

# Geog/Envr 360: Environmental Remote Sensing

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Office Hours: Thursdays 1:30-3 pm & by appt.

## Time and Location:

Lecture: T/R 10:30-11:45  
INTC 229 or  
INTC Spatial Analysis Lab (3<sup>rd</sup> floor)

## Course Description

Every day hundreds of satellites circle the earth acquiring data upon data upon data on various temporal and spatial scales. These satellites provide us with a plethora of information that allows scientists to answer questions across fields from sociology, geology, biology, economics, and epidemiology. Remote sensing is integral to our ability to understand global human-environmental dynamics, and help solve major issues facing our world today. This class will culminate in a research project, which will take you through the process research scientists know all too well, beginning with a research proposal. You will be able to use the knowledge and tools you learned in class to address a real-world question that interests you. You will leave this class with a skillset applicable to fields outside of geography, and the ability to propose and develop your own independent research project.

The course will introduce students to:

-  Spacecraft systems
-  Radiative transfer theory
-  Reflectance, thermal and radar remote sensing
-  Commonly used techniques for remote sensing data analysis

## Course Objectives

By the end of this class, you should be able to:

-  Have a theoretical understanding of remote sensing science
  - Understand how a photon of light travels from the sun, through the atmosphere, interacts with the surface of the earth, and is received by a satellite



MY HOBBY: GETTING LOST ON  
GOOGLE MAPS SATELLITE

- Visually interpret satellite imagery
- Gain familiarity with techniques and spectral indices used throughout the field
- ✎ Navigate complex data repository's and industry software
  - Download and process remotely sensed data
  - Use ENVI imaging software to implement commonly used remote sensing methodologies
- ✎ Develop, propose, and conduct a research project

### Course Materials

The textbook for this course is *Fundamentals of Remote Sensing: An Environmental Approach. Second Edition. 2016. Emilio Chuvieco*. Additional readings from other sources will be assigned during the semester. These readings will be accessible through the course web page. The web site for the class can be found on Blackboard.

### Course Work

These course objectives will be assessed through **weekly lab exercises, one midterm, class participation, in-class discussions, short-image presentations, and a final project**. The amount of time needed for this class will ramp up toward the end of the semester depending on how much time and effort you choose to put into the final project. Begin considering a research question/topic as early as possible. **There is no final exam.**

#### *Midterm (25% of grade)*

Exam questions are derived from class material and readings. No makeup exams will be given except in the case of legitimate and verifiable extenuating circumstances and **ONLY IF** you me at least 24 hours before an exam, missing a midterm results in a zero on the exam. The dates of the midterm is noted in the course calendar below.

#### *Labs (35% of grade)*

Labs are intended to be inquiry driven exercises that focus on scientific methods including the development of testable hypotheses and provide an opportunity for you to apply concepts you've learned into class to real-world problems. This is an interactive course and students are expected to fully engage in the learning process by working out each laboratory exercise with the help of the lab material and lecture notes. There will often be a short introduction preceding each lab; this is an excellent opportunity to ask any questions or ask for clarification. Many of the labs require write-ups to be handed in at the conclusion of the lab period. There may also be homework components to many of the labs including formal lab write-ups that will be completed as homework assignments. You can work in pairs during the labs. However, each student must submit their own write-up with the names of other group members listed at the top of the page for all assignments.

### *Research paper and presentation (30%)*

The 10-page research project is intended to allow students to pursue, in depth, the application of remote sensing to a topic of interest or to an area within their concentration. Through this assignment you will become more knowledgeable in at least one area of remote sensing, and recognize the elements required to use remote sensing effectively for analysis of environmental processes or problems. A project topic will be due before fall break. A one-page project proposal will be due on Thursday, Oct 31, and these proposals will be peer-reviewed on Tuesday Nov. 5<sup>th</sup>. You will need to address a specific question that you wish to answer. For example, if you want to inspect the urban growth of the Richmond metro areas vs vegetation cover loss over the past 20 years, you will also need to understand which data you need (Landsat TM data 1990s, Landsat ETM+ data from 2000...we'll learn more about this in class). You will be given time in class to work on your projects, but you will also be expected to work on these projects outside of class. You will also have to present your final project during the last week of classes.

### *Participation (10%)*

Your participation grade will be divided into five equal parts, as described below.

#### 1. Image Presentations.

You have to find a remotely-sensed image and present it (in 2-3 minutes) to the class. The image you present needs to fit on one screen without scrolling so it can easily be shown to the class. You will need to provide the location of the image, the URL, satellite name, sensor name, sensor bands or channels used in creating the image, image acquisition date, and spatial resolution. You can find more details and a PowerPoint template for these presentations on Blackboard.

#### 2. Remote-Sensing In-the-News

You must find and summarize two different remote sensing stories from the popular media (newspaper, magazine, radio, or television). The first is due before fall break, and the second is due at the end of the semester. The summaries should clearly describe what question is being asked, what remotely-sensed tool is being used, what methodology is being used – if you can tease that out, and what you want to learn more about. These should be 1-2 pages in length.

#### 4. Engaged participation. Engaged participation will be evaluated using the following guidelines:

Grade	Behavior
9-10/10	Always well prepared for class; facilitates productive peer discussions; offers reasoned responses of high quality and asks thoughtful questions on an ongoing basis.
7-8/10	Contributes regularly; generally prepared; asks questions and provides occasional responses of moderate quality; handles direct questions satisfactorily.
6/10	Participates infrequently; needs to be prodded; weak preparation; allows other to carry the ball in class discussions
5/10	Often inadequately prepared; little involvement in class discussions; repeatedly late or leaves during class.
0-4/10	Unprepared; disruptive in class; unauthorized use of computers during class – e.g. email, gChat; general browsing; repeated talking with other students about topics not related to class.

**The final grade will be determined based on University of Richmond guidelines**

(<http://registrar.richmond.edu/services/policies/grading.html>):

A > 93.5; A- 89.5 – 93.4; B+ 87.5 -89.4, B 83.5-87.4; B- 79.5-83.4; C+ 77.5-79.4; C 73.5-77.4; C- 69.5-73.4; D+ 67.5-69.4; D 59.5-67.4; E < 59.5

Course Policies

Late work will not be accepted, which means if something is not turned in on time, you will earn a 0 on that assignment. However, I understand that sometimes life gets in the way, so if you know you're going to have a problem attending class, turning in an assignment, e-mail me or stop by my office to chat **beforehand**. Or else it is a 0.

The classroom is a place of learning and respect. In order to maintain the proper learning environment, you should not engage in any other activities during class time. Please do not distract others by arriving late, leaving early, or chatting during class.

We will foster an inclusive and respectful environment in the classroom. I expect this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. If you ever feel uncomfortable in class, please do not hesitate to let me know.

If you prefer to go by an alternate name or gender pronoun, do not hesitate to let me know, and I will happily honor that request.

This course generally has a no cell-phone and laptop policy. But, bring your laptops to class as we will sometimes use them for in-class activities and research. We do ask that these devices be closed/off for note taking. Students' use of laptops in classrooms often contributes to multitasking and off-task behaviors (e.g., Kay & Lauricella, 2011) which, in turn, interfere with their performance (e.g., Fried, 2008; Hembrooke & Gay, 2003; Krausharr & Novak, 2010) and that of their peers (Sana et al. 2013). Even in the absence of off-task behaviors, such as internet browsing, notetaking via laptops compared to longhand may lead to shallower processing and, thus, less retention of course material (e.g., Mueller & Oppenheimer, 2014). Data do not favor the use of electronics in classrooms for lecture and discussion. Please ensure that laptops, iPads, phones, and other electronic devices are silenced and out of view when not required. Computer use for academic purposes will be specified by the instructors. Failure to comply with this policy may result in a reduction in your participation grade. **If you do feel like you need to use your laptops for note-taking, please write a paragraph reflecting on your previous experiences taking notes during lectures, study habits, reasons you feel a laptop will be beneficial to your performance in this class, and please include a line stating you will only use the laptop for note-taking purposes (i.e not internet browsing), and submit this to me via email.**

### Literature Citation Guide

The department of Geography and Environment uses the APA style to cite literature when appropriate. A comprehensive reference guide to APA citation style can be found here ([https://libguides.richmond.edu/ld.php?content\\_id=46073175](https://libguides.richmond.edu/ld.php?content_id=46073175)) and on Blackboard.

### Academic Honesty

All students are expected to abide by the University of Richmond's Honor Code. The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor.

### Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before January 18<sup>th</sup> to discuss appropriate accommodations.

### Time-on-Task Expectations:

To be successful in this course, you should expect to devote an average of 8-12 hours each week to preparing for class, participating in class and lab sessions, studying course related materials, and completing course assignments.

**Calendar (\*\*subject to change\*\* - want to fit UAVS in Nov. somewhere)**

<i>Week</i>	<i>Day</i>	<i>Topic</i>	<i>Important to Note</i>
Week 1	T, Aug 27	Intro	
	R, Aug 29	Maps, Scale, Photogrammetry	
Week 2	T, Sep 3	EM Spectrum	Lab 1
	R, Sep 5	Radiative Transfer	
Week 3	T, Sep 10	Reflectance spectroscopy of materials	Lab 2 <i>Lab 1 Due</i>
	R, Sep 12	Veg + Rocks	
Week 4	T, Sep 17	Image Acquisition	Lab 3 <i>Lab 2 Due</i>
	R, Sep 19	Image Acquisition	
Week 5	T, Sep 24	Thermal Remote Sensing	Lab 4 <i>Lab 3 Due</i>
	R, Sep 26	Thermal Remote Sensing	
Week 6	T, Oct 1	SMA	Lab 5 <i>Lab 4 Due</i>
	R, Oct 3	SMA	
Week 7	T, Oct 8	Classification	Lab 6 <i>Lab 5 Due</i>
	R, Oct 10	Classification	<i>Project Topic Due</i>
<b>Week 8</b>	<b>T, Oct 15</b>	<b>Fall Break</b>	
	R, Oct 17	Temporal Data Analysis	
Week 9	T, Oct 22	Hyperspectral Remote Sensing	Lab 7 <i>Lab 6 Due</i>
	R, Oct 24	Change Detection	
Week 10	T, Oct 29	Lidar/Radar	Lab 8 <i>Lab 7 Due</i>
	R, Oct 31	Soil, Veg, Water Resources	<i>Project Proposal Due</i>
Week 11	T, Nov 5	PEER REVIEW	
	R, Nov 7	Exam	
Week 12	T, Nov 12		Lab 9
	R, Nov 14	Soil, Veg, Water Resources	
Week 13	T, Nov 19	Lab: Work on final project	
	R, Nov 31	Fluorescence, Future Systems	<i>Labs 8 &amp; 9 Due</i>
Week 14	T, Nov 26	Lab: Work on final project	
	R, Nov 28	Thanksgiving // Watching the Lions lose	
Week 15	T, Dec 3	In-Class Presentations	
	R, Dec 5	In-Class Presentations	
	F, Dec 6	Final Project due to Blackboard at 5 pm	

## Student Needs

If you experience difficulties in this course, do not hesitate to consult with me. There are also other resources that can support you in your efforts to meet course requirements, including,

The *Academic Skills Center* (<http://asc.richmond.edu>, 289-8626 or 289-8956) assists students in assessing their academic strengths and weaknesses; honing their academic skills through teaching effective test preparation, critical reading and thinking, information conceptualization, concentration, and related techniques; working on specific subject areas (e.g., calculus, chemistry, accounting, etc.); and encouraging campus and community involvement. Hours at the Center are: Sunday through Wednesday 3:00-9:00 p.m. and Thursday 3:00-7:00 p.m. On-call tutors are also available.

*Boatwright Library Research Librarians* (<http://library.richmond.edu/help/ask/> or 289-8876): Research librarians assist students with identifying and locating resources for class assignments, research papers and other course projects. Librarians also provide research support for students and can respond to questions about evaluating and citing sources. Students can email, text or IM or schedule a personal research appointment to meet with a librarian in his/her office on the first floor Research and Collaborative Study area.

The academic environment at UR is challenging, our semesters are intensive, and classes are not the only demanding part of your life. *Counseling and Psychological Services* (<http://wellness.richmond.edu/offices/caps/> or 289-8119) assists currently enrolled, full-time, degree-seeking students in improving their mental health and well-being, and in handling challenges that may impede their growth and development. Services include short-term counseling and psychotherapy, crisis intervention, psychiatric consultation, and related services.

The *Speech Center* (<http://speech.richmond.edu> or 289-6409) assists with preparation and practice in the pursuit of excellence in public expression. Recording, playback, coaching and critique sessions offered by teams of student consultants trained to assist in developing ideas, arranging key points for more effective organization, improving style and delivery, and handling multimedia aids for individual and group presentations.

The *Writing Center* (<http://writing.richmond.edu> or 289-8263) assists writers at all levels of experience, across all majors. Students can schedule appointments with trained writing consultants who offer friendly critiques of written work.

*The Office of Disability Services* (<https://disability.richmond.edu/students/index.html> or 289.8032) works to ensure that qualified students with a disability (whether incoming or current) are provided with reasonable accommodations that enable that student to participate fully in activities, programs, services and benefits provided to all students. **Students with special needs that require an accommodation or an academic adjustment, please arrange a meeting with Dr. Spera within the first two weeks of the semester.**