GEOG 480/580 - Syllabus
Remote Sensing I: Principles and Applications

Instructor: Dr. Anne Nolin

Contact info: Office: Wilkinson 248
Mailbox: 104 CEOAS Admin Building
nolina@science.oregonstate.edu

Credits: 4

Office Hour M 2:30-3:30PM (and by appt.), Wilkinson 248

Class Schedule
Lecture: T, R: 11:00-11:50AM, Cordley 2113
Lab, Section 010: W 2:00-3:50PM, Wilkinson 210 (Travis Roth, TA)
Lab, Section 011: R 2:00-3:50PM, Wilkinson 210 (John Trimble, TA)
Lab, Section 012: W 9:00-10:50AM, Wilkinson 210 (Travis Roth, TA)

Course Calendar
See Canvas and the syllabus for quiz dates and assignment due dates.

Teaching Assistants
Travis Roth, rothtra@science.oregonstate.edu
Mailbox: Wilkinson 104, Office: Wilkinson 123
Office hours: T 12:00-1:00PM (and by appt.), Wilkinson 210

John Trimble, trimbljo@oregonstate.edu
Mailbox: Wilkinson 104, Office: Wilkinson 206
Office hours: W 1:00-2:00PM (and by appt.), Wilkinson 210

Catalog description. REMOTE SENSING I: PRINCIPLES AND APPLICATIONS. (4). Fundamentals of satellite remote sensing and image analysis. Topics include physical principles of remote sensing from the ultraviolet to the microwave, sensors and sensor technology, and environmental applications of remote sensing through image analysis. Lec/lab. PREREQs: GEOG 201.

Description: Fundamentals of satellite and airborne remote sensing and digital image analysis. Topics include physical principles of remote sensing from the visible to the microwave, sensors and sensor technology, and environmental applications of remote sensing through digital image analysis.

Recommended Prerequisite: OSU GEO 301 (Introduction to Map Interpretation), or equivalent course/work experience.

Additional Helpful Background: You will need basic skills in trigonometry and algebra. A basic understanding of physics is very helpful. Some lab assignments will require use of Excel.

Course Website: Canvas. I will post most lecture notes, templates and examples for projects and critiques, and links to useful websites.


Course Learning Outcomes: All students completing GEO 444 or GEO 544 should be able to:
(1) Describe the basic physics and principles of remote sensing;
(2) Summarize the differences and basic workings of relevant airborne and satellite remote sensing instruments;
(3) Perform image analysis (using image processing software) and understand basic image analysis techniques for environmental applications of remote sensing; and,
(4) Assess the synergies and limitations of remote sensing for environmental analysis.

Additionally, graduate students completing GEO 544 should be able to:

I. Formulate a research hypothesis related to an environmental application of remote sensing and image analysis;
II. Design and perform an image analysis research project using satellite, airborne, or other remote sensing imagery;
III. Analyze the imagery, understand the results, assess the errors, and draw conclusions with respect to the hypothesis; and,
IV. Communicate the research in a professional and effective manner using visual, written and oral scientific communication skills.

Graduate students: It is Oregon State University policy that when a graduate course is dual-listed with an undergraduate course (e.g., GEO 444/544), students taking the graduate course should receive additional education and training and must be held to higher standards of performance than students taking the undergraduate course.

To comply with this policy, graduate students taking GEO 544 will complete the term project in teams of two. In addition, when grading and assigning points to student work (lab assignments, quizzes and exams), the instructor will hold graduate students to higher standards of originality, accuracy, completeness, justification, and presentation than undergraduate students.

The project is assessed in four parts. Part I is assessed as check, check-minus, check-plus and is examined to ensure that you are making good progress and identify areas where you need assistance; Part II is the in-class poster presentation, Part III is the final extended abstract, and [Parts II and III are assigned a combined grade for the whole]. Part IV is where you explain to me the tasks performed individually on the project.

Grading:

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<tr>
<th></th>
<th>Labs</th>
<th>Quizzes</th>
<th>Project</th>
<th>Final Exam/Critique</th>
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<tbody>
<tr>
<td>Undergrads</td>
<td>35%</td>
<td>35%</td>
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<td>30%</td>
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<tr>
<td>Graduate Students</td>
<td>30%</td>
<td>30%</td>
<td>25%</td>
<td>15%</td>
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Grading Scale: Grades are based on the percentage of maximum points accumulated and assigned according to the following table:

- A 92-100%
- B+ 88-89%
- C+ 78-79%
- D+ 68-69%
- F <60%
- A- 90-91%
- B 82-87%
- C 72-77%
- D 62-67%
- B- 80-81%
- C- 70-71%
- D- 60-61%

Reading Assignments: It is the responsibility of each student to complete the assigned reading for each week. The readings are directly related to lecture topics and lab work. Associated page numbers are supplied for your convenience.
Quizzes: Students are expected to take the weekly quizzes (see schedule). If a student is unable to attend a quiz due to verifiable unforeseeable reasons (e.g. illness, accident, etc.), the instructor will, at their discretion, decide a make-up date for the quiz. Missing the make-up quiz will result in a score of zero for that quiz. Quizzes are worth 10 points each and are the only exams you have in this course. There is no midterm but there is a final exam at the regularly scheduled time.

Labs: Labs are designed to give students hands on experience viewing and manipulating remote sensing imagery. ENVI software is utilized for the majority of assignments and is probably new to most students.

Note: This is a 4-credit course with only two scheduled lab hours. Students are expected to spend one additional hour in the lab each week. Please check the Digital Earth Lab schedule for available times. You may sit in during another class as long as there is space and it is okay with the instructor of the class.

Lab Assignments: Lab assignments are due in the lab dropbox (the TA will go over this with you) prior to the start of next week’s lab. Efforts will be made to return them graded within one week after they are turned in. Late assignments are highly frowned upon as one week is plenty of time to complete each assignment. However, as life is often unpredictable, contact the instructor and the TA immediately if issues arise.

Late assignments will be penalized as follows:
- Day 1: -20 points (80% maximum score possible)
- Day 2: -30 points (70% maximum score possible)
- Day 3: -40 points (60% maximum score possible)
- Day 4: Not accepted

Graduate Student Projects: Graduate students have an additional requirement to complete a project on the subject of their choosing. Students will work in self-selected teams of two persons. The subject should relate to the use of remote sensing techniques to solve problems in their field of study. You should discuss your proposed project with me within the first two weeks of the course.

The project will be graded in multiple parts:

Part I: A collaboratively developed summary of your proposed project. This is a typed, single-spaced, 1-2 page summary that includes your problem statement and hypothesis, a description of the study site (with a map or a labeled image), a description of the remote sensing dataset(s), and an example of the data (showing me that you have downloaded the data and have worked with it). A template and example will be made available on the course website.

Part II: A collaboratively developed conference style poster presentation. A poster template will be made available on the course website and examples provided in the Digital Earth Lab.

Part III: A collaboratively written abstract of your project (2-3 pages maximum) that will be uploaded to an ArcGIS online “story map” (more details on this to be provided in class). The abstract and associated imagery and figures is a concise, structured overview of the project (problem statement or hypothesis, significance and motivation, specific objectives,
methodology, data sources, study area including a map), analysis of the results, discussion of their meaning, careful and clear presentation of figures, discussion of sources of errors, conclusions. A story map tutorial and examples will be made available on the course website.

**NOTE:** You must supply a near-final version of the abstract to your designated undergraduate reviewer no later than 5PM the day before the poster presentation.

**Part IV:** An individual brief statement attached to your individual abstract/story map entry describing the specific tasks you performed for the project (including data acquisition, processing, analysis, interpretation, and presentation). Each team member needs to email me their statement by the project due date.

**Undergraduate Critique of Graduate Student Projects**

All undergraduate students will perform a critique of a selected graduate students project, Each undergraduate student will be assigned one poster/abstract to review and critique. The reviews need to involve a careful reading of the poster content and the abstract as well as a discussion of the project with the graduate student presenter. **You are required to describe and critique the graduate student project in such a way that it is clear that you have met learning objectives 1-4.** A template for the critiques will be made available on the course website.

**Students with Disabilities:** Students with accommodations approved through Disability Access Services (DAS) are responsible for contacting the instructor prior to or during the first week of the term to discuss accommodations. This information is private and will not be shared or communicated to anyone else

Accommodations are collaborative efforts between students; faculty and DAS. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at Disability.Services@oregonstate.edu or 541-737-4098

**Special Notes:** If you have a conflict between religious observances and class lectures/quizzes or labs please let me know in advance so these can be made up.

**Incompletes:** Incomplete (I) grades are assigned only in emergency cases (usually only for a death in the family, major illness or injury, or birth/adoption of your child), and if the student has turned in 75% of the points possible. If you are having any difficulty that might prevent you completing the coursework, please don’t wait until the end of the term; let me know right away.

**Expectations for Student Conduct:** Student conduct is governed by the university’s policies, as explained in the Office of Student Conduct: information and regulations. Please review the OSU policies on classroom conduct and academic honesty at http://oregonstate.edu/studentconduct/code/index.php

**New text in the syllabus regarding Title IX:** Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources through Counseling and Psychological Services (confidential), sexual assault support services (confidential), CARDV, and campus police.
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<tr>
<th>WEEK</th>
<th>LECTURE TOPICS</th>
<th>READING (pages)</th>
<th>LAB TOPICS</th>
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<tr>
<td>0</td>
<td>Introduction, overview of RS, electromagnetic spectrum</td>
<td>1-5</td>
<td>No Lab</td>
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<td>1</td>
<td>Energy principles; Radiation interactions with the atmosphere</td>
<td>6-12</td>
<td>Intro to ENVI</td>
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<td>2</td>
<td><strong>Quiz 1; Radiation at the earth’s surface</strong></td>
<td>12-30</td>
<td>Scattering and absorption</td>
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<td>Resolution</td>
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<td><strong>Quiz 2; Resolution and orbits</strong></td>
<td>285-290</td>
<td>Resolution</td>
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<td>Multi- and hyperspectral, <strong>Graduate student project proposals due</strong></td>
<td>290-378, 271-282</td>
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<td><strong>Quiz 3; Thermal, multiangular</strong></td>
<td>243-270, 378-379</td>
<td>Multispectral/hyperspectral,</td>
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<td>LiDAR</td>
<td>471-484</td>
<td>multiangular, thermal</td>
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<td>5</td>
<td><strong>Quiz 4; Passive microwave</strong></td>
<td>466-470</td>
<td>LiDAR</td>
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<td>Radar</td>
<td>385-434</td>
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<td>6</td>
<td><strong>Quiz 5; InSAR</strong></td>
<td>435-442</td>
<td>Applications: Vegetation</td>
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<td>Gravity</td>
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<td><strong>Quiz 6; Change detection, land use/land cover</strong></td>
<td>611-618, 632-639</td>
<td>No Lab</td>
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<td>Soils, geology, &amp; geomorphology</td>
<td>618-628, 678-698</td>
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<td>8</td>
<td><strong>Quiz 7; Water</strong></td>
<td>639-648</td>
<td>Applications: Soils and geology</td>
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<td>Cryosphere</td>
<td>649-652</td>
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<td><strong>Quiz 8; Urban and regional planning</strong></td>
<td>652-654</td>
<td>No Lab</td>
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<td><strong>Thanksgiving – no class</strong></td>
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<td>10</td>
<td>Hazards and societal applications</td>
<td>665-678</td>
<td>Applications: Water</td>
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<td><strong>In-class Graduate student poster presentations; required attendance</strong></td>
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Undergrad critiques and grad student final project materials are due Fri, Dec 4th no later than 5:00 PM (email only)
FINAL EXAM: Tues, Dec. 8th, 2:00-4:00 PM; Cordley 2113