Electronic Course Authorization System (ECAS)

FNRM 3131 - VIEW COURSE PROPOSAL

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Approvals Received:

Department		College/Dean		Provost
on 5/3/23 by Colleen Oconnor (coconnor@umn.edu)	>	on 5/4/23 by Karen Sprengeler (ksprenge@umn.edu)	>	on 5/4/23 by Leslie Schiff (schif002@umn.edu)

Approvals Pending:	**LE**
Effective Status:	Active
Effective Term:	**New:** 1239 - Fall 2023 **Old:** 1153 - Spring 2015
Course:	FNRM 3131
Institution:	UMNTC - Twin Cities/Rochester
Campus:	UMNTC - Twin Cities
Career:	UGRD
College:	**New:** TCOA - **Old:** TCOA - College of Food, Agricultural and Natural Resource Sciences
Department:	**New:** 11024 - **Old:** 11024 - Forest Resources

General

Course Title Short:	GIS for Natural Resources
Course Title Long:	Geographical Information Systems (GIS) for Natural Resources
Max-Min Credits for Course:	4.0 to 4.0 credit(s)
Catalog Description:	Spatial data development/analysis in science/management of natural resources. Data structures/sources/collection/quality. Geodesy, map projections, spatial/tabular data analysis. Digital terrain analysis, cartographic modeling, modeling perspectives, limits of technology. Lab exercises. Both onsite and fully online options for course enrollment. prereq: Soph or jr or sr or UHP fr
Print in Catalog?:	Yes
CCE Catalog Description:	false
Grading Basis:	**New:** AFV **Old:** A-F
Topics Course:	No
Honors Course:	No
Online Course:	**New:** Yes **Old:** No
Freshman Seminar:	No

Is any portion of this course taught outside of the United States?:	No
Community Engaged Learning (CEL):	None
Instructor Contact Hours:	4.0 hours per week
Course Typically Offered:	Every Fall & Spring
Component 1:	**New:** LEC **Old:** LAB
Component 2:	**New:** LAB **Old:** LEC
Component 3:	**New:** <No text provided> **Old:** <No text provided>
Auto Enroll Course:	Yes
Graded Component:	LAB
Academic Progress Units:	4.0 credit(s) (Not allowed to bypass limits.)
Financial Aid Progress Units:	4.0 credit(s) (Not allowed to bypass limits.)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	<No Text Provided>
Course Equivalency:	**New:** <No text provided> **Old:** 00369 - FNRM 3131/FNRM 5131/FR 3131/
Cross-listings:	No cross-listings
Add Consent Requirement:	No required consent
Drop Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based):	003645 - soph or jr or sr or UHP freshman
Editor Comments:	**New:** <No text provided> **Old:** This is a copy of FR 4131: Geographical Information Systems for Natural Resource Analysis
Proposal Changes:	11/14/11 - added UHP freshman to prereq per Andy Jenks - ks 02/14/11 - updated syllabus and SLO's
History Information:	**New:** 05/2023 FNRM3131 - Geographic Information in Natural Resources - This course is taught in two modalities, as a hybrid lecture/in person mode with online and digital support, and online with an option for in-person interaction. These options serve diverse learning styles, helping self-starters to master concepts efficiently while providing repetitive treatment and support for those that learn better with multiple modes and/or multiple passes through different approaches to the materials. The class involves computer programming, spatial statistics, and problem solving with spatial data, the first introduction to programming and data science for many students. The in-person offering is comprised of two one-hour lectures each week, one three-hour lab, and an optional discussion section. Online students view lectures and lab materials asynchronously and also have the option to participate in an optional discussion section. Online lectures are typically a cluster of short videos interspersed with online questions/answers, scenarios, or other active learning resources. Online students may optionally attend any lecture or in-person lab or discussion session as needed, as we schedule classrooms so as to never be space-limited. All students perform the same quizzes (one per week), lab assessments (one per week),

homework (five per semester), and exams (five over the course of the semester, approximately every three weeks). Exam and overall grade comparisons over the past ten years show no difference in outcomes over the two modalities, and student surveys and enrollment find over 60% of the student prefer the primarily digital delivery. Part of the success is due to continuously modifying and adding materials in response to assessments and student questions, focusing on concepts or materials for which students have difficulty understanding. We also stress individual consultation, distributing our cell-phone numbers and encouraging students to reach out to schedule Zoom consults as needed. Digital material cover the most common questions for most students, freeing time for these frequent ad hoc consultation online.
The Dept Head, Kristen Nelson, has given approval for this change in ECAS. A new syllabus for FNRM 3131 is attached along with updates for Liberal Education Theme Technology and Society.

Crosslisting and equivalency is being removed from both 3xxx and 5xxx - Old: 00369 - FNRM 3131/FNRM 5131/FR 3131/
Old: <No text provided>

Faculty Sponsor Name: Paul Bolstad

Faculty Sponsor E-mail Address: pbolstad@umn.edu

Student Learning Outcomes

Student Learning Outcomes

* Students in this course:

- Can identify, define, and solve problems

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

New: Students learn the theory of geospatial problem solving and are taught specific tools useful in solving them. Problem specification, development, data and knowledge discovery, data development, analytical methods, method selection, and systems for application are treated in a sequenced manner. Lab exercises build through these steps, culminating in exercises in which a geospatial resource allocation problem is defined, and students must develop data and methods, justify and document an analysis, to develop recommendations.

Old: Students learn the theory of geospatial problem solving and are taught specific tools useful in solving them. Problem specification, development, data and knowledge discovery, data development, analytical methods, method selection, and systems for application are treated in a sequenced manner. Lab exercises build through these steps, culminating in exercises in which a geospatial resource allocation problem is defined, and students must develop data and methods, justify and document an analysis, to develop recommendations.

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

New: Through exams, homework, lab exercises, and student-defined projects. These include the 14 class exercises paced to the theory covered in lectures. Extended exercises in weeks 11 through 14 challenge students to develop their own problem solving strategies, base on theory and methods introduced in the course.

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- Can locate and critically evaluate information

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Data appropriateness and quality depends on problem formulation and method of analysis, and this formulation and these methods in turn limit the inferences possible from the analysis.

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Through exercises, students search out, acquire, evaluate, and report on geospatial data and appropriateness for specifically posed problems.

- Have mastered a body of knowledge and a mode of inquiry

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

Students cover the foundational third of the GIS&T Body of Knowledge, working through the theory and practice of 6 of the 11 sections. These include sections on conceptual models, data models, tools, protocols, evaluation of knowledge, data views, 3-D and 2-D world views, uncertainty in analysis, error analysis, metadata, and propogation of error.

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Through exams and laboratory exercises. Exams cover the specific topics, methods, and areas of scholarship identified in the body of knowledge.

Liberal Education

Requirement this course fulfills: TS Technology and Society

Other requirement this course fulfills: <no text provided>

Criteria for Core Courses:

Describe how the course meets the specific bullet points for the proposed core requirement. Give concrete and detailed examples for the course syllabus, detailed outline, laboratory material, student projects, or other instructional materials or method.

Core courses must meet the following requirements:

- **They explicitly help students understand what liberal education is, how the content and the substance of this course enhance a liberal education, and what this means for them as students and as citizens.**
- **They employ teaching and learning strategies that engage students with doing the work of the field, not just reading about it.**
- **They include small group experiences (such as discussion sections or labs) and use writing as appropriate to the discipline to help students learn and reflect on their learning.**
- **They do not (except in rare and clearly justified cases) have prerequisites beyond the University's entrance requirements.**
- **They are offered on a regular schedule.**
- **They are taught by regular faculty or under exceptional circumstances by instructors on continuing appointments. Departments proposing instructors other than**

regular faculty must provide documentation of how such instructors will be trained and supervised to ensure consistency and continuity in courses.

Criteria for Theme Courses:

Describe how the course meets the specific bullet points for the proposed theme requirement. Give concrete and detailed examples for the course syllabus, detailed outline, laboratory material, student projects, or other instructional materials or methods.

Theme courses have the common goal of cultivating in students a number of habits of mind:

- **thinking ethically about important challenges facing our society and world;**
- **reflecting on the shared sense of responsibility required to build and maintain community;**
- **connecting knowledge and practice;**
- **fostering a stronger sense of our roles as historical agents.**

New: We propose that FNRM 3131, GIS in Natural Resources, in both its in person and online sections, meets the following criteria for the Technology and Society Theme:

-The course examines technologies that have had and continue to have immense, measurable impact on contemporary society. Geographic Information Systems (GIS) are transformational technologies that have been deployed deeply and broadly across government, business, community, and volunteer organizations. Nearly everyone in the developed world has been affected by GIS, as it is key to Google Maps, GPS, FedEx or UPS deliveries, commercial airline navigation, and most transportation, energy, and water networks. GIS is used by political parties to plan campaigns, schools to redistrict, in most E911 emergency services, in environmental monitoring and compliance, and in infrastructure planning and management by public and private organizations (please see attached Chapter 1, from textbook used in the course).

-The course builds student understanding of the science and engineering behind the technology addressed. It teaches both the theory and application of GIS through combined lectures and laboratory exercises. In person offerings meet twice a week for fifty-minute lectures and once a week for a two-hour lab.

Online offerings view recorded lectures covering the same material, and are required to do the same lab work. There is an average of approximately 60 pages of reading required each week, with reading quiz at the start of each week to gauge completion. There is a weekly discussion during the first half-hour of the required lab period, addressing impact, motivation, ambiguity, alternative evaluation, and outcomes. Conceptual models, algorithmic foundations, data collection, processing, quality, and control, database organization, transparency, and access, and major classes of analyses are covered. Impacts and evaluation of the strengths, biases, and weaknesses of alternative data processing and analytical approaches within the major classes of analysis are taught. A set of 12 exercises complements theory with practical application of the most used commercial software (attached exercise).

-Students are exposed to concepts of the ethical and unethical use of technology, for example, in learning modified area unit theory, the concept underlying biased districting, and analyzing observed racial or income gerrymanders in recent elections. We teach the methods can be applied to design equitable or unrepresentative groupings, and how to document biased groupings.

Students consider the impacts of technology from multiple perspectives that include developers, users/consumers, and those indirectly affected. Diverse perspectives are examined at several points in the course, key to some sections. In several modules we stress how question framing may directly constraint the possible range of answers in spatial analysis. Through readings, lectures, and single and group exercises we underscore the importance of an adopted world view on the types of data collected and how these data are structured, and how choices on structure and type guide subsequent analysis. Students are challenged to develop data models and analytical frameworks from different perspectives within class and in homework and laboratory exercises. Various perspectives in synthesis and analysis are engaged, for example, a developer vs. a conservationist in land use planning, or both producer?s and user?s concepts on accuracy (please see attached Chapter 1, from the textbook).

Students engage in a process of critical evaluation that provides a framework with which to evaluate new technology in the future. An evaluation of the accuracy, utility, and appropriateness of GIS technology is a thread woven throughout the course. This is particularly stressed in our treatment of the differences inherent in algorithmic selection and analytical methods, the stress on the conceptual foundation that remains constant while hardware and software evolve, and the emphasis on logical and empirical evaluations of results. We seek to provide a foundation that will remain salient as technologies evolve.

The process of evaluation is dyads, paired or small group exercises, typically introduced in lecture or lab to engage active thinking. Given the large or online class size, this group formation can be self-assigned, but will be automatically assigned during synchronous meetings. These are typically short questions to be answered, for example, contrast how a logger or a wildlife biologist might structure a forest vegetation spatial database (variables, categories, linkages), justify these choices, and highlight the major similarities and differences between them. These activities typically take 10-15 minutes, including a problem or discussion topic, a goal, and a written and/or oral resolution. Students typically confer to resolve the problem, based on recent readings, lectures, and lab exercises, and typically finish with a volunteer, student-led discussion of a particular group?s reasoning and conclusions.

Old: We propose that FR3131, GIS in Natural Resources, meets the following criteria for the Technology and Society Theme:

-The course examines one or more technologies that have had some measurable impact on contemporary society. Geographic information systems (GIS) are truly transformative technologies. Nearly everyone in the developed world has been touched by GIS. These include those users of Google Map, a GPS, or mobile route finding. Anyone who has received a package delivered by UPS or Fed Ex, flown on a commercial airline, or purchased an imported good, has been indirectly affected, because GIS is used by many companies in the development and delivery of their services. Political parties map the electorate, plan campaigns, and predict outcomes based on spatial data, and reapportion districts using GIS. E911, fire dispatch, and other emergency services use these technologies (please see attached Chapter 1, from textbook).

-The course builds student understanding of the science and engineering behind the technology addressed. FR3131 teaches both the theory and application of GIS through combined lecture and laboratory exercises. Conceptual models, algorithmic foundations, data collection and processing, database organization, and major classes of analyses are taught. Impacts of alternative data processing and analytical approaches are described, and methods for selecting among various methods. A set of 12 exercises complements theory with practical application of the most commonly used commercial software (please see attached exercise 11, from class).

Students consider the impact of technology from multiple perspectives that include developers, users/consumers, as well as others in society affected by the technology. The various impacts and perspectives on GIS are examined and several points in the course, and are key to some sections. In particular, we stress the importance of perspective in framing the questions that a GIS may answer. Through readings, lectures, and single and group exercises we underscore the importance of an adopted world view on the types of data collected and how these data are structured, and how these choices of data type and structure limit or guide subsequent analysis. Students are challenged to develop data models and outline analyses from different perspectives, both in within-class sessions, and in laboratory exercises. Various perspectives in synthesis and analysis are engaged, for example, a developerï¿½s vs. a conservationistï¿½s perspective on ï¿½naturalï¿½ landscapes, or both producerï¿½s and userï¿½s concepts of accuracy (please see attached Chapter 1, from textbook).

Students engage in a process of critical evaluation that provides a framework with which to evaluate new technology in the future. An evaluation of the accuracy, utility, and appropriateness of GIS technology is a thread woven throughout the course. This is particularly stressed in our treatment of the differences inherent in algorithmic selection and analytical methods, the stress on the conceptual foundation that remains constant while hardware and software evolve, and the emphasis on logical and empirical evaluations of results. We seek to provide a foundation that will remain constant and useful as technologies evolve.

This process of evaluation is particularly stressed in DYADS, paired or small-group exercises, typically introduced mid-lecture to engage active thinking. Given the large class size, weï¿½ve chosen about 20 activities for students that we inject mid lecture. These are typically short questions to be answered, for example, ï¿½Contrast how a logger and a wildlife biologist might structure a spatial forest database. Describe the data model, data structure (including variables, categories, and linkages), and justify these choices.ï¿½ These activities typically take 10-15 minutes, including a problem or discussion topic, a goal, and a written and oral resolution. Students typically confer to resolve the problem, based on recent readings, lectures, and lab exercises, and we typically finish with a volunteer, student-led discussion of a particular groupï¿½s reasoning and conclusions.

LE Recertification-Reflection Statement (for LE courses being re-certified only): <No text provided>

Statement of Certification:

This course is certified for a Core (blank) as of
This course is certified for a Theme Fall 2014 as of 03/27/2014

Writing Intensive

Propose this course as Writing Intensive curriculum: No

Question 1 (see CWB Requirement 1):

What types of writing (e.g., reading essay, formal lab reports, journaling) are likely to be assigned? Include the page total for each writing assignment. Indicate which assignment(s) students will be required to revise and resubmit after feedback by the instructor or the graduate TA.

<No text provided>

Question 2 (see CWB Requirement 2):

What types of writing (e.g., research papers, problem sets, presentations, technical documents, lab reports, essays, journaling etc.) will be assigned? Explain how these assignments meet the requirement that writing be a significant part of the course work, including details about multi-authored assignments, if any. Include the required length for each writing assignment and demonstrate how the 2,500 minimum word count (or its equivalent) for finished writing will be met.

<No text provided>

Question 3 (see CWB Requirement 3):

How will students' final course grade depend on their writing performance? What percentage of the course grade will depend on the quality and level of the student's writing compared to the percentage of the grade that depends on the course content? Note that this information must also be on the syllabus.

<No text provided>

Question 4 (see CWB Requirement 4):

Write up a sample assignment handout here for a paper that students will revise and resubmit after receiving feedback on the initial draft.

<No text provided>

Question 5 (see CWB Requirement 5):

What types of instruction will students receive on the writing aspect of the assignments?

<No text provided>

Question 6 (see CWB Requirement 6):

How will the assistants be trained and supervised?

<No text provided>

Statement of Certification: This course is certified for a Theme (blank) as of

Course Syllabus

Course Syllabus:

New: Department of Forest Resources
University of Minnesota
FNRM 3131- GIS for Natural Resources ? Fall 2023

FNRM 3131
In-person Lecture: Monday, 4:05 ? 6:00 p.m., 110 Green Hall, and one of the following:

6:00 p.m. ?	8:00 p.m.	Monday	35 Skok	Section 2
12:50 p.m. ?	2:45 p.m.	Wednesday	35 Skok	Section 3

On-line Lecture (see Class Website); (you can also come to any in-person lecture if/as needed) Section 20
On-line Lab (you can also come to any in-person lab session if/as needed)
Section 21
(Online students view lectures and lab materials from in-person sections asynchronously and may participate in a discussion section.)

Both In-person and Online students: An optional discussion session(s) will be added, based on student schedules, on the first day of class.

Instructors: Andrew C. Jenks (he/him) Paul Bolstad (he/him)
215 Green Hall, 651-387-9600 301H Green Hall, 612-624-9711
ajenks@umn.edu pbolstad@umn.edu

Office Hours: Monday, 3-4 pm in 215 Green Hall & (click for Zoom link)

Required Texts: GIS Fundamentals: A First Textbook on Geographic Information Systems, Seventh Ed., Bolstad, Paul V., Eider Press, 2022. This book is on reserve in the Magrath Library and should be at the St. Paul Campus Bookstore, and via links at website www.gisfundamentals.org/order. A digital version is available via RedShelf for $18 (half year) or $24 (lifetime), and the physical book for around $44. Readings from this book are required. There are also supplementary readings, which will be posted on the class web link, http://giscourses.cfans.umn.edu/fnrm3131.
You should do the readings before class meets; there is a quiz each week prior to start of each Monday lecture on the week?s reading assignment.

Required Materials: You may download and print the exercises as PDFs from the class website, http://giscourses.cfans.umn.edu/fnrm3131. Throughout the labs sessions you will need to save/backup your work. You will be provided UMN class disk space, use it for your work.

Other Resources: The class website is http://giscourses.cfans.umn.edu/fnrm3131. This website has copies of this syllabus, and lab exercises. A related website, http://paulbolstad.net/gisbook.html has information on the textbook.

Student Responsibilities: You should attend the lectures (or access on-line lecture materials), do the readings, do assigned lab and homework problems submit them via Moodle; complete all quizzes and exams via Canvas. All material from lectures and readings may appear on the examinations.

If you need any assistive devices, services, or accommodations, or have any other special request, please contact the instructor(s).

FNRM 3131 Schedule
NOTE: Readings are from the required textbook, all lab sections meet 2nd week in-person or online

Week Lecture Topic -- Monday Labs & Homework Required Readings On-Line Exams
1 No Classes due to Monday Holiday No Lab due to Monday Holiday
2
Course Introduction: Course mechanics
Introduction to GIS, data models, data structures. \L1: Intro. and practice with ArcGIS
Chapters 1 & 2

3
Geodesy, datums
coordinate systems, map projections \L2: Projections
Chapter 3 &
ESRI PDF, Understanding Map Projections (skim)
4
Maps, data entry & editing, metadata, map transformations \L3: Digitizing
Chapter 4
Exam 1 (Chapters 1,2,3)
5
GPS, begin aerial and satellite images
\L4: Topology;
Chapters 5 & 6 up to pg. 273
6
Continue aerial and satellite images,
digital data, data sources,
Optional lab \L5: GPS (due end of 9th week)

\L6: Digital Data and Basic Table Operations
Start Homework 1 (see Week 6 on website) Chapter 6 to end & Chapter 7,
7
Introduction to Tables &
relational databases \L7: Tables
Start Homework 2 (see Week 7 on website) Chapter 8, up to pg. 357 Exam 2 (Chapters 4,5,6)
8 Spring Break Week Spring Break Week
9
Tables, normal forms
\L8: Table Import and Join
Chapter 8, pg. 358 to end
10
Basic spatial analyses
\L9: Buffering, overlay
Homework 1 due Friday Chapter 9 Exam 3 (Chapters 7 & 8)
11
Raster analysis
\L10: Raster Analysis
Homework 2 due Friday
Chapter 10

12
Terrain analysis, more spatial analysis
\L11: Terrain and more spatial analysis

Chapter 11

13
Interpolation, prediction, core area delineation. \L12: Interpolation

Chapter 12 Exam 4 (Chapters 9, 10, & 11)
14
Cartographic modeling, flowcharts \L13: Grouse Habitat Modeling Chapter 13
15
More cartographic modeling, dynamic spatial models, standards, data quality
\L14: Cartographic Modeling Chapter 14
16
New developments/future trends Continue Lab 14
Lab 14 due Fri., Friday Chapter 15 Exam 5 (comprehensive, but weighted, towards Chapters 12-14)
17 Finals Week

?
Overview

FNRM 3131 is an introduction to geographical information systems, focusing on spatial data development and analysis in the science and management of natural resources. Many of our most pressing environmental problems involve ?what? and ?where,? for example, which coastal communities are in danger of sea-level rise, what intersections are most dangerous for traffic, where might an oil spill cause the most damage, or which power plants are causing the most acid rain? We have developed tools, called GIS, which help us address many of these problems, but there are dangers as well as opportunities here, as our conceptions and values as much determine our recommendations as do our technical capabilities. This course seeks to impart both a technical expertise to perform spatial analysis and the basis to evaluate how our conceptual framework affects our conclusions. The course provides a technical understanding of the tools needed to solve these environmental problems, and how we may select the best conceptual models for any given problem. Topics covered in this course include basic data models, structures, data sources, data collection, data quality, geodesy and map projections, spatial and tabular data analyses, digital elevation data and terrain analyses, cartographic modeling, cartographic layout, metadata, and accuracy assessment. Laboratory exercises provide practical experiences that complement the theory covered in lecture.

This course introduces the methods and models that have been developed to solve spatial problems. Computers have enabled sophisticated, affordable, and easy spatial analysis. For example, spatial technologies allow us to identify the specific communities and households downwind of any given coal-fired power plant, and estimate the specific levels of particulates, sulfates, mercury, and other noxious pollutants we expect to fall on each household. This allows a fuller, fairer measure of the costs in siting, expanding, or upgrading such plants. Water pollution, the distribution of resources, risk to natural disasters, crime analysis, and endangered species recovery are examples of other problems that have been addressed with spatial analyses.

This course is time intensive, as it is a four-credit lab course covering theory and practice. For in-person or online students should expect to spend four hours a week completing and digesting the required readings, two hours on the lectures and material provided therein, two hours a week in lab and an additional two hours outside of lab time each week, approximately an hour each week on quizzes, discussions, and homework, and an average three to four hours every three weeks in a repeat-access exam. Our exams typically cover two to three chapters and are a combination computer and person-scored instruments. The computer scored sections are assessed immediately, and students provided feedback on the missed answers. You may then study themes where you performed poorly and retake the exam, for a total of three times. Questions are a random draw from a large pool, and hence will not be exactly the same between exams but will test the same thematic area. In this way exams are both an assessment and instructional tool.

Liberal Education ? Technology and Society Theme

This course satisfies the liberal education Technology and Society theme. We seek to develop broad knowledge and transferable skills, with a strong understanding of how to rationally solve challenging problems for important issues without resorting to dogma, and being conscious of the difference between fact, opinion, and values in judgement. The lecture, quizzes, and homework?s are software-agnostic, and help develop ways of thinking that should transcend technical developments or new methods. The labs teach how to apply concepts using the currently most common software tools.

The course examines technologies that have had and continue to have immense, measurable impact on contemporary society. Geographic Information Systems (GIS) are transformational technologies that have been deployed deeply and broadly across government, business, community, and volunteer organizations. Nearly everyone in the developed world has been affected by GIS, as it is key to Google Maps, GPS, FedEx or UPS deliveries, commercial airline navigation, and most transportation, energy, and water networks. GIS is used by political parties to plan campaigns, schools to redistrict, in most E911 emergency services, in environmental monitoring and compliance, and in infrastructure planning and management by public and private organizations (please see attached Chapter 1, from textbook used in the course).

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Mechanics

You should read the required book materials each week, typically a chapter or two comprised of 40 to 70 pages, before the start of the week. You will take a short quiz on the reading before the first lecture of the week. You should come to lecture either in-person or online and/or view the class videos each week. You should check for and complete any additional homework?s required for the week and prepare for and take exams as appropriate (5 exams over the semester). You should participate in the lab in person, or through one of the online sessions, engaging in the discussion section at the start of each lab. You should then complete the weekly lab exercise. You may complete the exercises at a campus computer lab or at home. You should read the lab in advance, and review/note new procedures or activities. Labs usually require more than the two-hour period to complete, with an average of approximately two extra hours each week. This class is generally a greater time investment than most other classes, as it is a 4-credit, lab class. The Skok 35 and Green 210A labs (as well as other UMN Computer Labs) are open additional hours.

Several options exist for access to the required ArcGIS Pro software and data (you choose the approach; you can use either of the options or switch between as needed throughout the class).

1. Attend class lab session and use the provided computers, software and data.

2. Install the UMN provided Citrix receiver software and then access the CFANS virtual desktop via a web browser. This will allow direct network computer access to ArcGIS without installing ArcGIS on your computer. (this approach can be used with Windows or MacOS computers).

All Labs assignment will to be submitted via Canvas, https://canvas.umn.edu.

All Labs are due the Friday (11.55 p.m.) of the week after your scheduled Lab session. Late labs are docked by 1/3, and labs won't be accepted if they are more than 1 week late. Makeup labs are possible if the instructor has advance notice, so please anticipate conflicts, and contact the instructor. Labs are only accepted through the Canvas Course Site. Labs are submitted as .pdf files; please do not send .aprx, MSWord, or shapefiles. The final lab will have special requirements for submitting your work; this will be explained before the assignment.
Grading, Integrity, Ethics

Please note you may work together on labs, but you each must do every part of each lab and turn in entirely your own work. That means each of you should perform every step indicated in the lab manual. Your grade is for individual effort; copied files/maps from other students will be construed as cheating, at a minimum you?ll get zero for the lab, and you may automatically fail the course.

We will try to grade labs in a one-week period, for quick turnaround. However, this won't happen in all cases. The four on-line exams will each be worth 8.20% points; the FINAL will be worth 16.39%. Each lab and homework will be worth 2.73%, except the final lab, which is worth 5.46%. Grading will be on a straight scale, not on a curve. If you all do well, you will all get an A. The scale is:

A	90 ? 100				
B+	88 ? 89.99	B	82 - 87.99	B-	80 ? 81.99
C+	78 ? 79.99	C	67 - 77.99	C-	65 ? 66.99
D+	63 ? 64.99	D	50 - 62.9		

Class assignments are weighted as follows:

13 required labs = 38.26%, 2 required homework = 5.46%, 13 on-line quizzes = 7.1%, 4 on-line exams = 32.79%, Final Exam = 16.39%); in addition, there are several opportunities to obtain extra credit (up to an additional 7.29% of the total course).

Note: during the class, when checking your grades on Canvas, please note the checkbox at the bottom of the ?Assignments are weighted by group:? section; the check box ?Calculate based only on the graded assignments? should be UNCHECKED to project your estimated FINAL Grade.

How EXTRA CREDIT is handled in the Canvas Grade Book

There are 4 Extra Credit opportunities: A 15-point Extra Credit Homework Quiz, a 15-point Extra Credit Lab, a 5-point Extra Credit GPS Lab and 5 possible points for ?finding? Geocaches. These points COULD total up to 40 Extra Credit points. These 40 points amount to an extra 7.29% of the graded class assignments.

How this Works
Extra Credit (optional, extra credit opportunities): If all extra credit is completed, you would receive and EXTRA 7.29% of the regular class. Extra Credit is Awarded IN ADDITION to the regular class work.

Extra Credit will appear in the Student Grade Book throughout the class as 0% UNTIL the final grade calculation at the end of the class. (See the Grade Book Section ?Assignments are weighted by group?.) When the final grades are calculated we will enter ?0? in all unsubmitted Extra Credit Assignments and change the Extra Credit Group percent (%) to 7.29%; So, at the very end of the class the TOTAL possible percent will display as 107.29%.

If you do complete one or more Extra Credit Assignments during the class, your points will be recorded, as they are submitted & graded, and WILL SHOW up in the Grade Book but WILL NOT be included in your Total % column until the final grade calculation at the end of the class. If you wish to CALCULATE BY HAND the value of your Extra Credit work prior to the end of the class, do the following: take your graded Extra Credit Points and divide them by 40 and then multiply the result by 7.29. This calculation will allow you to predict the extra % that will be added to your total percent (as displayed in the Grade Book during the class). At the end of the class, we will do this same calculation in the grade book and improve your total percent position by whatever percent of Extra Credit you achieved
.
For example, say you did 20 of the possible 40 extra credit points. (20/40) * 7.29 = 3.645
3.645% would then be ADDED to your regular class work percentage at the final grade calculation.

Student Conduct Code
The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected to adhere to Board of Regents Policy: Student Conduct Code. To review the Student Conduct Code, please see: https://regents.umn.edu/sites/regents.umn.edu/files/2022-07/policy_student_conduct_code.pdf

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach and/or a student?s ability to learn.? The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities.

Use of Personal Electronic Devices in the Classroom
Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each instructor to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: https://policy.umn.edu/education/studentresp.

Scholastic Dishonesty
You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: https://regents.umn.edu/sites/regents.umn.edu/files/2019-09/policy_student_conduct_code.pdf) If it is determined that a student has cheated, the student may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: https://policy.umn.edu/education/instructorresp.

The Office for Community Standards has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: https://communitystandards.umn.edu/avoid-violations/avoiding-scholastic-dishonesty. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class, e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Makeup Work for Legitimate Absences
Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: https://policy.umn.edu/education/makeupwork.

Appropriate Student Use of Class Notes and Course Materials
Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: https://policy.umn.edu/education/studentresp.

University Grading Scales
The University has two distinct grading scales: A-F and S-N.

A-F grading scale. The A-F grading scale allows the following grades and corresponding GPA points:

Grade	GPA Points	Definitions for undergraduate credit
A	4.000	Represents achievement that significantly exceeds expectations in the course.
A-	3.667	
B+	3.333	
B	3.000	Represents achievement that is above the minimum expectations in the course.
B-	2.667	
C+	2.333	
C	2.000	Represents achievement that meets the minimum expectations in the course.
C-	1.667	
D+	1.333	
D	1.000 -	Represents achievement that partially meets the minimum expectations in the course. Credit is earned but it may not fulfill major or program requirements.
F	0.000	Represents failure in the course and no credit is earned.

S-N grading scale. The S-N grading scale allows for the following grades and corresponding GPA points:

Grade	GPA Points	Definitions for undergraduate credit
S	0.00	Satisfactory (equivalent to a C- or better)
N	0.00	Not Satisfactory

For additional information, please refer to: https://policy.umn.edu/education/gradingtranscripts.

Sexual harassment, sexual assault, stalking and relationship violence
The University prohibits sexual misconduct, and encourages anyone experiencing sexual misconduct to access resources for personal support and reporting. If you want to speak confidentially with someone about an experience of sexual misconduct, please contact your campus resources including the Aurora Center, Boynton Mental Health or Student Counseling Services (https://eoaa.umn.edu/report-misconduct). If you want to report sexual misconduct,

or have questions about the University?s policies and procedures related to sexual misconduct, please contact your campus Title IX office or relevant policy contacts.

Instructors are required to share information they learn about possible sexual misconduct with the campus Title IX office that addresses these concerns. This allows a Title IX staff member to reach out to those who have experienced sexual misconduct to provide information about personal support resources and options for investigation. You may talk to instructors about concerns related to sexual misconduct, and they will provide support and keep the information you share private to the extent possible given their University role.

https://regents.umn.edu/sites/regents.umn.edu/files/2019-09/policy_sexual_harassment_sexual_assault_stalking_and_relationship_violence.pdf

Equity, Diversity, Equal Opportunity, and Affirmative Action
The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, membership or activity in a local commission created for the purpose of dealing with discrimination, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: https://regents.umn.edu/sites/regents.umn.edu/files/2019-09/policy_equity_diversity_equal_opportunity_and_affirmative_action.pdf.

Disability Accommodations
The University views disability as an important aspect of diversity, and is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

? If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the DRC office on your campus (UM Twin Cities - 626.1333) to arrange a confidential discussion regarding equitable access and reasonable accommodations.
? Students with short-term disabilities, such as a broken arm, can often work with instructors to minimize classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above.
? If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact your instructor early in the semester to review how the accommodations will be applied in the course.
? If you are registered with the DRC and have questions or concerns about your accommodations please contact your (access consultant/disability specialist).

Additional information:
? Crookston - https://www.crk.umn.edu/units/disability-resource-center, myers062@crk.umn.edu
? Duluth - http://www.d.umn.edu/disability-resources, access@d.umn.edu
? Morris - http://www.morris.umn.edu/academicsuccess/disability/, hoekstra@morris.umn.edu
? Rochester - http://r.umn.edu/student-life/student-services/disability-resources, sdzavada@r.umn.edu
? Twin Cities - https://diversity.umn.edu/disability/, drc@umn.edu)

Mental Health and Stress Management
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

Academic Freedom and Responsibility: for courses that do not involve students in research
Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost. [Customize with names and contact information as appropriate for the course/college/campus.]

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".
Old: Department of Forest Resources
University of Minnesota
FNRM 3131- INTRODUCTION TO GIS â¿¿ Spring 2014
FNRM 3131 Class Times: 4:00-6:00 p.m., Mondays, in 110 Green Hall, and
one of the following:
6:00 p.m. â¿¿ 8:00 p.m. Monday 35 Skok Section 3
8:30 a.m. â¿¿ 10:25 a.m. Tuesday 35 Skok Section 6
10:40 a.m. â¿¿ 12:35 p.m. Tuesday 35 Skok Section 5
4:05 p.m. â¿¿ 6:00 p.m. Tuesday 35 Skok Section 2
10:40 a.m. â¿¿ 12:35 p.m. Wednesday 35 Skok Section 4
On-line only section (come to any lab session as needed) Section 7
Instructor:

Paul V. Bolstad
301H Green Hall
624-9711
pbolstad@umn.edu

Andrew C. Jenks
215 Green Hall
651-387-9600
ajenks@umn.edu

Office Hours: By appointment

Required Texts: GIS Fundamentals: A First Textbook on Geographic Information Systems, 4th Ed., Bolstad, Paul V., Eider Press 2012. This book is on reserve in the Natural Resources Library 375 Hodson Hall and should be at the bookstore, and at the website http://www.bookmasters.com/marktplc/00729.htm. Readings from this book are required. There are also supplementary readings, which will be posted on the class web link, or the class Moodle site: https://ay13.moodle.umn.edu/course/view.php?id=9488
You should do the readings before class meets; there is a quiz each week prior to start of each Monday lecture on the weekâ¿¿s reading assignment.
Required Materials: You may download and print the exercises as PDFs from the class website,. Throughout the labs sessions you will need to save/backup your work. To do this you should purchase at a portable USB drive to use in the lab. As GIS files can be quite large, you should get a 2 GB or larger drive.
Other Resources: The class website or the Moodle class site:
https://ay13.moodle.umn.edu/course/view.php?id=9488.
This website has copies of this syllabus, lab exercises, and old exams. A related website, http://paulbolstad.net/gisbook.html has information on the textbook.
Student Responsibilities: You should attend the lectures, do the readings, and do assigned homework problems. All material from lectures and readings may appear on the examinations. If you need any assistive devices, services, or accommodations, due to a disability, please contact the Instructor.
2
FNRM 3131Schedule
NOTE: Reading from the required textbook, GIS Fundamentals; A First Textbook on Geographic Information Systems, 4th Edition, by Paul Bolstad. All lab sections meet week 2
Week
Lecture Topic -- Monday
Labs & Homework
Required Readings
On-Line Exams
1
Jan 20
No Lecture or Lab due to University holiday
2
Jan 27
Course Introduction: Course mechanics
Introduction to GIS, data models, data structures.
\L1: Intro. and practice with ArcGIS
Chapters 1 & 2
3
Feb 3
Geodesy, datums
coordinate systems, map projections
\L2: Projections
Chapter 3
and ESRI .pdf, Understanding Map Projections
4
Feb 10
Maps, data entry and editing, metadata, map transformations
\L3:Digitizing

Chapter 4
Exam 1 (Chapters 1,2,3)
5
Feb 17
GPS, begin aerial and satellite images
\L4: Map transformations, optional \L5: GPS
Chapters 5 & 6 up to 228
6
Feb 24
Continue aerial and satellite images
Digital data
\L6: Census, NWI, DEM data, basic table operations
Homework 1 due Friday
Chapter 6 to end & Chapter 7,
Exam 2 (Chapters 4,5,6)
7
Mar 3
Introduction to Tables &
Relational databases
\L7: Tables
Chapter 8, up to pg 332
8
Mar 10
Tables, normal forms
\L8: Table Import and Join
Chapter 8, pg 332 to end
9
Mar 17
Spring Break Week
Spring Break Week
10
Mar 24
Basic spatial analyses
\L9: Buffering, overlay
Homework 2 due Friday
Chapter 9
Exam 3
(Chapters 7,8,& 9)
11
Mar 31
Raster analysis
\L10: Raster Analysis
Chapter 10
12
April 7
Terrain analysis, more spatial analysis
\L11: Terrain and more spatial analysis
Chapter 11
13
April 14
Interpolation, prediction, core area delineation.
\L12: Interpolation
Chapter 12
Exam 4 (Chapters 10,11,& 12)
14
April 21
Interpolation, cartographic modeling, flowcharts
\L13: Grouse Habitat Modeling
Chapter 13
15
April 28
More cartographic modeling, dynamic spatial models, standards & data quality
\L14: Cartographic Modeling
Chapter 14
16
May 5
New developments & future trends
Continue Lab 14
Lab 14 due Fri., Friday May 9, 11:59 p.m.
Chapter 15
Exam 5 (comprehensive, weighted 1/3 towards Chapters 13,14 & 15)
3
FNRM 3131 is an introduction to geographical information systems, focusing on spatial data development and analysis in the science and management of natural resources. Topics covered include basic data structures, data sources, data collection, data quality, geodesy and map projections, spatial and tabular data analyses, digital elevation data and terrain analyses,

cartographic modeling, and cartographic layout. Laboratory exercises provide practical experiences that complement the theory covered in lecture.
This course satisfies the Technology and Society liberal education requirement. As such, we seek to do more than just teach the technical aspects of applying GIS to solve problems. We hope to equip you to critically evaluate the goals, methods, and biases in any analysis, and the strength and uncertainties surrounding any set of derived conclusions. We will examine both the societal push to include space in analysis, and the technological pull through the development of GIS. We will teach a detailed technical understanding of GIS. While important and often complex, knowledge of technical methods is usually not enough to address most problems. Optimal or â¿¿bestâ¿☐ outcomes usually depend on the perceptions, worldviews, goals, and other subjective characteristics of those conducting the analysis. There is a wide range of uncertainty in the spatial data, the model of system function, and analysis. This uncertainty is often masked by the technology, and has been used to seek specific conclusions or desired outcomes. We will cover how to incorporate different views in analysis, analyze spatial problems from different perspectives, evaluate the inherent uncertainty in data and analyses, and teach methods that attempt to isolate and identify the objective and subjective components of any spatial analysis. We will treat decision making under uncertainty, and how biases, history, or previous conceptions can affect estimates of reliability or â¿¿optimalâ¿☐ solutions. We hope to develop your ability to apply multiple, often conflicting approaches to solve spatial problems, assess weaknesses in current methods, and develop and evaluate new methods of analysis.
This course applies digital learning technologies, to support work in labs or at home. You should read the lab in advance, and review/note new procedures or activities. Labs may require more than the two-hour period to complete. The Skok35 and Green 210A labs are open additional hours. Registered students will receive a 1 year copy of ArcGIS for use at home. Work at home requires copies of class data files, from the Skok 35 or Green 210 lab computers, or downloaded from the course website.
All Labs assignment will to be submitted via Moodle, https://www.myu.umn.edu . Log in to www.myu.umn.edu, select â¿¿My Coursesâ¿☐ and then select the Moodle Site Link for FNRM 3131.
All Labs are due the Friday (11.55 p.m.) of the week after your scheduled Lab session. Late labs are docked by 1/3, and labs won't be accepted if they are more than 1 week late. Makeup labs are possible if the instructor has advance notice, so please anticipate conflicts, and contact the instructor. Labs are only accepted through the Moodle Course Site. Labs are submitted as .pdf files; please do not send .mdx, MSWord, or shapefiles. The final lab will have special requirements for submitting your work; this will be explained before the assignment.
Please note you may work together on labs, but you each must do every part of each lab, and turn in entirely your own work. That means each of you should perform every step indicated in the lab manual. Your grade is for individual effort; copied files/maps from other students will be construed as cheating, at a minimum youâ¿¿ll get zero for the lab, and you may automatically fail the course.
4
Course Grading
We will try to grade labs in a one-week period, for quick turnaround. However, this won't happen in all cases. The four on-line exams will each be worth 45 points; the FINAL will be worth 90. Each lab and homework will be worth 15 points, except the final lab, which is worth 30 points. Grading will be on a straight scale, not on a curve. If you all do well, you will all get an A. The scale is:
A 90 â¿¿ 100
B+ 88 â¿¿ 89.99 B 82 - 87.99 B- 80 â¿¿ 81.99
C+ 78 â¿¿ 79.99 C 67 - 77.99 C- 65 â¿¿ 66.99
D+ 63 â¿¿ 64.99 D 50 - 62.9
Total required points in the class are: 546 (13 required labs = 210 points, 2 required homework = 30 points, 12 on-line quizzes = 36 points, 4 on-line exams = 180 points, Final = 90 points). In addition, there are several opportunities to obtain extra credit points.

Strategic Objectives & Consultation

Name of Department Chair Approver:

New: Kristen Nelson
Old: <No text provided>

Strategic Objectives - Curricular Objectives:

How does adding this course improve the overall curricular objectives of the unit?

<No text provided>

Strategic Objectives - Core Curriculum:

Does the unit consider this course to be part of its core curriculum?

<No text provided>

Strategic Objectives - Consultation with Other Units:

Before submitting a new course proposal in ECAS, circulate the proposed syllabus to department chairs in relevant units and copy affiliated associate dean(s). Consultation prevents

course overlap and informs other departments of new course offerings. If you determine that consultation with units in external college(s) is unnecessary, include a description of the steps taken to reach that conclusion (e.g., catalog key word search, conversation with collegiate curriculum committee, knowledge of current curriculum in related units, etc.). Include documentation of all consultation here, to be referenced during CCC review. If email correspondence is too long to fit in the space provided, paraphrase it here and send the full transcript to the CCC staff person. Please also send a Word or PDF version of the proposed syllabus to the CCC staff person.

<No text provided>

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