NRM F369 GIS and Remote Sensing for Natural Resources
Spring 2016
3 Credits

Instructor: Norman R. Harris
Associate Professor of Range Management
UAF, AFES, Palmer Center for Sustainable Living

Prerequisites: A grade of "C" or higher in NRM F338 or instructor approval. NRM F312 recommended.

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

Course Objectives:

1) This course introduces upper division undergraduate and graduate students to the principles and terminology of natural resources, landscape ecology and ecosystem management.

2) The course develops students' analytical skills using spatial technologies consisting of geographic information systems (GIS), remote sensing, and global positioning systems (GPS) as tools to gain knowledge about landscape form and function.

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. Other spatial software will also be demonstrated in class. 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.

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

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.

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

Disabilities Services: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UA students have equal access to the campus and course materials. I will work with the Office of Disabilities Services (BEB 105, 786-4530) to provide reasonable accommodation to students with disabilities.

Contact Information

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

Phone: (907) 232-5732 (cell) or (907) 746-9475 (office)

SnailMail: Norm Harris
Palmer Center for Sustainable Living
1509 South Georgeson Dr.
Palmer, AK 99645

NRM F369 GIS and Remote Sensing for Natural Resources

Instructor: Norm Harris

Thursday Evening 5:50 – 8:30 PM, Location O'Neill 305

Date	Session/Laboratory Content	Readings & Assignments (points)
Jan. 14th	1 - Introduction to Natural Resources, Landscape Ecology and GIS/Remote Sensing	Chapter 1 and 2
Jan. 21st	2 - Natural Resources and Humans, Ecosystems, and Biogeography	Chapter 9
Lab 1	Data Sources and Acquisition, Import/Export Functions	Assign. 1 (10)
Jan. 28th	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. 4th	4 – Scale and Resolution, Remote Sensing Platforms	Chapter 7
Lab 3	Orthorectification of Aerial Photography	Assign. 3 (20)
Feb. 11th	5 – Flows between Landscape Elements	Assigned readings
Lab 4	Watershed Analysis	Assign. 4 (20)
Feb. 18th	6 – Vegetation Detection, Monitoring and Mapping	Chapter 10
Lab 5	Vegetation Indices	Assign. 5 (20)
Feb. 25th	7 – Animals on the Landscape	
Lab 6	Analysis of Animal Use and Movement	Assign. 6 (20)
Mar. 3rd	8 – Soils and Minerals on the Landscape, Review for Midterm	Chapter 13
Mar. 10th	9 – Mid-term Exam	
Mar. 24th	10 – Manmade and Natural Disturbances of the Landscape, Results of Midterm	Chapter 5
Lab 7	Unsupervised Classification of Remotely Sensed Data	Assign. 7 (10)
March 31st	11 – Time Change Analysis	Chapter 12
Lab 8	Time Change Analysis	Assign. 8 (20)
Apr. 2nd	**Field trip to UAF (9:30 AM to 3:30 PM)**	
Apr. 7th	12 – Land Use Planning	Chapter 8
Lab 9	Supervised Classification of Remotely Sensed Data	Assign. 9 (20)
Apr. 14th	13 – Accuracy Assessment, Model Assessment and Spatial Statistics	Chapter 11
Lab 10	Evaluation and Accuracy Assessment of Classification	Assign.10 (20)
Apr. 21st	14 – The Role of GIS in Decision Making: Multi-Criteria Evaluation (MCE) and Multi-Objective Land Allocation (MOLA)	
April 28th	Final Exam (5:50 through 7:50 PM)	