Summer Session 2017

BIO491 (Special Topics)
Drone Remote Sensing for Freshwater Ecology

3 credits: Lectures, Labs, Field Work
Course dates: August 7–18, 2017

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Prerequisites: Basic coursework in GIS is mandatory (can be met with FORS 250 Introduction to GIS for Forest Management or GPHY 284 Introduction to GIS and Cartography). Knowledge of or course work in remote sensing is preferred, but not required.

Course Description:

Ecological systems are diverse and spatially heterogeneous areas characterized by interacting natural and impacted terrestrial and aquatic mosaics, which consist of features, such as forests, grasslands, rivers or lakes. Key research topics in these landscape mosaics include the analyses, quantification and scaling of ecological flows, land-use and land-cover change, relating landscape pattern analysis with ecological processes, conservation and sustainability. In this context GIS analyses in concert with close range remote sensing using unmanned aerial or aquatic vehicles (UAVs), autonomously or remotely operated and equipped with various sensors such as NIR (Near infrared), TIR (Thermal infrared) or ADP (Acoustic Doppler Profiler) offer new opportunities for scale appropriate measures of ecological phenomena at high spatial- temporal resolutions.

The goal of this proposed class is to introduce and expose students to close range remote sensing in freshwater ecosystems. Students will be gain knowledge of basic spatial analysis through GIS and remote sensing techniques. In addition, students will learn basic application of drones and ADP, two remote sensing instruments of fast growing interest in ecological research and application. The students will learn about the essentials to operate drones and ADPs, the initial post processing of data products and examples how to integrate these data into ecological research and application.

Reference Texts: (1) Carbonneau, P.E. and H. Piegay. 2012. Fluvial Remote Sensing for Science and Management. Wiley-Blackwell. (2) van der Meer, F.D. and S.M. de Jong. 2001: Imaging spectrometry – Basic principles and prospective applications. Springer. Note: Students who already own these texts are encouraged to bring them; however, it is not necessary to purchase the texts for the course. Electronic copies of reference readings and excerpts will be provided by the instructors.

Course and Field Supplies/Equipment (*available for purchase at the FLBS Bookstore)

- Waterproof field notebook (Rite in the Rain No. 393 spiral notebook)*
- Pencils or All Weather Clicker Pen*
- Hot/cold mug*
- Plastic, resealable containers for lunch pack-up*
- Laptop (highly recommended)
- Proper clothing, rain gear
- Water bottle*
- Wading shoes
- Bear spray (optional)*
- Sunglasses, sunscreen, cap/hat
- Daypack
- First aid kit (personal size)
- Insect repellent
- **Other items to bring checklists: (Click to view)**

Student Learning Outcomes:

1) Get an introduction to basic GIS and Remote Sensing techniques for freshwater ecosystems.
2) Knowledge about the basics of spatial-temporal data acquisition using drones and ADP and its potential for landscape ecology with the focus on rivers, floodplains, and other shallow water environments
3) Have the general knowledge to deploy drones and ADP in the field
4) Are able to do simple post processing and product generation using remotely sensed data
5) Can (critically) evaluate and interpret products and data
6) Are able to integrate the application of remotely sensed data into their own research design or practical projects.

Evaluation and Grading:

Grading	A	≥94%	A-	90–93%
	B+	87–89%	B	84–86%
	B-	80–83%	C+	77–79%
	C	74–76%	C-	70–73%

Quizzes	25%
Research proposal written report	30%
Research proposal presentation	45%

Quizzes

Quizzes will be both written and computer examples. Quizzes on basic concepts of GIS and remote sensing, drone/ ADP use and operation, and computer exercises using GIS and remote sensing techniques will be completed during the first week of the course.

Research Proposal – Written Report and Presentation

As students progress in their academic and professional career, they will find the need to write proposals to guide their research, solicit funding, and meet reporting requirements. During the first week of class, students will review research integrating remote sensing and freshwater ecosystems. By the end of week 1, students will write group proposals, incorporating baseline field data you that they will collect during the course. The last day of the class the students will present a power point or prezi presentation describing their group project for colleagues from class and at FLBS. In addition, graduate students will have to submit a written report with their project clearly showing the linkage between science and technology. Graduate students will need to demonstrate their ability to integrate the role of technology used into a broader ecological context and to discuss opportunities and limits of application in science and practice.

Course Policies:

Schedule:

Date	Morning	Afternoon
7-Aug-17	• General introduction and goals of the course • Introduction to GIS and Remote Sensing	• Hands on examples and exercises • Data processing, classification and information extraction

8-Aug-17	• Quiz 1: GIS & RS • Introduction to Drone and ADP systems • Theory, Principles of operation and data acquisition, product overview	• Application examples from science and practice • Floodplain monitoring and evaluation using remote sensing • Assessing hydromorphological impacts of experimental floods • Success control of restoration actions • Demonstration of drones and ADP
9-Aug-17	• Quiz 2: Drones and ADP • Worked examples of archived data. Using previously acquired imagery and ADP data, students will work through how to process, integrate, and analysis coupled imagery and ADP data.	• Continue morning program and discussion of results
10-Aug-17	• Quiz 3: GIS & RS exercise on the computer • Start exploration and discussion of student group projects • Hypotheses, design, data needs, potential data merging with previous or following courses if applicable	• Revision and finalization of group projects proposals
11-Aug-17	• Groups present research proposals	• Set up equipment and first data collection (both imagery and ADP) for training on the technique and feasibility of project at nearby location.
14-Aug-17	• Data collection for group projects begins at Nyack floodplain	• Data collection at Nyack floodplain
15-Aug-17	• Continued data collection for projects	• Start processing imagery and ADP data
16-Aug-17	• Imagery and data processing	• Begin analysis and interpretation for group projects
17-Aug-17	• Final analysis and interpretation of data for group projects	• Preparation of presentation and report
18-Aug-17	• Group presentations and discussions	• Wrap up, feedback on goals archived, discussion on missing course content and improvements