NRM F369 GIS and Remote Sensing for Natural Resources
Spring 2018
3 Credits

Instructor: Norman R. Harris
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Contact Information

Office Hours: 10:00 to 12:00 PM Tuesdays, Thursdays or by appointment. I maintain an open-door policy. If I am in, I can usually talk.

E-mail: nrharris@alaska.edu Always include "GIS Class" in the subject line, so you do not get buried in my email!

Phone: (907) 746-9475 (office)

Prerequisites: A grade of "C" or higher in NRM F338 or instructor approval. NRM F375 recommended.

Text: **Remote Sensing of the Environment: An Earth Resource Perspective 2nd Edition** By John R. Jensen ISBN-10: 0131889508

Course Description:

Introduces the principles and terminology of natural resources, ecosystem management and landscape ecology while developing analytical skills using spatial technologies consisting of geographic information systems, remote sensing data, and global positioning systems.

Course Objectives:

1) Introduce upper-division undergraduate students to the principles of landscape ecology and the terminology used to describe patterns on the earth.

2) Develop students' analytical skills using the spatial technology of a geographic information system (GIS).

3) Develop students' understanding of remote sensing data with its strengths and weaknesses and use computer image processing to extract important data for effective natural resource and ecosystem management.

4) Develop students' appreciation of global positioning systems (GPS) as a tool to gain knowledge

about geographic location and the effect of scale.

5) Relate computer generated output to actual landscape form and function.

Student Learning Outcomes:

Students will be able to:

1) Recognize the complexity of the biotic and abiotic interactions that influence a landscape.

2) Demonstrate a fundamental comprehension of the electromagnetic spectrum and how wavebands relate to different ecological processes by citing examples from nature.

3) Apply a conceptual framework to collect spatial data, conduct pertinent analysis, make informed management decisions, monitor results and readjust.

4) Determine the best ecological and remote sensing scale for image analysis for different natural resource management issues.

5) Demonstrate an understanding of global positioning systems (GPS) technology and its limitations and strengths especially relating to accuracy, precision and geographic scale.

6) Critically analyze GIS and remote sensing manuscripts and create a synthesis paper relating the strengths and weaknesses of the technology to accurately capture ecological functions of a landscape.

Topics to be covered:

The definition of natural resources is dualistic in meaning. In one usage, the definition can be stated as "any material from nature having potential economic value or providing for sustenance of life," such as timber, minerals, oil, water and wildlife. In the second usage, the definition can be further expanded as "environmental features that serve a society's well-being or recreational interests," such as parks or wilderness areas. The management of these resources is complex and multi-faceted. New spatial technologies provide resource managers with powerful tools for decision support and for monitoring the effects of ecological forces or past management actions.

Landscape ecology explores how a collection of identifiable patches, habitats or elements - such as grasslands, shrub land, forests, meadows, riparian corridors, urban, etc. - are structured, function and, furthermore, how they change with time. In this class, background information about landscape ecology, ecological processes and natural resource issues will be presented and discussed. We will examine the distribution of elements across the landscape and explore relationships between spatial position and environmental parameters. Issues involving scale and data quality will also be discussed and illustrated.

Students will analyze landscapes typical of Alaska. They will learn about GPS, basic electronic data management, and importation of files that are useful for landscape analysis, such as USGS Digital Elevation Models and Digital Line Graphs, and to create and develop a GIS database. Students will remove internal and external distortion from aerial photography to develop orthorectified imagery to further augment the GIS database. The flow of organisms, water, nutrients, and energy within and

between landscape elements will be examined and quantified in a spatial context through watershed and landscape analyses. Electromagnetic properties of vegetation and soils will be compared and techniques to quantify differences will be tested through the use of remote sensing and vegetative indices. Spatial point analysis will be explored in the context of animal use and distribution across the landscape through examination of GPS collar data. Students will also develop land class maps from LandSat TM and Quickbird satellite imagery. Landscape patterns through time (especially as influenced by human activity) will be quantified, analyzed and displayed by comparing historic with recent aerial photography and satellite imagery.

Since landscape analysis is heavily dependent upon computer analytical techniques, students should have a familiarity with the Windows operating system and compatible computers. Students will become familiar with ESRI ArcGIS, a PC-compatible GIS software package, and Hexagon Geospatial ERDAS Imagine, a remote sensing/image processing (RS/IP) software package. Both software packages are widely used in both the governmental and private sectors for spatial analysis and mapping. Landscape analysis will be conducted through assigned exercises to demonstrate both the strengths and weaknesses associated with these powerful technologies. These exercises will also demonstrate the usefulness of landscape level analysis for examination of common ecological and natural resource issues, and for monitoring the effects of management actions on the ecosystem.

Class Format:

This class consists of 14 sessions of approximately 3 hours each. A short break of 10 to 15 minutes will occur during each session. These sessions are a combination of lectures/analytical demonstrations and computer lab time. GIS laboratory sessions will focus on the analysis of landscapes in Alaska, primarily using the UAF Matanuska Experiment Farm outside of Palmer. This course has a **required** Saturday field trip to the UAF campus. Students not able to participate in the field trip will be required to write a 10-page term paper on a topic assigned by the instructor. Participation in class, completion of all assignments, a 1-hour mid-term (to be given during the term) and a 2-hour final exam (at the end of the term) are required to receive a grade.

Computer Assignments:

Lecture notes and laboratory assignments will be distributed using the Blackboard® system. Completed assignments will be turned in using the assignment submission built into Blackboard. If you are unfamiliar with Blackboard, please contact me, I am still learning the new version too.

Homework assignments will require analysis of data sets provided by the instructor. These analyses can be done using the computer lab in Rasmuson 404 or MBS 116 (both open 24 hours). Students who have access to the required software elsewhere can use that equipment. Students will have some time, usually 1 to 1.5 hours, to work on assignments during the classroom session but are expected to complete lab assignments based on their own time schedules and on available lab space (scheduled classes have priority, then on a first-come basis).

Late assignments will be penalized a point for each day they are late, for a total of half the assignment (for example: On a 20 point assignment, 10 points will be deducted one point for each day the assignment is late. After ten days, the maximum grade possible will only be 10 points). Any missing assignments or tests at the end of the term will result in an incomplete grade for the class.

Outside Reading:

From the required text and any assigned scientific papers.

Testing and grading:

One 1-hour midterm exam	100 points
One 2-hour final exam	200 points
Ten Homework Assignments	180 points
Field Trip Questions	50 points
Class Participation	70 points
Pop-Quizzes	100 points
Total	700 points

The instructor will award 5 points for each lecture based on attendance and class participation. Your attendance at all lectures is expected and would be a great ego boost. So remember that,

AN INSTRUCTOR WITH AN INFLATED EGO IS AN EASY GRADER!!!

Grading Scale: Percentage (rounded to nearest integer)

A	100 – 90
B	89 – 80
C	79 – 70
D	69 – 60
F	<60
I	Incomplete, missing assignments or tests

Plus "+" and minus "-"grades are not given in this class, therefore a grade of "C" (2.0) is the minimum acceptable grade that undergraduate students may receive for this course to count toward major or minor degree requirements, or as a prerequisite for another course.

Your instructor follows the University of Alaska Fairbanks Incomplete Grade Policy: The letter "I" (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C or better) the majority of work in a course but for personal reasons beyond the student's control, such as sickness, he or she has not been able to complete the course during the regular semester. Negligence and indifference are not acceptable reasons for an "I" grade.

Academic Integrity – UA Policy

Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- Cheating – use or attempted use of unauthorized materials, information or study aids
- Fabrication – falsification or invention of any information
- Tampering – altering or interfering with evaluation instruments and documents
- Plagiarism – representing the words or ideas of another person as one's own
- Assisting – helping another commit an act of academic dishonesty

Students participating in any of the above actions will be given an incomplete in the course and referred to the Dean of Student Affairs.

UAF eLearning Student Services

Helps students with registration and course schedules, provides information about lessons and student records, assists with the examination process, and answers general questions. Our Academic Advisor can help students communicate with instructors, locate helpful resources, and maximize their distance learning experience. Contact the UAF eLearning Student Services staff at 907. 479.3444 or toll free 1.800.277.8060 or contact staff directly – for directory listing see: http://elearning.uaf.edu/contact

Disabilities Services

The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials. I will work with the Office of Disabilities Services (208 WHITAKER BLDG, 474-5655) to provide reasonable accommodation to students with disabilities. http://uaf.edu/disability/

Effective communication

Students who have difficulties with oral presentations and/or writing are strongly encouraged to get help from the UAF Department of Communication's Speaking Center (Phone 907-474-5470, email speak@uaf.edu) and the UAF English's Department's Writing Center (Phone 907-474-5314, location Gruening 8th floor).

Help (Library and Help Desk)

Contact the Elmer E. Rasmuson Library at UAF reference desk for help with research. http://library.uaf.edu or 907-474-7481
Go to http://www.alaska.edu/oit/ to see about current network outages and news. Reach the Help Desk at: e-mail at helpdesk@alaska.edu or phone: 450.8300 (in the Fairbanks area) or 1.800.478.8226 (outside of Fairbanks)

Title IX

See http://www.uaf.edu/oeo/civil-rights/aa-eo/ University of Alaska Board of Regents have clearly stated in BOR Policy that discrimination, harassment and violence will not be tolerated on any campus of the University of Alaska If you believe you are experiencing discrimination or any form of harassment including sexual harassment/misconduct/assault, you are encouraged to report that behavior. If you report to a faculty member or any university employee, they must notify the UAF Title IX Coordinator about the basic facts of the incident. Your choices for reporting include: 1) You may access confidential counseling by contacting the UAF Health & Counseling Center at 474-7043; 2) You may access support and file a Title IX report by contacting the UAF Title IX Coordinator at 474-6600; 3) You may file a criminal complaint by contacting the University Police Department at 474-7721.

Discrimination

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.

NRM F369 GIS and Remote Sensing for Natural Resources

Instructor: Norm Harris

Thursday Evening 5:30 – 8:30 PM, Location O'Neill 305

Date	Session/Laboratory Content	Readings & Assignments (points)
Jan. 18th	1 - Introduction to Natural Resources, Landscape Ecology and GIS/Remote Sensing	Chapter 1 and 2
Jan. 25th	2 - Natural Resources and Humans, Ecosystems, and Biogeography	Chapter 9
Lab 1	Data Sources and Acquisition, Import/Export Functions	Assign. 1 (10)
Feb. 1st	3 – Natural Resource Assessment: Patches, Matrices, and Corridors / Modeling the Surface of the Land	Chapter 6
Lab 2	Digital Elevation Models (DEM) and Triangulated Irregular Networks (TIN)	Assign. 2 (20)
Feb. 8th	4 – Scale and Resolution, Remote Sensing Platforms	Chapter 7
Lab 3	Orthorectification of Aerial Photography	Assign. 3 (20)
Feb. 15th	5 – Flows between Landscape Elements	Readings
Lab 4	Watershed Analysis	Assign. 4 (20)
Feb. 22nd	6 – Vegetation Detection, Monitoring and Mapping	Chapter 10
Lab 5	Vegetation Indices	Assign. 5 (20)
Mar. 1st	7 – Animals on the Landscape	
Lab 6	Analysis of Animal Use and Movement	Assign. 6 (20)
Mar. 8th	8 – Soils and Minerals on the Landscape, Review for Midterm	Chapter 13
Mar. 22nd	9 – Mid-term Exam	
Mar. 29th	10 – Manmade and Natural Disturbances of the Landscape, Results of Midterm	Chapter 5
Lab 7	Unsupervised Classification of Remotely Sensed Data	Assign. 7 (10)
Apr. 5th	11 – Time Change Analysis	Chapter 12
Lab 8	Time Change Analysis	Assign. 8 (20)
Apr. 7th	**Field trip to UAF (9:30 AM to 3:30 PM)**	
Apr. 12th	12 – Land Use Planning	Chapter 8
Lab 9	Supervised Classification of Remotely Sensed Data	Assign. 9 (20)
Apr. 19th	13 – Accuracy Assessment, Model Assessment and Spatial Statistics	Chapter 11
Lab 10	Evaluation and Accuracy Assessment of Classification	Assign.10 (20)
Apr. 26th	14 – The Role of GIS in Decision Making: Multi-Criteria Evaluation (MCE) and Multi-Objective Land Allocation (MOLA)	
May 3rd	Final Exam (5:30 through 7:30 PM)	