Integration of GIS and Remote Sensing Data Analysis in Natural Resource Applications

INT 527 3 Credits Spring Semester 2020

Lecture: 9:00-10:00 a.m. Monday, Wednesday, 254 Nutting Hall
Lab: 1:00-4:00 Wednesday, 254 Nutting Hall

Instructors:
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Course Web Site: http://wheatlandlab.org/for-students/sfr406/int527/

Text and Materials: The recommended book is *Mastering ArcGIS Pro*, by Maribeth Price (first edition, published by McGrawHill Education). This book is available for purchase or rental in e-book (you will need only the book, NOT *CONNECT*) form from several online vendors. Software reference materials will be available, as will supplemental texts on a variety of RS/GIS topics. Published articles from scientific journals or chapters from the text may be assigned reading each week on different topics. Lecture notes, PowerPoint presentations, reading and web assignments, and instructions for the lab exercises and reports will appear on the course web site. Students will need a portable hard drive (recommend 500GB to 1TB) or other data storage solution (e.g. Box or Google Drive) for saving and transferring data used in the lab exercises.

Course Description: This introductory level course will explore techniques and procedures required for spatially-explicit data analysis in forest resources, wildlife, and natural resources applications, specifically using ArcGIS 10.7 and ArcGIS Pro 2.4 Desktop software. The first one-third of the course explores vector- and raster- based GIS analysis in the context of wetland, wildlife habitat, and environmental assessment. The second third of the course will explore remote sensing (RS) fundamentals, image interpretation, land cover mapping, forest monitoring (change detection), ecosystem analysis and integration of raster and vector data. There will be two guest lectures demonstrating application of RS/GIS in natural resources management. Students will answer question sets and write brief technical summaries or reports on selected lab exercises during the first 2/3rds of the course. The final third of the course will be devoted to research and applications employing image processing and spatial data analysis in natural resources and environmental assessments for a final project. Student projects will involve developing a research question answerable using GIS and RS tools, writing a brief research proposal, collecting (web-available or your own data) and analyzing spatial data, preparing a final project report in the form of a poster, and presenting a summary of the project

to the class in a poster "conference" during the final lab session. The course has no prerequisites, although a cursory knowledge of GIS concepts is helpful but not required.

Course and Learning Objectives: Progressing toward the completion of the course, students will be expected to:

1. Understand the theory, methods, and techniques of spatial analysis using remotely sensed and GIS data.
2. Understand basic techniques of satellite image processing and how the data are interpreted and integrated into spatial analysis of landscapes.
3. Translate research questions in natural resource fields into RS and GIS analysis techniques.
4. Apply ArcGIS functionality towards natural resource questions.
5. Understand the advantages and limitations of RS/GIS based analysis approaches.
6. Independently plan and conduct spatially explicit research or application using RS and GIS techniques.
7. Write brief but concise laboratory reports in appropriate technical style demonstrating the student's understanding and interpretation of results.

Grading: Grades will be based on 500 points (4.0) and will include plus and minus grades. The course grading breaks down as follows:

Grade	Points	Proportion
Exam 1	50	10%
Exam 2	50	10%
Class discussion and participation	50	10%
Lab assignments and technical reports	200	40%
Project proposal (25), poster (100), and presentation (25)	150	30%
Total	**500**	**100%**

Attendance Policy, Late Work and Participation: Attendance and participation in laboratory is mandatory. Late or incomplete lab reports and reading assignments will be substantially marked down in grading. Students may work individually or with a lab partner on weekly assignments. Students are expected to work independently on technical reports, class assignments, and on their semester project. Some weekly exercises (and particularly the semester project) will require computer time beyond the scheduled lab period; therefore, students should plan accordingly to complete lab

assignments on time. Participation in discussion during class lecture is part of the course grade, and information is presented that will be important for examinations. Students needing to miss lecture or lab should notify the instructors beforehand and ensure they review the material missed during their absence.

Nutting Security Key Card Door Entry and Computer Account

Nutting Hall and room 254 are locked during the week after ~5 p.m. and on weekends. See Louis Morin, Nutting 208, between 8-9 am in the morning sometime during the first week of class to get your security key card entry (you need your Mainestreet ID) to access to the building and Nutting 254 outside of normal daily working hours. If you previously were given access to the building, you should still have access. Your Mainestreet ID and password will enable you to use the computer workstations in 254.

Academic Honesty Statement: Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University.

Students Accessibility Services Statement: If you have a disability for which you may be requesting an accommodation, please contact Student Accessibility Services, 121 East Annex, 581.2319, as early as possible in the term. Students who have already been approved for accommodations by SAS and have a current accommodation letter should meet with Dr. Loftin or Hayes privately as soon as possible.

Observance of Religious Holidays/Events: The University of Maine recognizes that when students are observing significant religious holidays, some may be unable to attend classes or labs, study, take tests, or work on other assignments. If they provide adequate notice (at least one week and longer if at all possible), these students are allowed to make up course requirements as long as this effort does not create an unreasonable burden upon the instructor, department or University. At the discretion of the instructor, such coursework could be due before or after the examination or assignment. No adverse or prejudicial effects shall result to a student's grade for the examination, study, or course requirement on the day of religious observance. The student shall not be marked absent from the class due to observing a significant religious holiday. In the case of an internship or clinical, students should refer to the applicable policy in place by the employer or site.

Sexual Discrimination Reporting

The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell a teacher about an experience of **sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct or any form of gender discrimination** involving members of the campus, **your teacher is required to report** this information to Title IX Student Services or the Office of Equal Opportunity.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

For *confidential resources on campus*: **Counseling Center: 207-581-1392** or **Cutler Health Center: at 207-581-4000**.

For *confidential resources off campus*: **Rape Response Services:** 1-800-871-7741 or **Partners for Peace**: 1-800-863-9909.

Other resources: The resources listed below can offer support but may have to report the incident to others who can help:

For *support services on campus*: **Title IX Student Services: 207-581-1406**, **Office of Community Standards: 207-581-1409**, **University of Maine Police: 207-581-4040 or 911**. Or see the OSAVP website for a complete list of services at http://www.umaine.edu/osavp/

INT 527 Course Schedule for Spring Term 2020

Day	Date	Topic	Assignment
Wed	1/22	Intro to GIS, Data Sources and Formats, and Term Project	Intro, Chptrs. 1,2,3,5 in Price text; See Proposal Guidelines
		Lab 1: Introduction to GIS and ArcGIS Pro	
Mon	1/27	Geoids, Datums, and Coordinate Systems	Chapter 4 in Price Text
Wed	1/29	Selection, queries, and relational databases	Chapters 7, 9 in Price text;
		Lab 2: Working with projections, tables, attribute queries	**Lab 1 Report Due (25 pts)**
Mon	2/3	Vector Data, Spatial Joins	Chapters 5 (cont.), 10 in Price text
Wed	2/5	Intro to Geoprocessing tools (Overlays)	Chapter 10 (cont.) in Price text

		Lab 3: Spatial Joins	**Lab 2 Report Due (25 pts)**
Mon	2/10	Introduction to Rasters	Chapter 6 in Price text
Wed	2/12	Raster Analysis	Chapter 11 in Price Text
		Lab 4: Vector and Raster Analysis	**Lab 3 Report Due (25 pts)**
Mon	2/17	NO CLASS (Presidents' Day)	
Wed	2/19	Editing, Metadata, Sharing data	Chapters 8, 12 in Price Text
		Lab 5: Editing, Modelbuilder	**Lab 4 Report Due (25 pts)**
Mon	2/24	Other GIS tools, resources, software	Web readings, handouts
Wed	2/26	Analysis Scenarios, Review of GIS material	No Lab 5 assignment due
		Lab: Open / Project Work	
Mon	3/2	Exam during lecture time	**EXAM 1 (50 pts)**
Wed	3/4	Introduction to Remote Sensing	video; Canada RS Tutorial: Chptrs. 1, 2, 4, 5
		Lab 6: Remote Sensing Data Resources	Learn about NAIP, Landsat, Sentinel, MODIS, etc.
Mon	3/9	Digital Image Interpretation	
Wed	3/11	Image Processing Workflow	
		Lab 7: Digital Image Processing	**Project Proposal Due (25 pts)**
Mon	3/16	NO CLASS (Spring Break)	
Wed	3/18	NO CLASS (Spring Break)	
		NO LAB (Spring Break)	
Mon	3/23	Forest / Land Cover Classification	
Wed	3/25	Classification Accuracy Assessment	

		Lab 8: Digital Image Classification	**Lab 7 Report Due (25 pts)**
Mon	3/30	An Ecological View of Change	video; Kennedy et al. 2014
Wed	4/1	Forest / Land Cover Change Detection	video
		Lab 9: Digital Image Change Detection	**Lab 8 Report Due (25 pts)**
Mon	4/6	Introduction to LiDAR	Lidar videos (NEON)
Wed	4/8	LiDAR Forest Structure Metrics	White et al., 2013
		Lab 10: Enhanced Forest Inventory Modelling	**Lab 9 Report Due (25 pts)**
Mon	4/13	Digital Photogrammetry	
Wed	4/15	UAS Demo	
		Lab 11: Photo Point Clouds	**Lab 10 Report Due (25 pts)**
Mon	4/20	Landscape Analysis	Landscape Pattern Metrics
Wed	4/22	Ecological Modelling	Masek et al. 2015
		Lab 12: Google Earth Engine Demo	**Exam 2 Due (50 pts)**
Mon	4/27	Guest Lecture	
Wed	4/29	Guest Lecture	
		Lab: Open / Project Work	
Mon	5/4	Final Draft of Project Poster Due (by 5pm)	
TBD	TBD	Poster Session (during final exam period)	

Course Schedule Disclaimer (Disruption Clause): In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.