Au Sable Institute
of Environmental Studies

BIO/GEOG/ENVS 3620:

Environmental Applications in Geographic Information Systems

Summer 2022: 6 June – 8 July 2022 Online, Asynchronous

Instructor Contact Information

BIO/GEOG/ENVS 3620	
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Course Information

Course Description: All environmental issues—water quality, habitat loss, energy, climate, natural hazards, invasive species, and many more—take place *somewhere*, affecting people's lives as well as their environmental surroundings. In addition, these issues often exhibit spatial patterns that can be mapped and analyzed, and require the analysis of data in the form of 2D and 3D maps, aircraft and satellite imagery, real time data feeds from the Internet of Things, and much more. Geographic Information Systems (GIS) is an exciting way for you to put your interest and passion for all things about the Earth and the Environment into **action** in ways that are in demand in the workplace by nonprofit organizations, government agencies, academia, and private industry and incredibly relevant to our 21st Century world! This course provides theoretical foundations and practical applications for social and ecological problem-solving. Through a series of readings, videos, and hands-on exercises covering a variety of environmental themes, issues, and scales, you will learn the fundamentals modern mapping, including projections, symbology, classification, and analysis. You will build your own web mapping applications, including story maps. You will gain skills and confidence to empower you to be able to conduct your own field studies and use maps as analytical tools to build a brighter, more sustainable, more resilient tomorrow!

This course is completely online and asynchronous. However, to foster community and networking, you are strongly encouraged to work through the course in step with your classmates; that is, completing Week 1 content *sometime during* Week 1, completing Week 2 content *sometime during* Week 2, and so on. Choose your coursework time that best fits your schedule. We will also hold occasional live virtual sessions in Zoom, as needed. This is a compressed 4 credit course: Therefore, plan to spend at least *10 hours each week* working through the content of this course.

Course Learning Outcomes

1. Identify ways in which GIS, maps, and geo-visualizations are providing a common language and framework for **communication and solving problems.**
2. Apply **cartographic design** principles such as symbology, color, and classification methods to create, modify, and critically evaluate **effective maps and visualizations.**
3. **Analyze environmental and other data spatially** with web GIS tools using a variety of techniques, including visualization, filtering, map overlay, routing, mean center, and proximity.
4. Demonstrate **how to create and map data** from spreadsheets, from GPS data, from field surveys, from joining data, and from pre-existing maps.
5. Identify **how society influences mapping, and how mapping influences society**, through data availability, data quality, map projections, crowdsourcing, location privacy, the Internet of Things, and design, and examine the connections between Christian ethics, GIS, and environmental science.
6. **Create multimedia 2D maps and 3D scenes that effectively communicate** an environmental issue, event, or theme, via results of a research investigation.

Course Purpose and Expectations

The purpose of this course is to lay a firm foundation for your successful use of GIS by introducing you to the ways that digital maps from GIS can be created, symbolized, and used in visualizations to solve problems and serve as communication tools in environmental science and beyond. Through this course, you will gain fundamental skills in cartography and spatial analysis with an environmental focus through hands-on work. But equally importantly, you will gain understanding of the technological and societal implications that these tools have on 21st Century society and how you can chart your own pathway forward using these tools and perspectives.

Prerequisites

This course has no prerequisites, other than a desire to learn, an inquisitive mind, and a goal to be a positive change agent in the world 😊. It is advisable, however, for you to be comfortable with operating a web browser, understanding the difference between file types (DOCX, JPG, PNG, XLSX), and be comfortable with managing files and folders on your own device (laptop or tablet).

Required Texts and Materials

Given the rapidly evolving nature of geotechnologies, there is no suitable required text for this course. However, there **are** required readings and videos for this course, which are given in sequential order as follows:

Videos

You will be watching and reflecting upon a set of 1 to 3 short videos each week.

Readings and Discussions

In your overview in Populi, our Learning Management System (LMS), you will find a main set of readings

for each week. There are 5 sets of readings total, one set of each week. Videos are sometimes embedded within these readings. Please promptly inform your instructor if you are not able to open any content. Labs (hands-on work with GIS and maps) build on the reading content of each module and allow you to work in a problem-solving mode with the topics raised in the readings. Therefore, it is recommended to work through the readings first before completing the hands on activities (labs) for each week. At the end of each week's readings, you will be asked a short set of questions to respond to in discussion mode so that we can all be learning from each other.

References

You will be provided with a reference list of articles and other resources in this course. Feel free to explore these as you have time, or even after this course ends, to keep learning and moving forward. You won't be graded on any of these outside readings unless they are included in the main readings for each week.

Labs (Hands-on Activities) and Discussions

Maps and geo-visualizations are inherently so compelling, so visual, and so appropriate for addressing real and serious issues in our world (from population to water, from biodiversity to health, from equity to energy, and more) that each week you will have the opportunity to work with data, tools, and maps to address these issues. At the end of each hands-on lab, you will be presented with a short set of questions to respond to in a discussion forum. You will often be asked to share the URLs of the maps you create in this courses so everyone can see your maps and learn from your work.

Quizzes

At the end of each week, you will be given a short quiz of 6 questions. Rather than viewing them as a stress-inducing item, use them as a self-assessment opportunity to gauge how much you are learning and moving forward.

Course Policies

Technology Requirements

You will need:

1) Software:

   (1a) Software: Access to Microsoft Office software (Word and Excel) for completion of selected assignments (or the ability to export a DOCX file via Open Office or Google Docs).

   (1b) ArcGIS Online (www.arcgis.com). This is our main GIS platform for this course. ArcGIS Online, as the name implies, runs completely online on the web and requires nothing to be installed on your local device. Most of the activities using ArcGIS Online in this course requires a sign in; that is, for you to be a named user with creator/publisher privileges within the AuSable ArcGIS Online organizational account. The Au Sable ArcGIS Online administrator will invite you to join this organizational account by the time the course begins. You will sign in to www.arcgis.com and you will be a named user in that organizational account. All of the maps, web mapping applications (such as story map), and spatial data that you create will be stored in this ArcGIS Online account. You should share your maps with the **organization** and not with "everyone" (that is, the whole world); that way, only those of us (your instructor and your fellow students) will have the ability to view the maps and apps that you share.

   (1c) We will use other mapping tools besides ArcGIS Online occasionally in the course as well, such as WorldMapper for the analysis of cartograms and assorted other tools. These will all run in a web browser requiring no sign in or installation of software.

2) Hardware:
(2a) Access to a computer (laptop or high end tablet). Note that a Chromebook or iPad will allow you to be successful only with a *fraction* of this course.

(2b) A smartphone for collecting data in the field in your own area that you will map and analyze.

3) A broadband connection to the Internet.

Late Assignments Policy
This course is only 5 weeks long, so it is especially critical that you turn your work in each week as appropriate. In general, assignments turned in late will still be graded but will be subject to a 10% reduction in points so long as they are turned in no longer than 2 weeks past the due date. This policy may be waived in case of personal emergency, but ***it is your responsibility*** to notify your instructor and request an extension.

Class Participation
While there are no face-to-face class sessions, key to success in the use of GIS is networking and peer-to-peer interaction. Therefore, full and collegial participation is required for student success in the course. An "absence" is a gap in a student's full participation that results in their completing less than 50% of the required activities for that week, or a lack of participation in the discussion forums for entire week. **Your instructor is here to help you to succeed**, so keep the lines of communication open.

Course and Instructor Evaluations
At the conclusion of every Au Sable course, you will be asked to evaluate the course and instruction that you experienced. Providing feedback through course evaluations is an important responsibility for every student, and the process is entirely anonymous and secure. I as your instructor will not have access to course evaluations until after grades are submitted.

I take those evaluations seriously and I use them to help me improve future offerings of this course and to help me to become a better instructor for other courses. I and other faculty members use course evaluations to improve teaching effectiveness, to revise courses, and to evaluate the program. Course evaluations are also considered in the hiring, retention, promotion, and tenure of faculty members.

Academic Integrity
In keeping with our Christian heritage and commitment, Au Sable Institute is committed to the highest possible ethical and moral standards. Just as we will strive to live up to these high standards, we expect our students to do the same. To that end, cheating of any sort will not be tolerated. Students who are discovered cheating are subject to discipline up to and including failure of a course and expulsion. Cheating includes but is not limited to: 1. Plagiarism – the use of another's work as one's own without giving credit to the individual. This includes using materials from the internet. 2. Copying another's answers on an examination. This includes copying and pasting answers from a website (i.e. Wikipedia) into your quizzes without proper attribution. 3. Deliberately allowing another to copy one's answers or work.

Accessibility Statement
Au Sable is committed to creating an inclusive learning environment. If you anticipate or experience any barriers to learning in this class related to a disability, contact the Au Sable staff at https://ausable.populiweb.com/router/contacts/people/directory to schedule an appointment.

Title IX

Students who believe they have been harassed, discriminated against, or involved in sexual violence should contact Au Sable for information about campus resources and support services, including confidential counseling services. Your instructor is concerned about the well-being and development of all students, and is available to discuss any concerns.

Faculty are legally obligated to share information with the Institute's Title IX coordinator in certain situations to help ensure that the student's safety and welfare is being addressed, consistent with the requirements of the law. These disclosures include but are not limited to reports of sexual assault, relational/domestic violence, and stalking. Please refer to the following site for contact information and further details: https://ausable.populiweb.com/router/contacts/people/directory

Method of Assessment and Grading Rubrics

Labs Discussions:	5 labs x 10 points each =	50 points
Readings Discussions:	5 discussions x 5 points each =	25 points
Quizzes:	5 quizzes (each is 6 questions) x 3 points each =	15 points
Implementation Plan:	1 plan x 10 points =	10 points
Total:		100 points

Details:

DATE DUE	ASSIGNMENT NAME	POINTS
End of Week 1	Week 1 Readings Discussion	5
End of Week 1	Week 1 Lab Discussion	10
End of Week 1	Week 1 Quiz	3
End of Week 2	Week 2 Readings Discussion	5
End of Week 2	Week 2 Lab Discussion	10
End of Week 2	Week 2 Quiz	3
End of Week 3	Week 3 Readings Discussion	5
End of Week 3	Week 3 Lab Discussion	10
End of Week 3	Week 3 Quiz	3
End of Week 4	Week 4 Readings Discussion	5
End of Week 4	Week 4 Lab Discussion	10
End of Week 4	Week 4 Quiz	3
End of Week 5	Week 5 Readings Discussion	5
End of Week 5	Week 5 Lab Discussion	10
End of Week 5	Week 5 Quiz	3
End of Week 5	Implementation plan	10
	Total	**100**

Grading Rubrics: For each type of assignment, a grading rubric has been developed.

The weekly **discussion** rubric is as follows:

Category	5 Points	2 Points	0 Points
Discussion *quantity*	At least 1 original discussion post **and** 1 reply to another student's discussion is posted.	Only 1 original discussion is posted **or** 1 reply to another student's discussion is posted, but not both.	No discussion is posted.
Discussion *quality*	Discussion posts are substantive and relate to key principles of the assignment.	Discussion posts are generally short phrases demonstrating that the readings have only been skimmed and/or not much effort is made.	No discussion is posted.

The weekly **lab** assignment rubric is as follows:

Category	10 Points	5 Points	2 points	0 Points
Key Principles	Questions are answered with understanding of the fundamentals of visualization and analysis.	Only some questions are answered with understanding of the fundamentals of visualization and analysis.	Few questions are answered with evidence of understanding of the fundamentals of visualization and analysis.	No questions are answered.
Skills	Maps are created, visualizations constructed, and analysis conducted with sufficient evidence that the necessary skills have been acquired.	Maps are created, visualizations constructed, and analysis conducted with only some evidence that the necessary skills have been acquired.	Most maps are created, visualizations constructed, and analysis conducted with no evidence that the necessary skills have been acquired.	No maps or visualizations are created.

The weekly **quiz** rubric is as follows:

Category	3 Points	2 Points	0 Points
Quiz results	Questions are answered with understanding of the fundamentals of visualization and analysis. All quiz answers are correct.	Only some questions are answered with understanding of the fundamentals of visualization and analysis and/or some quiz answers are incorrect.	No questions are answered with evidence of understanding of the fundamentals of visualization and analysis; none of the quiz answers are correct.

The course **implementation** plan rubric is as follows:

Category	10 Points	2-5 Points	0 Points
Quiz results	A plan of implementing specific data layers, perspectives, and tools is outlined with benchmarks.	Only a partial or vague plan of implementing what was learned in this course is briefly described.	No plan of implementing what was learned in this course is provided.

Grading Scale

The following table shows how point percentages for the course correspond to the standard grades and grade points used at Au Sable (left) and non-passing administrative grades used (right):

Course Percentage	Letter Grade	Grade Points			
95-100%	A	4.00		DW (Dropped without permission)	0.00
90-94.9%	A-	3.67		W (Withdrawal)	0.00
87-89.9%	B+	3.34		I (Incomplete)	0.00
83-86.9%	B	3.00		NG (no grade)	0.00
80-82.9%	B-	2.67		NS (Not submitted)	0.00
77-79.9%	C+	2.34		AU (Audit)	0.00
73-76.9%	C	2.00			
70-72.9%	C-	1.67			
67-69.9%	D+	1.34			
63-66.9%	D	1.00			
60-62.9%	D-	0.67			
0-59.9%	F	0.00			

Weekly Course Outline and Checklist. Feel free to use this to keep track of your progress.

Week	Readings and Videos	Readings Discussions	Lab Discussions and Quizzes
1	Readings ❑ Videos: ❑	Readings Discussion 1 ❑	Lab Discussion 1 ❑ Quiz 1 ❑
2	Readings ❑ Videos: ❑	Readings Discussion 2 ❑	Lab Discussion 2 ❑ Quiz 2 ❑
3	Readings ❑ Videos: ❑	Readings Discussion 3 ❑	Lab Discussion 3 ❑ Quiz 3 ❑
4	Readings: ❑ Videos: ❑	Readings Discussion 4 ❑	Lab Discussion 4 ❑ Quiz 4 ❑
5	Readings: ❑ Videos: ❑	Readings Discussion 5 ❑	Lab Discussion 5 ❑ Quiz 5 ❑ Your implementation plan ❑

Course Schedule

June 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5 Week 1	6	7	8	9	10	11
12 Week 2	13	14	15	16	17	18
19 Week 3	20	21	22	23	24	25
26 Week 4	27	28	29	30		

July 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3 Week 5	4	5	6	7	8 Course Ends	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Weekly Course Themes

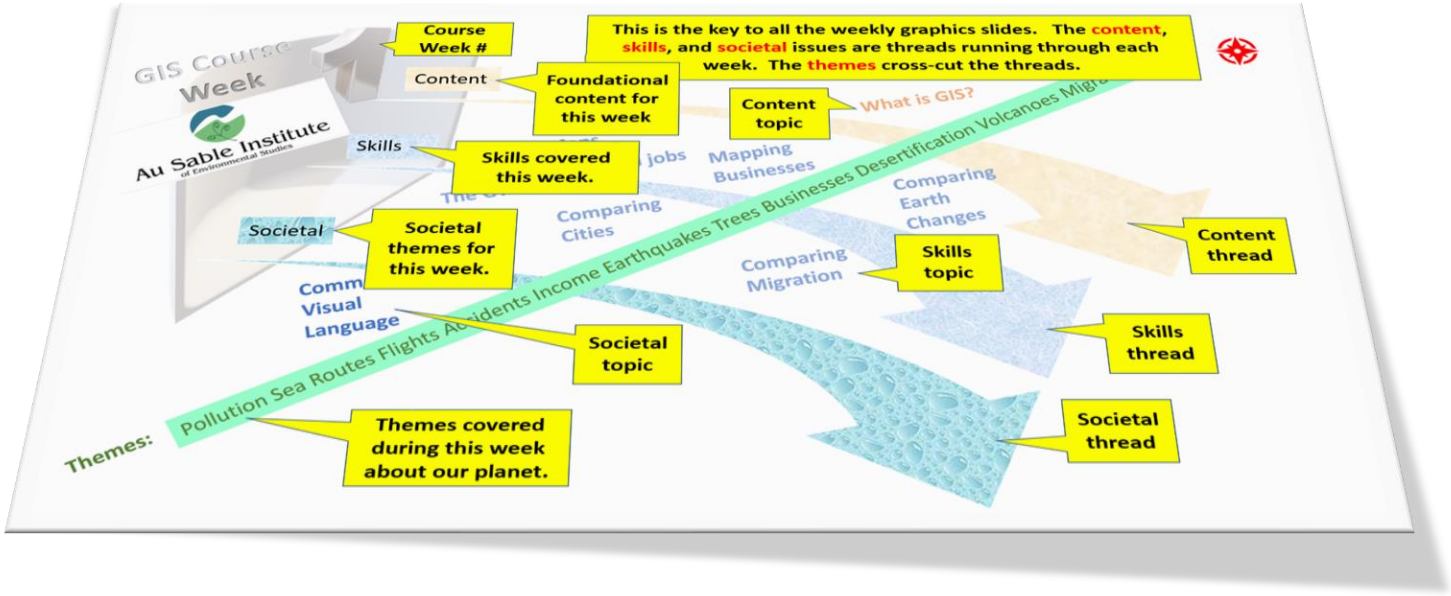
Week 1: Get Mapping! Introduction to GIS in Environmental Science
Week 2: Space, Place, and Time.
Week 3: From the Field to the Lab.
Week 4: Surveys, Stories, and Spatial Analysis.
Week 5: The Future is Now.

Each week, you will learn **core content,** develop a set of **technical skills**, and address a **societal issue** associated with geotechnologies.

Weekly Course Maps

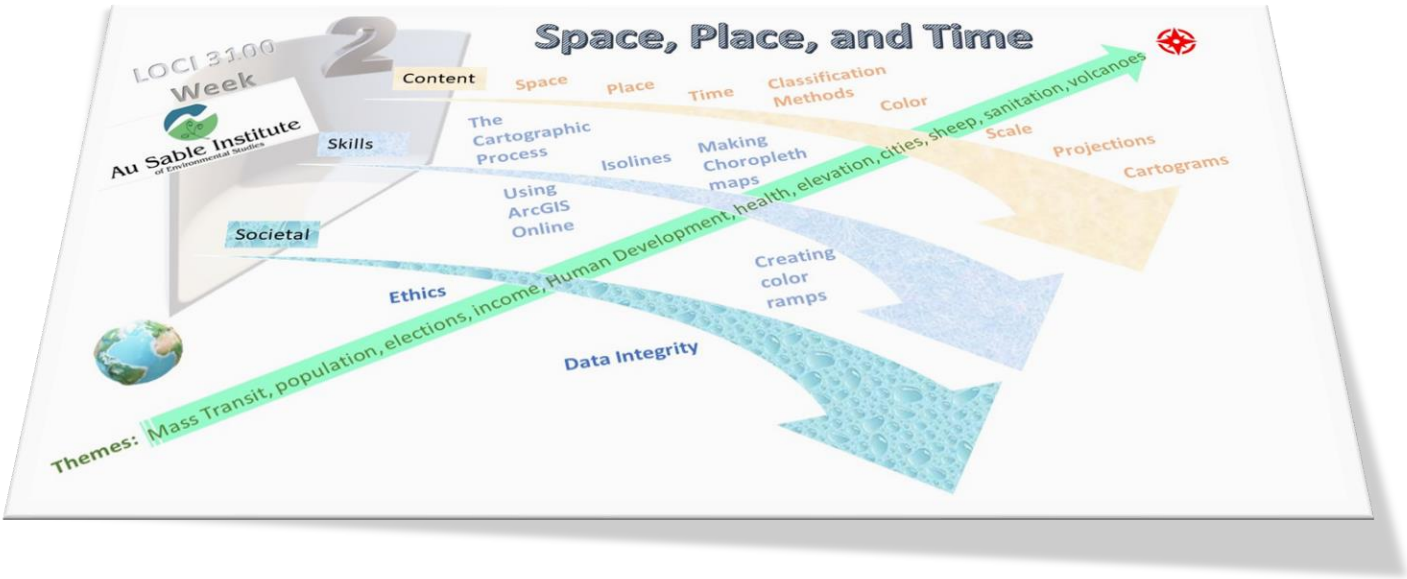
The following maps for each week have been created to help you understand how the above 3 threads of content, skills, and societal issues weave together.

Key to weekly course maps:

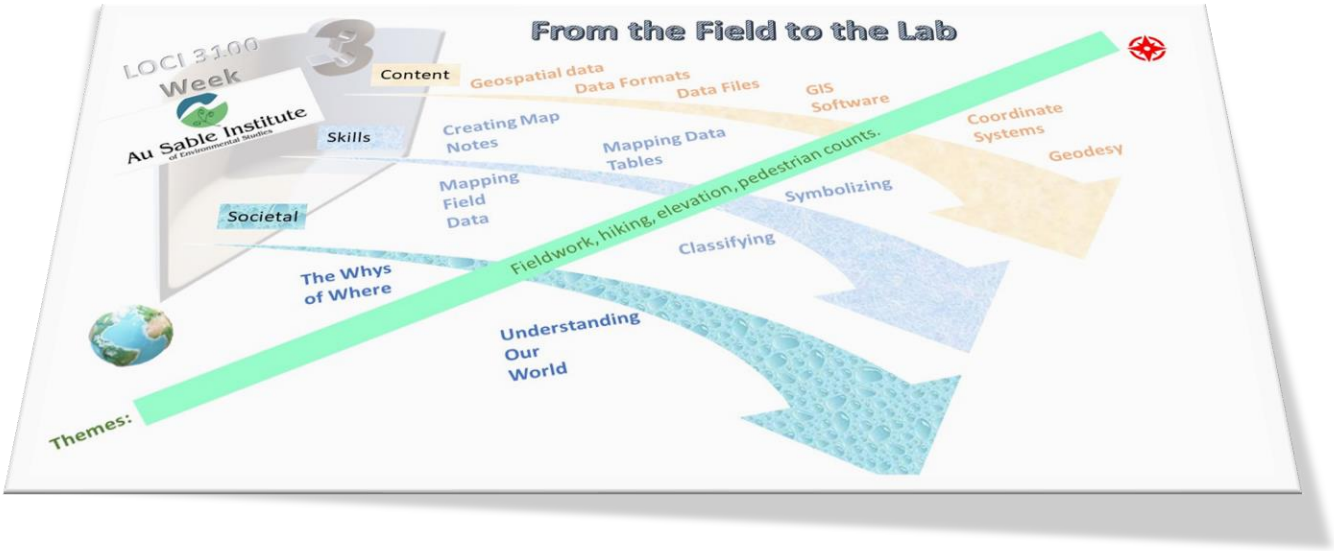


Week 1 course map:

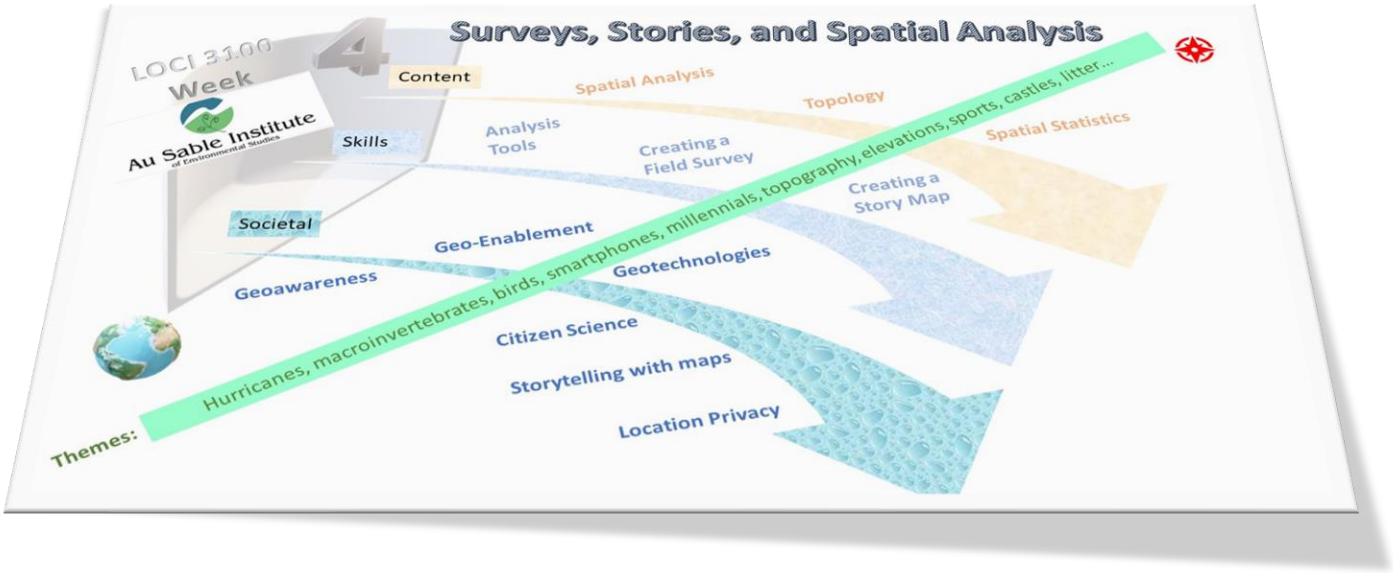
Week 2 course map:



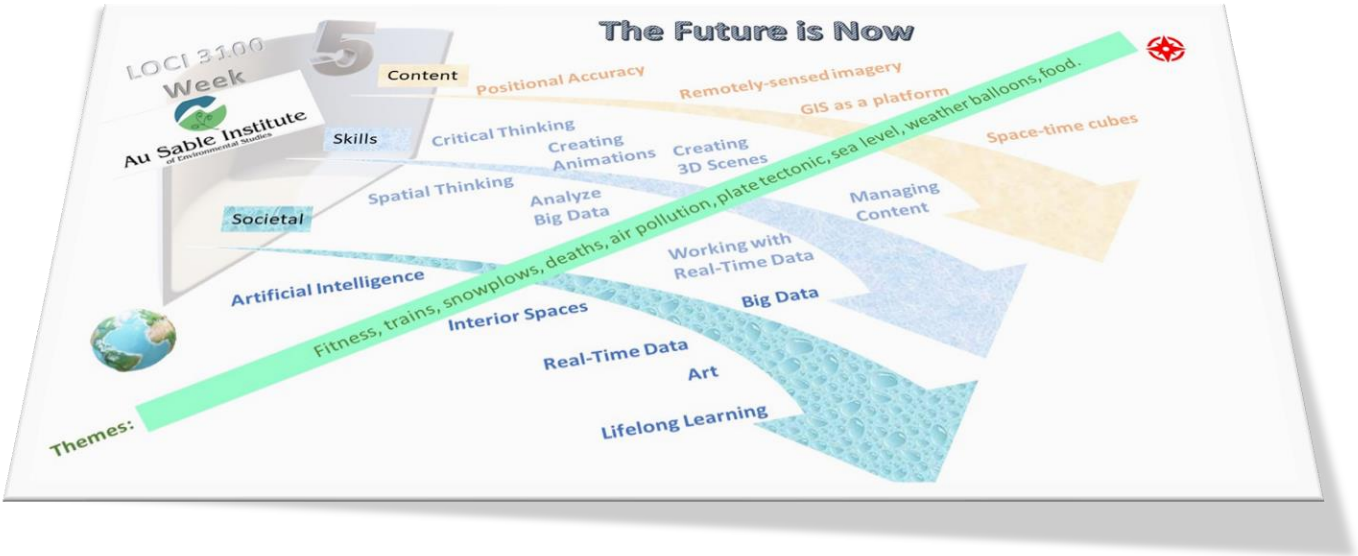
Week 3 course map:



Week 4 course map:



Week 5 course map:



Detailed Course Plan

Week	Course-Level Learning Objectives	Weekly-Level Learning Objectives	Assessments	Instructional Materials	Learning Activities
Week 1: **Get Mapping!** **Introduction to GIS in Environmental Science**	1. Identify ways in which GIS, maps, and geo-visualizations are providing a common language and framework for communication and solving problems. 2. Apply cartographic design principles such as symbology, color, and classification methods to create, modify, and critically evaluate effective maps and visualizations. 3. Analyze environmental and other data spatially with web GIS tools using a variety of techniques, including visualization, filtering, map overlay, routing, mean center, and proximity. 4. Demonstrate how to create and map data from spreadsheets, from GPS data, from field surveys, from joining data, and from pre-existing maps. 5. Identify how society influences mapping, and how mapping influences society, through data availability, data quality, map projections, crowdsourcing, location privacy, the Internet of Things, and design, and examine the connections between Christian ethics, GIS, and environmental science. 6. Create multimedia 2D maps and 3D scenes that effectively communicate an environmental issue, event, or theme, via results of a research investigation.	1. Define what a map is, identify several types of maps, define what GIS, define a Geographic Information Systems, and identify why maps GIS matter to society, 2. Describe how information is represented in a GIS. 3. Identify and describe 2-3 careers that use GIS and how they do so. 4. Use ArcGIS Online to examine selected environmental patterns. 5. Use selected web mapping applications to examine spatial patterns. 6. Be able to state why it is important to be critical of mapped data, and provide one example.	1. Discussion Board: Ways in which online mapping is transforming some aspect of society, student use of mapping tools, and societal issue: Finding and assessing data, the open data movement, and metadata. 2. Participation in crowdsourced web map: Tree or plant species where you live. Assess web apps in terms of purpose, audience, scale, and symbology. 3. Completion of hands-on mapping activity. Explore data, analyze and modify maps—spatial patterns, symbology, the geodatabase, metadata. 4. Quiz 1: 1 question on societal issue; 2 questions on elements and design, 2 questions on hands-on activity, and 1 reflective question: What was the most significant thing you learned this week?	1. Weekly video and selected videos on Course introduction. Why get excited about web maps? Kerski's presentation on the evolution of mapping and the whys of where. 2. Readings: What is GIS? Why maps? GIS as a platform. History of GIS. Geospatial technology competency model. Organizations that use GIS. 3. Lab: Exploring maps and apps, comparing earth changes, cities, and other data.	1. Watch and reflect upon videos. 2. Read and reflect upon the readings. 3. Respond to discussion forum on readings. 4. Complete hands-on activity. 5. Complete quiz.
Week 2: **Space, Place, and Time.**	1. Identify ways in which GIS, maps, and geo-visualizations are providing a common language and framework for communication and solving problems. 2. Apply cartographic design principles such as symbology, color, and classification methods to create, modify, and critically	1. Describe how space, place, and time can be analyzed using GIS maps and tools. 2. Describe ways of locating objects on the planet with addresses and latitude and longitude. 3. Identify why map projections matter and scale matter in	1. Discussion Forum on Readings. 2. Completion of hands-on mapping activity. Share and reflect in Discussion Forum. 3. Quiz 2: 1 question on societal issue; 2 questions on elements and design, 2 questions on hands-on activity,	1. Weekly video and Selected videos on week 2: Map design and spatial analysis. 2. Readings: Space, place, time, classification methods, color, scale, projections, cartograms, isolines. Data integrity. Ethics. Geospatial	1. Watch and reflect upon videos. 2. Read and reflect upon the readings. 3. Respond to discussion forum on readings.

Week	Course-Level Learning Objectives	Weekly-Level Learning Objectives	Assessments	Instructional Materials	Learning Activities
	evaluate effective maps and visualizations. 3. Analyze environmental and other data spatially with web GIS tools using a variety of techniques, including visualization, filtering, map overlay, routing, mean center, and proximity. 4. Demonstrate how to create and map data from spreadsheets, from GPS data, from field surveys, from joining data, and from pre-existing maps. 5. Identify how society influences mapping, and how mapping influences society, through data availability, data quality, map projections, crowdsourcing, location privacy, the Internet of Things, and design, and examine the connections between Christian ethics, GIS, and environmental science. 6. Create multimedia 2D maps and 3D scenes that effectively communicate an environmental issue, event, or theme, via results of a research investigation.	communicating with maps. 4. Describe the cartographic design process. 5. Identify at least 3 cartographic classification methods. 6. Describe why ethics matter in GIS. 7. Use ArcGIS Online to classify and symbolize data. 8. Use ColorBrewer and the Axis Maps contour generator. 9. Interact with 3D globes to understand cities and population distribution. 10. Create cartograms and understand what cartograms are. 11. Use ArcGIS Online to filter and examine imagery to understand the eruptions in Kilauea. 12. Use a story map to understand a current event (here, the Kilauea eruptions). 13. Identify the three legs of geoliteracy. 14. Identify the two data models of GIS (raster and vector) and give one example of each. 15. Describe at least three types of files that can be used in a GIS. 16. Understand where to obtain spatial data for GIS analysis. 17. Understand how the Earth's shape is measured and describe why the Earth's shape matters to GIS analysis. 18. Map data from GPX files and from spreadsheets in ArcGIS Online. 19. Add data from the Living Atlas to ArcGIS Online. 20. Create bi-variate maps. 21. Add multimedia to maps via map notes and from spreadsheets.	and 1 reflective question. From th5	data, data formats, data files, GIS software, coordinate systems, geodesy. The whys of where. 3. Lab: Using color, creating isolines, making choropleth maps, spatial analysis, using ArcGIS Online maps and apps. Creating map notes, mapping field data, mapping spreadsheets, classifying, filtering, and symbolizing. 4. Readings: geospatial data, data formats, data files, GIS software, coordinate systems, geodesy. The whys of where.	4. Complete hands on activity. 5. Complete quiz.

Week	Course-Level Learning Objectives	Weekly-Level Learning Objectives	Assessments	Instructional Materials	Learning Activities
Week 3: **From the Field to the Lab**	1. Identify ways in which GIS, maps, and geo-visualizations are providing a common language and framework for communication and solving problems. 2. Apply cartographic design principles such as symbology, color, and classification methods to create, modify, and critically evaluate effective maps and visualizations. 3. Analyze environmental and other data spatially with web GIS tools using a variety of techniques, including visualization, filtering, map overlay, routing, mean center, and proximity. 4. Demonstrate how to create and map data from spreadsheets, from GPS data, from field surveys, from joining data, and from pre-existing maps. 5. Identify how society influences mapping, and how mapping influences society, through data availability, data quality, map projections, crowdsourcing, location privacy, the Internet of Things, and design, and examine the connections between Christian ethics, GIS, and environmental science. 6. Create multimedia 2D maps and 3D scenes that effectively communicate an environmental issue, event, or theme, via results of a research investigation.	1. Critically assess maps, identifying one good and one poor example of map design in any map examined. 2. Identify two principles of typography on maps. 3. Define Fitness for Use and Truth in Labeling in mapping. 4. Describe at least three reasons why data quality matters in GIS work. 5. Define the "fee vs. free" debate in the provision of data, and describe the open data movement. 6. Map and analyze demographic variables in ArcGIS Online. 7. Calculate a drive-times and walk times in ArcGIS Online. 8. Create proximity buffers, routes, and summarize within, in ArcGIS Online. 9. Filter, dissolve, intersect, and enrich data in ArcGIS Online. 10. Use ArcGIS Online to be able to make a decision. 11. Critically assess maps, identifying one good and one poor example of map design. 12. Identify 2 principles of typography on maps. 13. Define fitness for use and truth in labeling in mapping. 14. Describe at least 3 reasons why data quality matters in GIS work. 15. Define the fee vs free debate in the provision of mapped data and describe the open data movement. 16. Map and analyze demographic variables in ArcGIS Online. 17. Calculate a drive-times and walk times in ArcGIS Online. 18. Create proximity buffers, routes, and summarize within, in ArcGIS Online.	1. Discussion Forum on Readings. 2. Completion of hands-on mapping activity. Share and reflect in Discussion Forum. 3. Quiz 3: 1 question on societal issue; 2 questions on core content, 2 questions on hands-on activity, and 1 reflective question.	1. Video: Weekly introduction. 2. Readings: spatial analysis, topology, spatial statistics. Geo-awareness, geo-enablement, geotechnologies, citizen science, storytelling, location privacy. Cartographic design, spatial statistics, data quality, fee vs free data. 3. Lab: Analyzing data, creating a field survey using Survey123 on an environmental topic, creating a story map. Analyzing natural hazards in a mountain county. Spatial thinking, cartographic tools, analysis tools, critical thinking.	1. Watch and reflect upon videos. 2. Read and reflect upon the readings. 3. Respond to discussion forum on readings. 4. Complete hands-on activity. 5. Complete quiz.

Week	Course-Level Learning Objectives	Weekly-Level Learning Objectives	Assessments	Instructional Materials	Learning Activities
		19. Filter, dissolve, intersect, and enrich data in ArcGIS Online. 20. Use ArcGIS Online to be able to make a decision.			
Week 4: **Surveys, Stories, and Spatial Analysis**	1. Identify ways in which GIS, maps, and geo-visualizations are providing a common language and framework for communication and solving problems. 2. Apply cartographic design principles such as symbology, color, and classification methods to create, modify, and critically evaluate effective maps and visualizations. 3. Analyze environmental and other data spatially with web GIS tools using a variety of techniques, including visualization, filtering, map overlay, routing, mean center, and proximity. 4. Demonstrate how to create and map data from spreadsheets, from GPS data, from field surveys, from joining data, and from pre-existing maps. 5. Identify how society influences mapping, and how mapping influences society, through data availability, data quality, map projections, crowdsourcing, location privacy, the Internet of Things, and design, and examine the connections between Christian ethics, GIS, and environmental science. 6. Create multimedia 2D maps and 3D scenes that effectively communicate an environmental issue, event, or theme, via results of a research investigation.	1. Identify the 5 forces acting to shape GIS and why they matter. 2. Identify the key issues around location privacy. 3. Explain what topology is and why it matters to GIS. 4. Explain what spatial analysis is and name some core spatial analysis tools. 5. Gain comfort in critically assessing a wide variety of maps, infographics, and geovisualizations.	1. Completion of readings. 2. Completion of hands-on mapping activity. Share and reflect in Discussion Forum. 3. Quiz 4: 1 question on societal issue; 2 questions on core content, 2 questions on hands-on activity, and 1 reflective question.	1. Video: Weekly introduction. 2. Readings: Forces and trends in GIS, Legal issues, data quality, metadata, data standards, continuous surface maps, cartographic design. 3. Lab: Creating a Survey123 with an environmental theme, studying location privacy, creating a story map, spatial analysis: Trace Downstream, zebra mussel study in invasive species.	1. Watch and reflect upon videos. 2. Read and reflect upon the readings. 3. Respond to discussion forum on readings. 4. Complete hands-on activity. 5. Complete quiz.
Week 5: **The Future is Now: 3D, animations, big data, and more.**	1. Identify ways in which GIS, maps, and geo-visualizations are providing a common language and framework for communication and solving problems. 2. Apply cartographic design principles such as symbology, color, and	1. Define spatial positional accuracy. 2. Describe two advantages to UAV Drone data over traditional satellite imagery. 3. Define what a map animation is and be able to create one.	1. Completion of readings. 2. Completion of hands-on mapping activity. Share and reflect in Discussion Forum. 3. Quiz 5: 1 question on societal issue; 2 questions on core content, 2 questions	1. Video: Weekly introduction. 2. Readings: Artificial intelligence, interior space mapping, BIM, real time data, art, the Internet of Things, lifelong learning.	1. Watch and reflect upon videos. 2. Read and reflect upon the readings. 3. Respond to discussion

Week	Course-Level Learning Objectives	Weekly-Level Learning Objectives	Assessments	Instructional Materials	Learning Activities
Turn in all remaining assignments.	classification methods to create, modify, and critically evaluate effective maps and visualizations. 3. Analyze environmental and other data spatially with web GIS tools using a variety of techniques, including visualization, filtering, map overlay, routing, mean center, and proximity. 4. Demonstrate how to create and map data from spreadsheets, from GPS data, from field surveys, from joining data, and from pre-existing maps. 5. Identify how society influences mapping, and how mapping influences society, through data availability, data quality, map projections, crowdsourcing, location privacy, the Internet of Things, and design, and examine the connections between Christian ethics, GIS, and environmental science. 6. Create multimedia 2D maps and 3D scenes that effectively communicate an environmental issue, event, or theme, via results of a research investigation.	4. Identify at least two trends changing GIS (such as big data, Artificial Intelligence, the Internet of Things, UAVs, 3D, Building Information Management). 5. Discuss two reasons why GIS becoming a platform is important to society. 6. Create a 3D scene in ArcGIS Online. 7. Manage your content in ArcGIS Online (folders, groups, sharing, data types). 8. Identify ways in which you will use what you learned in this course.	on hands-on activity, and 1 reflective question. 4. Implementation plan—what is 1 thing that you do with what you have learned?	3. Lab: Working with real time and big data, creating animations and 3D scenes from earthquakes and weather balloon data.	forum on readings. 4. Complete hands-on activity. 5. Complete quiz. 6. Complete implement ation plan.