EAS 531 / ENVIRON 411: Principles of GIS

Instructors	Professor: Dr. Kathleen Bergen, School for Environment & Sustainability	Secs 002 & 004 GSI: Colin Welk, School for Environment & Sustainability	Sec 003 GSI: Shannon Blair, School for Environment & Sustainability
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Office Hours	Monday 4-5:30 pm	TBD	TBD
Class Meets	Lecture (001): Mondays and Wednesdays 2:30 - 4 pm (synchronous remote lecture class) Lab: Thurs. 6:30-9:00 pm (002); Fri. 9-11:30 am (003); Fri. 11:30-2pm (004) (synchronous remote lab class)		
Objectives	One of the most relevant and highest growth job markets in environmental sciences is Geographic Information Systems (GIS). Graduates of this comprehensive *Principles of GIS* course are well-prepared for jobs having GIS components in a variety of professional fields. The goals of this class are therefore to provide a firm understanding of the conceptual and analytical approaches and uses (lecture), plus technical methods (lab) in GIS. The lab is mainly taught using latest versions of ArcGIS Desktop and ArcGIS Pro; we will also introduce QGIS. Labs and lecture also cover applications of GIS in the natural, social, data, and environmental sciences making this course of interest to students broadly.		
Prerequisites	There are no specific prerequisites other than graduate or jr/sr standing. Prior general exposure to any type of analysis and quantitative reasoning is no doubt helpful. This course can be taken as a first comprehensive GIS course or as a follow-on to GIS courses with more limited content. We introduce and teach what you need to learn. Past experience has shown that students both with and without prior exposure to GIS can succeed equally well in this course if they apply themselves and keep up with the coursework and reading.		
Main Deliverables	This is a high-content lecture-lab course. Deliverables are two lecture exams (midterm and final), and weekly lab assignments. lab assignments (the homework for this course) require additional work outside of scheduled lab times.		
Required Textbook	**Required Textbook** – you will read much of Bolstad, P. *GIS Fundamentals: A First Text on Geographic Information Systems,* **Sixth Edition** (inexpensive and should also come with digital access). At **Barnes & Noble,** follow textbook link for course in Wolverine Access.		
CANVAS site	An EAS531/ENVIRON411 CANVAS site will be used for class announcements, to distribute pdf copies of lecture slides, scheduling, lecture & lab recordings, materials for lab assignments, online submission of lab assignments, grading, exams, etc.		

Course Policies

Attendance	The course will be taught in synchronous remote mode this Fall 2020*. (*note: if you are an international student located in a significantly different time zone let us know at beginning of the course for asynchronous material).
	The best predictors of performance in 531/411 are 1) thorough familiarity with lecture material 2) reading the textbook, and 3) completion of labs. Be on time for synchronous lecture and lab sessions (computer connection up and ready to go!) *(see above)
	We encourage you not to be absent during the academic semester. However, if you have any

	unavoidable formal absences (i.e. a required conference presentation etc.) that might interact with lab or other graded deadlines you must: a) let us know about this at the ***beginning of the semester*** and b) provide a formal note from your academic advisor. If absences conflict significantly with this course and its graded material, they may not be approved. See also Exams and Grading below. Do ***not*** plan to miss exams.
Labs & Assignments	Synchronous remote labs will start promptly on the hour or half hour. Attendance at synchronous lab sessions is expected* as it is the most efficient time to interact with your GSI regarding questions about the technical aspects of lab. Doing so will be considerate of your GSI's time. Be on time (computer connection up and ready to go!). The GSI also gives a short presentation at the beginning of each lab. If you will have to miss lab, notify your GSI as soon as possible beforehand. (*exception, overseas students in significantly different time zones) Although you may talk to each other about lab assignments, **each student is expected to do every part of each lab themselves and to turn in your own unique write-ups and maps. Written answers must be <u>in your own words</u>.** This is, of course, also how you will **learn**. You will have one week to complete a lab assignment. Completed labs must be submitted before or by the official start of your next lab period to be on time. Labs must be submitted via the assignment tool on CANVAS as a single PDF file. (To do this it will be necessary to convert Word documents and map files to PDFs and merge them so contact your GSI if you're unsure how to do this). Maps must always be on a <u>separate page</u> and in the best format for the shape of the particular map (landscape or portrait). **<u>Always name your file as follows:</u>** Uniqname_LabAssignment## example: kbergen_Lab12
Grading and Exams	Your semester grade will be based on one lecture midterm exam, one lecture final exam (both also remote, through Canvas), and 12 lab assignments. Lecture exams are cumulative and focus on thorough understanding of the concepts presented in both lecture and textbook. Dr. Bergen will grade these exams. Should serious circumstances beyond your control result in missing an examination, documented verifiable evidence must be presented. Otherwise missed examinations will not qualify for make-up procedures. Your lab grade will be based on 12 (weekly) lab assignments. Your lab instructor (GSI) will grade your lab assignments. Unexcused late lab assignments will lose 2 points per day late, up to a maximum of 50% lost (in addition to points lost due to answer quality) if turned in.
Disabilities or Religious holidays	We will make every effort to accommodate the needs of students with hearing, visual, or other disabilities in coordination with Rackham policy: https://rackham.umich.edu/rackham-life/students-with-disabilities/accommodations-for-graduate-students-with-disabilities/ . Likewise, we will try to accommodate for major religious holidays. If you are an SEAS international student located in a significantly different time zone let us know at beginning of the course and also contact SEAS OAP staff so that they have a record of this situation. *Be sure to let us know your needs **well in advance**.*

Computing

Remote Instruction Software	Remote instruction for lecture is expected to take place using Zoom and/or BlueJeans. All students should have both Zoom and BlueJeans software/app loaded on their personal computers before the first day of class (first synchronous lecture session) and know how to connect. You will receive a meeting invite prior to your first class period – check your UMICH email. Zoom: https://its.umich.edu/communication/videoconferencing/zoom/getting-started BlueJeans: https://its.umich.edu/communication/videoconferencing/blue-jeans/getting-started

Personal Computing for Labs	For this course, you will use ESRI ArcGIS Desktop (version 10.8) and ESRU ArcGIS Pro (version 2.5) either through installing the software on your computer (Windows OS), or through network access to the software on the UM ITS *Virtual Sites* or both. ESRI ArcGIS software is written only for Windows OS. UM provides Macs access to the software 'virtually' through *Virtual Sites* (or you may want to investigate software such as Bootcamp that installs a Windows partition on a Mac). You will also need to have a good Internet connection to work from home (access software via *Virtual Sites*, transfer datasets, etc.). Optional: some students with laptops like to have optional laptop docking station with a larger external monitor and external keyboard/mouse. Here is the ESRI information on computing configurations for your reference: https://pro.arcgis.com/en/pro-app/get-started/arcgis-pro-system-requirements.htm https://desktop.arcgis.com/en/arcmap/latest/get-started/setup/arcgis-desktop-system-requirements.htm https://pro.arcgis.com/en/pro-app/get-started/run-pro-on-a-mac.htm
Lab Software & Access	UM Information Technology (ITS) has site licenses to costly ESRI GIS software. As part of that you will have free student ESRI software to load on your computer (assuming you can run a Windows OS) OR access the software remotely (via *Virtual Sites* and *Apps Anywhere*) from your computer. At this writing it is our understanding that you are responsible for your own computer's systems administration. Here is the UM site with fuller explanations of hardware, software, and/or installations for use of ESRI GIS products (including for Macs). Additional information below as well. https://docs.google.com/document/d/11yka41nNApAfsEVaL4JCtV0dRflJC8FDeGcRuBNMvWc/edit **Windows OS personal computer** -Student copies of ArcGIS (both Desktop 10.8 and Pro 2.5) are available for install directly on personal computers (Windows OS only) with instructions at https://its.umich.edu/computing/computers-software/software-services/software-information/arcgis -You may also access ArcGIS Desktop and Pro by first setting up your access to *Virtual Sites*: https://its.umich.edu/computing/computers-software/campus-computing-sites/virtual-sites/ (note: students do not have 'MiWorkspace' computers, so ignore that part) -Then access the particular software package using *Apps Anywhere*: https://its.umich.edu/computing/computers-software/campus-computing-sites/software. -Students may install the open source QGIS https://qgis.org/en/site/ on your computer and also access it through *Apps Anywhere*. **Mac OS personal computer** -To access ArcGIS Desktop and Pro first set up your access to *Virtual Sites*: https://its.umich.edu/computing/computers-software/campus-computing-sites/virtual-sites/ (note: students do not have 'MiWorkspace' computers, so ignore that part) -Then access the particular software package using *Apps Anywhere*: https://its.umich.edu/computing/computers-software/campus-computing-sites/software. -You can install the open source QGIS https://qgis.org/en/site/ on your computer and also access it through *Apps Anywhere*. -Depending on your computer, Mac owners may be able to install an ArcGIS student copy on your computer via a Windows OS partition on your computer using Bootcamp or similar (you will need to get/support this yourself, to our knowledge not available through UM ITS).

Lab Data Storage	**Storage Space**
	AFS: One storage option to save GIS work is UM AFS space (your personal UM networked drive space). This space is backed up. If you have not used AFS space before, you must 'request' your AFS space: **REQUEST YOUR AFS SPACE PRIOR TO 531/411 LAB 0** using the AFS Self-Provisioning Tool at http://mfile.umich.edu/ For an AFS overview see: http://documentation.its.umich.edu/node/234/
	SEAS "U:" drive this may also be a useable storage space for you.
	Hard drive: You may save GIS output to your computer's hard drive, however also *always back it up elsewhere*. Lost data will not be considered an approved excuse for late lab assignments. As students in this course and as GIS professionals, it is your responsibility to make sure your work is backed up and retrievable at all stages.

Grade Calculation

Assignment(s)	Dates	% of Final Grade
Lab Write-ups	Weekly	60
Lec Midterm	Oct 26	20
Lec Final	Dec 10	20

Overall %	Letter Grade
97.0 or above	A+
91.0 to 96.9	A
89.5 to 90.9	A-
85.5 to 89.4	B+
81.0 to 85.4	B
79.5 to 80.9	B-
75.5 to 79.4	C+
71.0 to 75.4	C
69.5 to 70.9	C-
65.5 to 69.5	D+
61.0 to 65.4	D
59.5 to 60.9	D-

NRE 531: Schedule of Topics

Date	Topic(s)	Lab	Readings 6th ed*
Mon Aug 31 Wed Sept 2	Lec 1: What is 'GIS'?; Course Goals and Logistics; Maps as models Lec 2: Geographical and Attribute Measurement	Lab 0: Intro to Lab	Ch 1 p 1-17, 22; Ch 2 p 39-40; Ch 4 p 150-156 Ch 2 p 27-38, p 66-67
Mon Sept 7 Wed Sept 9	**No Class – Labor Day** Lec 3: Map Design	Lab 1: Intro to ArcGIS (Desktop)	Ch 4 p 181-188; Ch 9 p 384-393; ESRI: Intro Map Design p 1-5, 7-14, 16-19
Mon Sept 14 Wed Sept 16	Lec 4: Vector Data Structures Lec 5: Raster Data Structures	Lab 2: Creating Map Layouts (Desktop)	Ch 2 p 40-50, p 67-70 Ch 2 p 51-59; p 69-72
Mon Sept 21 Wed Sept 23	Lec 6: Datums, Projections & Coordinate Systems Lec 7: Attributes & Databases	Lab 3: Spatial Data Structures (Desktop)	Ch 3 p 87-89, 90-107, 108-113, 116-136 Ch 8 p 331-344, p 350-365
Mon Sept 28 Wed Sept 30	Lec 8: Data Creation & Georeferencing Lec 9: Data - GPS	Lab 4: Projections & Coordinate Systems (Desktop)	Ch 4 p 156-180 Ch 5 p 201-217
Mon Oct 5 Wed Oct 7	Lec 10: Data – Remote Sensing Lec 11: Data – Existing GIS Data Case Study: GIS data creation	Lab 5: Intro to ArcGIS **Pro** (Pro)	Ch 6 p 245-259, 270-292 Ch 7 – all pages
Mon Oct 12 Wed Oct 14	Lec 12: Data Query & SQL Lec 13: Distance, Vector Buffer, Join & Overlay	Lab 6: Data Creation & Attributing (Pro)	Ch 9 p 373-384, 394-395 Ch 9 p 398-419
Mon Oct 19 Wed Oct 21	Lec 14: Metadata and Accuracy Lec 15: Raster Analysis Basics	Lab 7: GIS Query & Analysis (Pro)	Ch 4 p 187-191; Ch 14 p 620-634 Ch 10 445-461

Mon Oct 26	**LECTURE MIDTERM**	Lab 8: Application – Land-Use Change (Pro)	(midterm covers through Lec 14)
Wed Oct 28	Lec 16: Neighborhood Operations Case Study: GIS inputs for Modeling		Ch 10 p 462-471
Mon Nov 2	Lec 17: Raster Modeling	Lab 9: Application – Raster Suitability Mapping (Pro)	Ch 13 p 573-593
Wed Nov 4	Lec 18: Terrain Analysis I – DEMs, DSM, TINs, Slope & Aspect		Ch 2 p 60; Ch 11 p 485-493, 503-509
Mon Nov 9	Lec 19: Terrain Analysis II – Watershed & Hydrology	Lab 10: Application – Terrain / Viewshed Analysis (Pro)	Ch 12 p 494-503
Wed Nov 11	Lec 20: Distance & Cost Distance		Ch 10 p 471-475
Mon Nov 16	Lec 21: Network Analysis	Lab 11: Intro to **QGIS** (QGIS)	Ch 9 p 420-425
Wed Nov 18	Lec 22: Spatial Interpolation		Ch 12 p 521-534, 541-544
Mon Nov 23	**NO CLASS (Vacation Break)**	**NO LAB (Vacation Break)**	
Wed Nov 25	**NO CLASS (Vacation Break)**		
Mon Nov 30	Lec 23: Geocoding	Lab 12: Application – Developing a Least-Cost Path Model (Pro) **OR** Geocoding & Pollution Health Disparities (Pro)	Ch 9 p 426-428
Wed Dec 2	Lec 24: Cost Distance & Model Builder		Ch 12 p 593
Mon Dec 7	Lec 25: GIS & Society	No Lab	Ch 14 p 619
Wed Dec 9	Review		
Thur Dec 10	**LECTURE FINAL EXAM 4-6 pm**		