SYLLABUS WINTER 2020

ESRM430: Remote Sensing of the Environment

Lectures:	TTh 12:30 – 1:20 ROOM: EXED 110
Labs:	Session A: T 2:30 – 3:50 BLD261
	Session B: T 4:00 – 5:20 BLD261
	Session C: Th 2:30 – 3:50 BLD261
	Session D: Th 4:00 – 5:20 BLD261
Course Web Site:	http://sites.uw.edu/ESRM430
SEFS Virtual Desktop:	https://madrona.sefs.uw.edu/

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Lab Instructor:	Jonathan Batchelor
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Office Hours:	in Bloedel 389 1:30-2:30 T & Th & by appointment

Course summary: (5 credits = 2 lecture credits + 3 lab credits) Students will be exposed to the principles of photogrammetry, image & point cloud interpretation & hyperspatial (high spatial resolution) remote sensing applications in natural resource management. In the first half of the course, manual & computer-based laboratory exercises emphasize conventional analysis of aerial photographs & high resolution satellite imagery. Students will have the opportunity to apply these principles & obtain hands-on experience. The second half of the course focuses on the application of active remotely sensed data, specifically LiDAR (Light Detection & Ranging). The uses of hyperspatial remotely sensed information for wetlands, watersheds, forest resources, wildlife habitat, point & non-point pollution, environmental monitoring, land use planning, urban-suburban-forestry interfaces, & outdoor recreation will be discussed & illustrated using research examples throughout the course. Practitioners & users from public & private institutions may be involved as guest lecturers. Students will come out of this course with a mastery of a wide variety of interpretation, measurement, environmental monitoring & map making skills specific to hyperspatial remote sensing.

Course objectives: To develop an understanding of hyperspatial remote sensing fundamentals & the ability to interpret & manipulate high-resolution remotely sensed images & datasets. Students will be presented with the traditional & 'state of the art' image processing techniques, & a firm theoretical & practical background in hyperspatial remote sensing applications. By the end of the course students will be expected to evaluate available remote sensing data sources & design simple projects related to environmental applications.

Textbooks

The course spans some traditional & very new sub-branches of remote sensing, thus, there is no one textbook that would best fit the class content. Most of the readings you are expected to do are peer-reviewed literature reviews & research articles & are listed on Canvas. Below are suggested optional textbooks that relate to the course content, some are on hold for you at the Odegard Library.

- Thomas Lillesand, Ralph W. Kiefer & Jonathan Chipman, 2015. Remote Sensing & Image Interpretation, 7th ed. Wiley, p768.
- James Campbell & Randolph Wynne, 2011. Introduction to Remote Sensing, 5th ed. The Guilford Press, p.667.
- Thomas Blaschke, Stefan Lang & Geoffrey Hay, 2008. Object-Based Image Analysis: Spatial Concepts for Knowledge-Driven Remote Sensing Applications (Lecture Notes in Geoinformation & Cartography). 1st ed. Springer, p. 836
- Kathryn Keranen & Robert Kolvoord, 2015. Making Spatial Decisions Using GIS & Lidar: A Workbook, 1st ed. ESRI Press, p. 264.

Other Resources:

- In 2020 onwards we will be using ESRI ArcGIS Pro as the lab software, past lab software is available (its freeware) from the links in the 'Software' section of the class website, you can install it on your personal computers, but we do not provide support or will we grade the old lab modules (we only provide these modules for further learning or software comparison purposes; ask the TA for more information..
- Aerial photography & other map resources at the UW Libraries can be found at: http://www.lib.washington.edu/maps/ -- I will let you know if you need them

Required Course Supplies: USB flash drive for archiving your course work (1GB recommended).

Undergraduate Student Grading:

Midterm	20%
Labs (9)	45%
Lab 10 – Final Project	25%
Random Quizzes (3-5)	10 %

Approximate letter grades will be 93% (A=4.0), 82 % (B= 3.0), 71 % (C= 2.0), & 60% (D= 1.0). You will fail the course if your cumulative % is below 59 % (F = 0.0).

Graduate Students ONLY: Annotated Bibliographies

Graduate students do not submit labs. Every week, starting week two, an annotated bibliographic reference based on a remote sensing - theme refereed journal article will be due at the beginning of each lab session; for a total of 9 annotated bibliographies. Thus, graduate student are expected to attend the labs, however, the annotated bibliographies will substitute for the lab grade, midterm grade & Final Project (Lab 10 grade) totaling **90%** of the graduate student grade; the remanding **10%** of the graduate student grade is based on quizzes.

Papers for annotated bibliographies can be selected from the list in the 'Readings' section of the class website or they can be a remote sensing paper of the student's choice that is related to class topics. **Submit annotated bibliographies via the lab assignment submission form on canvas (i.e. submit annotated bibliography 1 via the lab 1 submission form)**

Instructions on how to produce an annotated bibliography are available at Cornell Library Site. Each bibliographic reference will be graded as follows: 10 pts = Excellent, 8 pts = Good, 6 pts = Fair, 4 pts = Poor, 0 pts = Late or did not hand in.

Assignments, Lab, Exam Submissions: Use the **ESRM 430 Canvas site** to submit your labs, midterm, final & annotated bibliography. Always use your name in the file name of your submission. Always assure that you are uploading files to the correct folder. **You will have until the end of the next lab session to submit your lab.**

Course Policies:

- Missed Exams/Quizzes & Late Labs/Assignments: The UW policies will be followed to determine whether a make-up exam or quiz would be given, or late labs/assignments allowed.
- Academic Integrity Statement: Please follow the UW policies on cheating & plagiarism: http://www.washington.edu/students/handbook/conduct.html. For more information on the University's academic integrity policy, definitions & examples of academic misconduct, please refer to: http://depts.washington.edu/grading/issue1/honesty.html
- Students with Disabilities: If you have a disability that requires special attention, please see me at my office & contact the University's Disability Resources for Student Office (448 Schmitz, 206.543.8924, TTY 543.8925, uwdss@u.washington.edu). The Disability Resources for Students has a website at http://www.washington.edu/students/drs.
- Religious Accommodations Policy: The UW policy and request form can be found here: https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/

Tentative Course Outline

Week 1 - Principles of remote sensing & hyperspatial image analysis

- Supplemental Reading: Campbell & Wynne Chapters 1, 5 and 10, Chambers et al. 2007, Tatem et al. 2008, Adams et al. 2004, Melesse at al. 2007
- Lab 1: Image interpretation & validation of aerial & satellite imagery

Week 2 - High resolution imagery, georeferencing, & spatial portals

- Research examples using aerial photography and high resolution imagery
- Supplemental Reading: Campbell & Wynne Chapters 3 and 4, de Leeuw et al. 2011, Gordon 2005
- Lab 2: Importing aerial photography & temporal analysis in Google Earth o Lab 1 and Annotated Bibliography 1 Due.

Week 3 - Natural Resource Management Remote Sensing from Forestry, Landcover Change, Landscape Ecology, Geovisualization, Landuse Planning, and Wildlife Applications

- Image measurements & calculations
- Supplemental Readings: Campbell & Wynne Chapters 9, 13, 16 and 17; Franklin et al. 2000
- Lab 3: Working with hard copy & digital aerial photography o Lab 2 and Annotated Bibliography 2 Due.

Week 4 - Natural Resource Management Remote Sensing from Forestry, Landcover Change, Landscape Ecology, Geovisualization, Landuse Planning, and Wildlife Applications

- Introduction to fundamental laws of remote sensing
- Image analysis, manipulation & segmentation
- Supplemental Readings: Campbell & Wynne Chapters 20 and 21; Moskal and Franklin 2004
- Lab 4: Digital image analysis o Lab 3 and Annotated Bibliography 3 Due

Week 5 – Midterm Review

- Take home midterm
- Lab 5: Introduction to computer aided image segmentation o Lab 4 and Annotated Bibliography 4 Due

Week 6 - Accuracy assessment & historical change detection

- Supplemental Readings: Campbell & Wynne Chapter 14; Sullivan et al. 2009
- Lab 6: Historical change detection & accuracy assessment o Midterm, Lab 5, and Annotated Bibliography 5 Due

Week 7 - Pattern recognition, image segmentation & PhoDAR

- Supplemental Readings: Campbell & Wynne Chapters 11 and 12; Moskal et al. 2011; Myint et al. 2011
- Lab 7: Structure from motion (SfM) & creating 3D point clouds from photographs o Lab 6 and Annotated Bibliography 6 Due

Week 8 - LiDAR Part I

- Active Remote Sensing
- Aerial and Terrestrial LiDAR
- Supplemental Readings: Campbell & Wynne Chapter 7; Vaughn et al. 2011; Erdody and Moskal 2010; Zheng and Moskal 2009; Richardson et al. 2009; Moskal et al. 2009; Kato et al. 2009
- Lab 8: Introduction to LiDAR analysis o Lab 7 and Annotated Bibliography 7 Due

Week 9 - LiDAR Part II

- LiDAR Applications
- Supplemental Reading: Campbell & Wynne Chapter 8; Moskal and Zheng 2012
- Lab 9 - LiDAR Data Analysis and GIS Integration o Lab 8 and Annotated Bibliography 8 Due

Week 10 - New developments in remote sensing

- Supplemental Readings: Campbell & Wynne Chapter 15; Moskal 2005
- Lab 10 Final project assigned (synthesis of past labs) o Lab 9 and Annotated Bibliography 9 Due

Finals Week – No Class, NO FINAL EXAM, but Final Project is due one week after final lab meeting

Revised: 1/7/2020 8:49 AM