Syllabus: SSC 545 -601: Remote Sensing Applications in Soil Science and Agriculture
Spring 2016

1. Instructor:
Dr. Jeff White
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Office hours: Forums as described below. Office or Skype: by appointment. Blackboard Collaborate: as needed and scheduled.

2. Course goals and objectives: Understand remote sensing principles and methods and their applications in soil science and agriculture. Develop strategies for incorporating remote sensing in students’ research and related areas. Develop some practical, hands-on skills for processing, analysis, display, and discussion of remote sensing data. Develop skills and experience in reviewing relevant literature and writing a remote-sensing based research or applied project proposal.

3. Specific Learning Outcomes: At the end of this course, a student will be able to:
1. Explain what remote sensing is (and is not), outline its history and evolution, and display appropriate vocabulary in explaining the underlying physical principles, i.e., electromagnetic radiation and its interaction with matter.
2. Describe and explain the broad range of remote sensing techniques, instruments, data acquisition formats, systems, and platforms that have applications in soil science and agriculture, including: black and white, color, and color-infrared film and digital photography/imaging; multispectral and hyperspectral sensors; electromagnetic induction measurement (EMI) of soil electrical conductivity (EC); ground penetrating radar (GPR); synthetic aperture radar (SAR); thermal infrared imaging/thermography; lidar; passive microwave radiometry; passive gamma-ray spectrometry; and ground, aerial, and satellite/space platforms.
3. Outline and explain the basic principles of acquisition, storage, transmission, processing, and analysis of remotely sensed data, to include: derivation of vegetation and soil indices; unsupervised and supervised image classification and spectral signature development; shape and pattern recognition.
4. Outline and explain past, current, and future applications of remote sensing in soil science and agriculture.
5. Display a working knowledge of the historic and current literature of remote sensing, including the principle journals publishing in the field.
6. Formulate strategies for incorporating remote sensing into the student’s research or area of interest (and career), and write a research or applied project proposal incorporating remote sensing.

4. Textbook: There is no single textbook for this course. Students will be referred to: texts and journal articles on print and electronic reserve at Hill Library and posted on the class Moodle site, other websites, and to software tutorials and documentation.

5. Course organization and scope:
   1) Course and Moodle Overview
   2) Electromagnetic Radiation Physics
   3) Aerial Photography and Digital Imaging
   4) Aerial Photography in Soil Survey
   5) Satellites & Remote Sensing Platforms
   6) FIRST HOUR EXAM
   7) Digital Image Processing & Interpretation
8) Digital Image Classification
9) ArcGIS Image Analysis Extension & Exercises
10) Hyperspectral Remote Sensing
11) Soil Reflectance
12) Plant Reflectance and Vegetation Indices
13) Topographic Remote Sensing Methods: lidar, synthetic aperture radar (SAR)
14) SECOND HOUR EXAM
15) Soil Electrical Conductivity
16) Ground Penetrating Radar (GPR)
17) Thermal Infrared Imaging, Thermography
18) Passive Microwave Radiometry
19) Passive Gamma-wave Spectrometry
20) Remote Sensing to Optimize Nitrogen Fertilization
21) Remote Sensing for Precision Weed Control
22) Famine Early Warning System
23) FINAL EXAM

6. Projected schedule of reading assignments: Will be revealed as the semester progresses. A partial list can be found via Library Course Tools on Moodle and “My Reserves” at the Library website.

7. Coursework: exams, homework assignments, project proposal, “Class Participation,” etc.
   a. Two 50 min exams and one 3-hour comprehensive final. Homework and readings as assigned, typically about 1 per week.

   b. Research or applied project proposal for incorporating remote sensing in the student’s research, other research interests, or an appropriate application.

   c. Exploratory exercises using the image analysis/classification tools within ArcGIS 10.3. NB: SSC 545 does NOT emphasize hands-on use of remote sensing analysis software (e.g., ERDAS Imagine), which is the core of GIS 512 Introduction to Environmental Remote Sensing.

   d. Class Participation: To encourage class interaction, collaborative learning, and to receive full credit for participation, during the semester you must post:
      1) ≥ 15 glossary entries (~ 1/week);
      2) ≥ 5 remote sensing news items;
      3) ≥ 1 question or answer within each topic-associated Question and Answer Forum and other Forums as assigned. Note: Frivolous or solely humorous posts will not receive credit. However, humor within substantive posts is not discouraged. All posts are expected to observe basic rules of netiquette; a good guide is the Core Rules of Netiquette
      4) Extra credit: there will be a semester-long “Course Improvement” Forum dedicated primarily to posts concerning problems with course presentation. For example, within a video what I write on the board or what I point to in a slide may not be visible. If you notice this, please post the problem with the video title and timing. Another example: dead web links.

   Students may be required to disclose personally identifiable information to other students via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.
8. Grades, relative value of the various evaluation components of the course, i.e., the portion of the grade that derives from quizzes, tests, final exam, projects, attendance, etc.:

- Hour exams: 30%
- Research proposal: 15%
- Homework/Assignments: 20%
- Final Exam: 25%
- “Class participation”: 10%.

Letter grades will be assigned on a percentage basis: 96.7-100 = A+; 93.3-96.6 = A; 89.9-93.2 = A-; 86.5-89.8 = B+; 83.1-86.4 = B; 79.7-83 = B-; 76.3-79.6 = C+; 72.9-76.2 = C; 69.5-72.8 = C-; 66.1-69.4 = D+; 62.7-66 = D; 59.3-62.6 = D- and < 59.3 = F

9. Policies on incomplete grades, late assignments, and scheduling makeup work:
In accordance with NCSU policy (REG 02.50.03 - Grades and Grade Point Average), an incomplete grade will be granted only where a serious interruption in a student’s work was not caused by their own negligence. The following penalty will be assessed for unexcused late submissions: 20% grade reduction for each day (or part thereof) that an assignment is late; thus, an assignment turned in 4+ days after the due date will receive zero credit. Students should discuss prospective excused absences with the instructor beforehand whenever possible and as soon as possible after emergency absences in order to arrange for due date extensions. Please see: REG 02.20.03 - Attendance Regulations for definitions of “excused” and “emergency” absences. This is a one-semester course that follows the schedule as posted. Students are expected to keep up.

10. Course prerequisites or restrictive statements: Desired but not required: SSC 200 Soil Science, or equivalent (basic soils); PY212 College Physics II: Electricity, and magnetism, light, modern physics, or equivalent. Basic familiarity with production agriculture. Students with concerns about these should discuss them with the instructor. Some resources are provided or recommended to students with deficiencies in these areas.

11. Academic Integrity Statement:
Students must comply with NCSU policy on conduct and academic integrity: POL 11.35.01 - Code of Student Conduct. By participation in this course, students acknowledge tacitly the Honor Pledge: “I have neither given nor received unauthorized aid on this test or assignment.”

12. Non-Discrimination Policy
NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State’s policies and regulations covering discrimination, harassment, and retaliation may be accessed at Equal Opportunity and Non-Discrimination Policy and Office for Institutional Equity and Diversity (OIEO). Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact (OIEO) at 919-515-3148.
13. **Statement for Students with Disabilities:**
Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see Academic Accommodations for Students with Disabilities.

14. **Statement on “pass-through” charges:** There may be optional fields which may incur nominal charges to offset expenses. Students will not be penalized if unable to participate.

15. **Educational Philosophy:** I encourage collaborative, participatory learning: teaching yourself, learning by doing, learning from others, learning by teaching others, and guided discovery. Typically, students in this course come from broad range of backgrounds and interests. We will exploit this to facilitate and broaden learning.

Workload: This syllabus outlines the extensive and intensive learning objectives of SSC 545. To realize these objectives will require substantial effort by all of us. The course includes considerable material covered at varying intensities. I am enthusiastic about remote sensing and its potential to help us better manage spatial and temporal variability of agriculture, soils, and other natural resources. Remote sensing has been and continues to be an integral component of much of my research. I hope to instill in you a similar sense of excitement and enthusiasm about remote sensing that will make realization of the learning objectives a satisfying pursuit for all of us.

Excepting exams, I will attempt to make this course as “paperless” as possible. Unless otherwise directed, students should access and submit all assignments via Moodle.

16. **Feedback!** As the semester progresses, I can and will customize this course to better meet your needs. To help me do that, I urge you to communicate with me about any aspect of the course at any time. However, most questions regarding course content should be posted to the appropriate forum. If the course is moving too quickly or too slowly, you find the workload oppressive, or you’d like a supplementary resource, say so. Let’s work together to make this the best course possible!

**ClassEval:** Near the end of the semester, I will encourage you to complete the standardized NCSU course/instructor evaluation, ClassEval. All evaluations are confidential; instructors will not know how any one student responded to any question, and students will not know the ratings for any instructors.