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

INT 527   3 Credits   Spring Semester 2022

Lecture: 9:00-9:50 a.m. Monday & Wednesday
Lab: 1:00-4:00 p.m. Wednesday

Lecture & Labs held in the GIS computer classroom **Nutting Hall Room 254**

Instructors:
Tony Guay, Wheatland Geospatial Lab, 260 Nutting Hall
        anthony.p.guay@maine.edu office hours by appointment
Dan Hayes, School of Forest Resources, 260A Nutting Hall
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Course Web Site: Course materials, announcements, and assignments will be organized with the INT 527 (Section 0001) course site on *Brightspace*, the learning management system used by the University of Maine. Assistance with this system is available to students through the Center for Innovation in Teaching and Learning: umaine.edu/citl/brightspace/.

Text and Materials: The recommended book is *Mastering ArcGIS Pro*, by Maribeth Price (first edition, published by McGrawHill Education) for the first six weeks of the class. This book is available for purchase or rental as an e-book (you will need only the book, NOT *CONNECT*) from several online vendors. Some of the lab exercises will come from this text, so you will need access to a copy of the text, either your own or shared with a classmate. 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 Brightspace site. Students will need to have a data storage and back-up plan. This can be a portable or local hard drive (recommend 1TB) or other data storage solution (e.g., Google Drive, your own laptop/desktop) for saving and transferring data used in the lab exercises. While working on the class exercises and your class project, you will need access to ArcGIS Pro. If you have ArcGIS Pro installed on your own desktop or laptop computer, you may use that for the class work.

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 Pro Desktop software. The first half of the course explores vector- and raster- based GIS analysis in the context of wetland, wildlife habitat, and environmental assessment. The second half 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. Students will answer question sets and write brief technical summaries or reports on selected lab

exercises during the course. A key component of the course will be devoted to research and applications employing image processing and spatial data analysis in natural resources and environmental assessments for each student's 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) 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 live poster session during the final exam period. The course has no prerequisites; a cursory knowledge of GIS concepts is helpful but is 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.

Attendance Policy, Late Work and Participation: Attendance and participation in laboratory is mandatory. Students may work on lab exercises individually or with a lab partner during the lab session; however, the work you turn in should be your own, unless otherwise instructed. Students are expected to work independently on technical reports, class assignments, and on their semester project. Some weekly exercises (preparatory work for the lecture, and particularly the semester project) will require computer time beyond the scheduled class period; therefore, students should plan accordingly to complete 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.

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.

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

Item	Qty.	Pts. / Ea.	Tl. Pts.	Pct.
Attendance & Participation	15		100	20%
Lab Reports	9	25	225	45%
Lab Practicum	1	50	50	10%
Project Abstract	1	25	25	5%
Project Poster	1	100	100	20%
Total			**500**	**100%**

Letter Grade	From	To
A	93	100
A-	90	93
B+	87	90
B	83	87
B-	80	83
C+	77	80
C	73	77
C-	70	73
D+	67	70
D	63	67
D-	60	63
F	0	60

Nutting Security Key Card Door Entry
See Mark Austin (Nutting 208) to get your security key card entry (you need your Mainestreet ID) for after-hours access to Nutting 254.

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/

Additional relevant and up-to-date information is posted on the University of Maine's Center for Innovation in Teaching and Learning website.

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.

INT 527 Course Schedule for Spring Term 2022

Day	Date	Topic	Assignment
Wed	19-Jan	Introductions	Intro, Chapters 1,2,3,4 in text
	19-Jan	**Lab 1:** Finding GIS Data; Introduction to GIS and ArcGIS Pro	
Mon	24-Jan	Selections, queries	Chapter 5,9 in text
Wed	26-Jan	Attribute joins and relates	Chapter 7 in text
	26-Jan	**Lab 2:** Intro to Coordinate Systems and Projections; Working with tables, attribute queries, joins, relates	**Lab 1 Report Due**
Mon	31-Jan	Spatial Joins	Chapter 10 in text
Wed	2-Feb	Working with Geoprocessing tools (Overlays)	Chapter 10 in text
	2-Feb	**Lab 3:** Spatial Joins, geoprocessing	**Lab 2 Report Due**
Mon	7-Feb	Introduction to Raster Data and Raster Analysis	Chapter 6, 11 in text
Wed	9-Feb	Editing, Metadata	Chapters 8, 12 in Text
	9-Feb	**Lab 4:** Comparing Vector and Raster Analysis	**Lab 3 Report Due**
Mon	14-Feb	ModelBuilder, ArcGIS Online	Web readings
Wed	16-Feb	Intro to Geostatistical Analyst	Web readings, handouts
	16-Feb	**Lab:** Editing, ModelBuilder, ArcGIS Online **(no lab report due)**	**Lab 4 Report Due**
Mon	21-Feb	**NO CLASS (PRESIDENT'S DAY)**	
Wed	23-Feb	Example Analysis Scenarios	
	23-Feb	**Lab Practicum:** Celebration of Knowledge	
Mon	28-Feb	Programming Tools	
Wed	2-Mar	Introduction to Remote Sensing	
	2-Mar	**Lab:** Finding your Remote Sensing Data	**Lab Practicum Due**
Mon	7-Mar	Multi-spectral Imagery	
Wed	9-Mar	Image Processing Workflow	
	9-Mar	**Lab 5:** Processing your Imagery	**Draft Proposal Due**
Mon	14-Mar	**NO CLASS (SPRING BREAK)**	

INT 527 Course Schedule for Spring Term 2022 (cont.)

Day	Date	Topic	Assignment
Wed	16-Mar	**NO CLASS (SPRING BREAK)**	
Mon	21-Mar	Image Interpretation	
Wed	23-Mar	Image Analysis Workflow	
	23-Mar	**Lab 6:** Analyzing your Multispectral Imagery	**Lab 5 Report Due**
Mon	28-Mar	Land Cover / Land Use Classification	
Wed	30-Mar	Image Classification Workflow	
	30-Mar	**Lab 7:** Classifying your Imagery	**Lab 6 Report Due**
Mon	4-Apr	Multi-temporal Imagery	
Wed	6-Apr	Change Detection Workflow	
	6-Apr	**Lab 8:** Detecting Change in your Imagery	**Lab 7 Report Due**
Mon	11-Apr	Introduction to LiDAR	
Wed	13-Apr	LiDAR Modeling Workflow	
	13-Apr	**Lab 9:** LiDAR Forest Inventory Demo	**Lab 8 Report Due**
Mon	18-Apr	Terrain & Hydrologic Modeling	
Wed	20-Apr	Unoccupied Aerial Systems	
	20-Apr	**Lab:** 3-D Photogrammetry Demo	**Lab 9 Report Due**
Mon	25-Apr	Google Earth Engine Demo	
Wed	27-Apr	No Class (Maine Day)	
	27-Apr	**Lab:** Open / Project Work	**Poster Due**
Mon	2-May	Poster Session (during final exam period, 10:30-12:30pm)	