FOR 6934: Remote Sensing of Terrestrial Ecosystems (3 credits)

Lectures and Discussion: Tuesday periods 4-5 (10:40 – 12:35); Wednesday period 4 (10:40-11:30); Newins-Ziegler Hall 219

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Course Description

This course will focus on the intersection of remote sensing and ecology of forests and other terrestrial ecosystems. We will focus especially on high resolution remote sensing (multi- and hyper-spectral, lidar) now available from satellites, aircraft and drones, which has high enough resolution to give information on individual plants. We will explore how the RS data can be linked to field data and scaled to coarser scale images. Students will learn how remote sensing can be used to provide meaningful ecological information, grounded by understanding how energy detected from remote sensing interacts with forests. Students will be introduced to how various remote sensing analysis approaches, for example spectral mixture analysis, partial least squares regression, support vector machine, can be used for various ecological applications such as mapping plant functional traits (water stress, leaf area index, nitrogen content), tree and forest structure, and individual species, including invasive.

A large amount of high resolution remote sensing data is about to become available with the National Ecological Observatory Network (NEON). One of the first NEON sites will full data collection is the UFUF Ordway Swisher Biological Station. We will take advantage of these data being available to use now, and also our ability to go out to Ordway to see the site and collect additional remote sensing and ecology data. We will analyze "real" NEON remote sensing and field data to learn different concepts and tools. NEON is US government-funded, multi-million dollar project that will build infrastructure and operate standardized ecological data collection at 20 core sites in various ecosystems across the US for the next thirty years (see links below) with current and future employment opportunities for Ph.D. students and post-docs, as well as a huge data base from which to write proposals and conduct research. With this course, I want to position UF graduate students to be early adopters of NEON data and science.

http://www.neoninc.org/sciencebrochure/scientific-ebrochure.pdf
http://www.neoninc.org/

Students can choose one of two final products from the class, which can be done individually or in groups: analyzing an ecological questions using remote sensing and field data related to the graduate student's project, or a manuscript based on analysis of Ordway Swisher NEON data.

Course Objectives

Students will develop skills to integrate remote sensing and field data to analyze function and structure of forests and other terrestrial ecosystems. Specific objectives include:

- Understand biophysical interpretation of different remote sensing types (multi-spectral, lidar, drone-based point clouds) for forests and other terrestrial ecosystems lidar and hyperspectral data
- Develop a tool set of analyzing high resolution remote sensing data to answer ecological questions
- Introduce students to scaling, data integration and big data approaches that utilize remote sensing, field data and modeling to address ecological questions
- explore specific scientific questions that can be addressed with NEON data at our local site, regions and at a continental scale
- gain experience in field-based remote sensing data collection that complements high resolution remote sensing data
- enable students to be "early adopters" of the NEON data stream for ecological and computational research
- prepare a manuscript or proposal based on initial NEON data from OSBS, or multiple sites – or conduct a project that integrates remote sensing and ecological field data into the student's research question

Course is Designed For: Graduate Students in Ecology, Biology, Forest Resources, Geography, Computer Science, and other fields.

Format:

Lectures and discussion will cover a range of topics in remote sensing as applied to terrestrial ecosystems. Students will read primary literature, much of it very recent and "cutting edge" due the recent advances in sensor technology, analysis techniques and integration of remote sensing and field data. Students will analyze remote sensing and field data from the Ordway Swisher NEON site to apply concepts and learn analysis techniques. This course will also include at least one field trip to OSBS to visit the site to learn about data collection and collect remote sensing data ourselves. Finally, student will work individually or in groups to prepare a proposal or manuscript related to the local NEON site, or larger spatial scale analysis – or – students will work individually or in groups to do a remote sensing analysis related to students' research area. Students may be asked to lead lectures and/or discussion in their areas of expertise and/or interest.