allows meaningful comparisons of election results among Virginia's counties, the use of descriptive statistics to understand what constitutes typical and unusual values within the dataset, and the choice of a method to classify the data (grouping counties with similar values together) so that the resulting map effectively and accurately models the geographic pattern of election results. Finally, they must ethically apply cartographic design concepts covered earlier in the semester (visual balance, figure-ground relationships, symbol design) to create a map that effectively visualizes and communicates a geographic pattern in a manner that is not intentionally misleading. To demonstrate their ability to to meet this assignment's goals, students: 1) produce a publishable-quality map of election results (produced in ArcGIS Pro but submitted as a PDF that has the potential to be shared across a variety of media); 2) produce a frequency histogram and descriptive statistics of the dataset to defend their choice of classification method; and 3)

answer a set of questions designed to help students understand the advantages and limitations of the various data processing and design decisions they had to make.

While each student is required to submit their own work as individuals, they are encouraged to work together to help each other solve technical problems and to assess the effectiveness of the maps they produce. In addition, while students are working on this assignment, class time is used to collaboratively interrogate similar maps to improve students' abilities to understand the advantages and limitations of this mapping method.

SLO Rationale:

This assignment meets to SLO objective, "Uses digital tools to safely, ethically, and effectively produce and exchange information and ideas" because:

1. Students must make creative but informed decisions to process and classify the data and to symbolize those data in a map that effectively and ethically helps people visualize the results of elections.

2. During class time, students work collaboratively to evaluate maps similar to those they are producing and, on their own time, are encouraged to help each other solve technical problems and to assess the effectiveness of each others' maps.

3. Students use ArcGIS Pro, the current industry standard in Geographic Information Systems, to create a geodatabase representing Virginia's counties, to process raw data representing recent election results, to import those data into the geodatabase, to generate a histogram and descriptive statistics, and to design a map that effectively visualizes and communicates the geographic pattern of election results.

4. Through the creation of a map visualizing election results and answering questions designed to help them understand the advantages and limitations of the choices they made in that map's production, students demonstrate their growing awareness of the ways geodatabases and maps can only selectively represent geographic phenomena and that the students they make to create such selective representations have repercussions for how we understand our world. In this case, students gain awareness of the limitations for how class choropleth maps represent election results and how these limitations can influence civic engagement.

Type of Assignment:

Database
Visualization
Other

Other

Assessment:

Letter grade
Rubric

Support:

In-class instruction or demonstration
Online training material
Peer support

Availability of Student Work - Public:	
Social Media Platforms:	
Availability of Student Work - Private:	Canvas
Sustainability Plan for Public Projects:	None or N/A

Using the form below, address each of three of the learning outcome of the Digital Intensive program and indicate the assignments or other structured activities that will be used to meet each SLO. Typically, these outcomes will be the focus of three different assignments, but in some cases a single assignment or activity could address multiple areas. Whatever the arrangement cases, please complete each section with the assignment or activity that best demonstrates the course's attention to each goal, respectively.

SLO:	Successfully locates and critically evaluates information using the Internet, library databases, and other digital tools.
Assignment Name:	Building the GIS database
Assignment Description:	This is the third of eight laboratory assignments in the course. The objective of this assignment is to create a geodatabase containing a variety of geographic information about Fredericksburg, Virginia, including a raster model of elevation and vector models of city streets, streams, the Rappahannock River, historic districts, and the historical locations of key sites related to nineteenth century water-powered industries in the city. To do this, students learn to find reliable sources of geographic information on the internet (in this case to use the United States Geological Survey to obtain elevation data), edit existing geographic data and their coordinate systems so that they effectively and accurately model geographic phenomena found in Fredericksburg, and create new datasets to accurately represent the locations of historical water-powered mills, industrial canals, and related water bodies. As they work and create these data, students learn about the limitations and advantages of different data models and files for accurately and ethically representing geographic phenomena both through laboratory practice and through discussions and ungraded activities occurring during class times. This includes discussions about how data are usually created within social institutions and therefore are designed to serve these institutions' interests. In order to accomplish this assignment's objective, students must correctly apply knowledge and skills built in previous graded and ungraded assignments including their ability to conceptualize geographic phenomena as objects that can be coded into vector or raster data, to use ArcGIS Pro to work with and choose the appropriate coordinate systems to locate vector

and raster data relative to each other, and to use generalizing processes to make the data appropriately detailed for the geodatabase's scale and purpose. Then they must master new skills including the creation of a geodatabase in ArcGIS Pro, the methods to import vector and raster data files from a variety of sources (including the internet) into that geodatabase, the ArcGIS Pro tools necessary to reproject those data into an appropriate coordinate system that most accurately locates the geographic phenomena modeled by the geodatabase, and the tools necessary to select features within a dataset most relevant to the geodatabase's purpose. Finally students learn to create the appropriate files types within a geodatabase to hold the locations and attributes of water-powered mills and associated canals and waterbodies and to digitize these features from a source map.

To demonstrate their ability to meet this assignment's goals students produce a geodatabase containing edited vector data files representing Fredericksburg's streets, streams, the Rappahannock River, historic districts, and historical mills, canals, and water bodies. The geodatabase also contains a raster model of elevation downloaded from the USGS but generalized and reprojected so it only shows elevation within the city's boundaries. Finally, students answer a set of questions designed to help them think about what aspects of the geographic phenomena represented by the geodatabase they create are included and excluded and what that means for how the geodatabase should be used to solve geographic problems.

SLO Rationale:

This assignment meets the SLO objective, "successfully locates and critically evaluates information using the Internet, library databases, and/or other digital tools," because

1. students continue to build their abilities to work with ArcGIS Pro, the industry standard and state of the art geographic information system, to import, edit, and create geospatial data within a geodatabase - the most current structure designed to store and share such data.

2. By creating and editing geospatial data, students practice the ethic of accuracy to strive to ensure that the database they create represents certain geographic phenomena as accurately as possible. In addition, they continue to gain awareness of the advantages and limitations of conceptualizing geographic phenomena as objects that can be coded as vector or raster data including the fact that such data always represent geographic phenomena in partial and selective ways. Working with digital geographic information in an ethical matter requires a recognition of this fact and an awareness that it enables and limits the ways such data can be used to ask and answer geographic questions.

3. Students begin learning about providers of reliable geospatial data and to use metadata to understand who created and maintains certain data, at what scales and for what purposes certain data should be used. In addition, through laboratory practice and in class discussions, students learn that most geographic information represents certain social interests and, therefore, are designed to serve those interests.

Type of Assignment:

Database
Other

Other

Answers to questions designed to help students critically understand how a geodatabase can and cannot represent geographic phenomena

Assessment:	Letter grade Rubric
Support:	In-class instruction or demonstration Online training material Peer support
Availability of Student Work - Public:	
Social Media Platforms:	
Availability of Student Work - Private:	Canvas
Sustainability Plan for Public Projects:	None or N/A

Using the form below, address each of three of the learning outcome of the Digital Intensive program and indicate the assignments or other structured activities that will be used to meet each SLO. Typically, these outcomes will be the focus of three different assignments, but in some cases a single assignment or activity could address multiple areas. Whatever the arrangement cases, please complete each section with the assignment or activity that best demonstrates the course's attention to each goal, respectively.

SLO:	Creatively adapts to emerging and evolving technology
Assignment Name:	Raster Analysis in GIS
Assignment Description:	This is the eighth of eight laboratory assignments in the course and, in many ways, is the culminating assignment in the class. The objective of this assignment is to choose the correct data and data analysis methods to locate potential sites for vineyards in Fauquier County, Virginia - a county striving to preserve its agricultural character while facing problems associated with suburban sprawl due to its proximity to the Washington, DC metropolitan area. Vineyards are a form of value-added agriculture that can make agricultural practices more viable in the face of rising land values caused by suburbanization. To do this, students read a review of the literature identifying the characteristics a site must have to support viticulture, rework those characteristics into measurable location factors, find and create the geospatial data that represent those location factors, and use the appropriate raster-analysis tools in ArcGIS Pro to yield a new dataset representing potential vineyard sites. Finally, students write a report for an imagined client that introduces the project's purpose, details and defends the data and methods used in the analysis, describes the analysis's results, and discusses what

those results mean both in terms of the limitations of the raster data and tools used and whether the amount and locations of potential vineyard sites might help preserve Loudoun County's agricultural character.

In order to accomplish this assignment's objective, students first have work independently to translate a set of topographic and other characteristics associated with areas suited for viticulture into a set of measurable location factors, such as elevation, slope, aspect, and zoning, and then to choose from a provided geodatabase the vector and raster files necessary to conduct the analysis. This step requires them to critically examine data to determine which data are relevant and how those data must be processed to prepare them for analysis. Then students design a geospatial workflow (or set of steps and associated digital tools) comprised of a description of the initial data, the identification of the tools in ArcGIS Pro necessary to prepare those data for the analysis, and ending with the identification of the tools, complete with a description of their parameters, necessary to conduct the analysis. Student ability to do this is built on all previous laboratory assignments, in class ungraded activities and discussions, feedback on quizzes and exams, and new material on raster data analysis provided. For example, students begin creating similar workflows as part of in class activities a couple of weeks before this lab exercise is assigned. And, students are encouraged to get feedback on their workflow for this assignment from the instructor and from peers. Once their workflow has been designed, student operationalize it within ArcGIS Pro and then have to systematically evaluate the results to ensure they make sense both given the inputs and the overall context and purpose of the project. Finally, they use feedback given on previous assignments to write a report as a professional GIS analyst communicating their results to a client – in this case the Fauquier County government.

To demonstrate their ability to meet this assignment's goals, students must use knowledge and skills developed earlier in the semester to create a geodatabase, select the data needed to conduct the analysis, design and workflow and select the tools necessary to process the input data, create new data, and conduct the analysis. Once their analysis is complete they must write a report, in the style and voice of a GIS professional, that successfully describes the project’s purpose, methods, and results and interprets those results within the given scenario. This report must include at least one map that effectively communicates the project’s results – where potential vineyard sites are located relative to Fauquier County’s towns, roads, and other features necessary for the client to visualize these sites within the county

SLO Rationale: This assignment meets the SLO objective, “creatively adapts to emerging and evolving technology” because

1. Students must identify the appropriate tools in ArcGIS Pro as part of designing a geospatial workflow that will yield useful results. This involves evaluating different data and tools to determine if they should be included in the analysis.

2. Students must work independently to create their geospatial workflow based on the provided review of literature about vineyard locations and the knowledge and skills they have already acquired during the semester. In addition, they must systematically and critically

	evaluate results and troubleshoot problems that occur as they operationalize their workflow within ArcGIS Pro. 3. As in two previous laboratory assignments, students write reports as GIS professionals conducting analyses for imagined clients. This helps them develop professional identities.
Type of Assignment:	Database Visualization Other
Other	Report written as GIS professional to an imagined client describing the project's purpose, detailing the data and methods used, describing the results, and discussing those result
Assessment:	Letter grade Rubric
Support:	In-class instruction or demonstration Online training material Peer support
Availability of Student Work - Public:	
Social Media Platforms:	
Availability of Student Work - Private:	Canvas
Sustainability Plan for Public Projects:	

Additional Digital Intensive Elements

Please describe any other aspects of the course not listed for each SLO that helps characterize it as Digitally Intensive.

Other aspects of GEOG 250 that characterize it as Digitally Intensive:
1. Aspects that ensure a student successfully locates and critically evaluates information using the Internet, library databases, and/or other digital tools:
-- Across all eight laboratory assignments students learn to work with, find, create, and edit digital geospatial information using ArcGIS Pro - a digital technology relevant to the discipline of geography and to several other disciplines (the course meets requirements or serves as an elective in: conservation biology, environmental science, historic preservation, classical archaeology, and marketing)
-- Readings provided online as well as in class discussions and activities are designed to help

students understand the partial and selective ways digital geospatial information represents geographic phenomena and that professionals must make ethical choices since what is representing vs. what is left out can have significant impacts on both results and people affected by those results
-- Lab assignments require students to answer questions or write reports that situate the digital tools they use within real world scenarios to increase student awareness of social and cultural issues raised by the use of digital geospatial information. Questions in quizzes and exams also ask students to draw from readings and class sessions to deal with these issues

2. Uses digital tools to safely, ethically, and effectively produce and exchange information and ideas.
-- As a discipline, cartography is focused on both the creation of maps as visualization and communication devices and on critically examining how maps work socially and culturally. Using ArcGIS Pro, students apply cartographic design principles to ensure their maps, as digital visualizations of digital information, effectively and ethically represent the geographic patterns evident in the data
-- For the most part, students work independently in this class but are strongly encouraged to assist each other to solve technical problems and to provide informal feedback on maps and solutions to laboratory assignments. In readings and class sessions, students learn that GIS Professionals typically work as members of teams and that some geospatial projects involve working collaboratively with people with data that might be globally distributed. Engaging in such work, however, requires students to master knowledge and skills taught in upper level courses.
-- Working with tools in ArcGIS Pro, students produce new digital geospatial information as they pursue solutions to problems posed in all eight laboratory assignments.
-- Lab assignments, quizzes, exams, and in class activities and discussions situate the production of digital geospatial information as well as map making in social and cultural contexts. For example, when learning about designing map symbols, students learn how to adjust map colors to make a map accessible to people with certain types of color blindness and to think about the cultural meanings attached to certain colors

Creatively adapts to emerging and evolving technology
-- All lab assignments ask to students to identify and use the right digital tools in ArcGIS Pro to fulfill an assignment's objectives. In later labs (as well as during class sessions), students are faced with a variety of choices as they learn to design geospatial work flows that will lead to solutions to the assigned problems. This requires they experiment with tools and evaluate the results produced in order to determine if a tool relevant to a particular problem
-- A key course objective is for students to independently design geospatial workflows or methodologies to solve problems. This requires that students learn to examine the digital geospatial data they use and create critically and to engage in problem-solving when results do not make sense in the context of the problem or given the data inputs.
-- In the last three laboratory assignments, students learn to write as GIS professionals to a knowledgeable audience. In addition, when designing maps to communicate geographic information, students are encourage to think about their audiences and what they may need to effectively interpret the information the map is intended to convey

	effectively interpret the information the map is intended to convey.
Please attach a sample syllabus for this class, assignment descriptions, or any other documents that may help evaluate this course's Digital Intensive status.	GEOG-250-01-SHanna-202108.pdf

Reviewer Comments

Key: 139