SYLLABUS WINTER 2016

ESRM430: Remote Sensing of the Environment

Lectures:	TTh 12:30 – 1:20 ROOM: TBA
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://courses.washington.edu/esrm430
Instructor:	Dr. L. M. Moskal
Contact Info:	Office – Bloedel 382 http://faculty.washington.edu/lmmoskal lmmoskal@uw.edu cell: 206.225.1510
Office Hours:	by appointment
Lab Instructor:	Caileigh Shoot
Contact Info:	Office – Bloedel 357/389 esrm430@uw.edu
Office Hours:	in Bloedel 357 1:30-2:30 T and Th and by appointment

DropBOX
GradeBOOK
SEFS GIBSON

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

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

Textbooks

The course spans some traditional and 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 and research articles, the course readings are found on the readings tab. Below are suggested optional textbooks that relate to the course content.

- Thomas Lillesand, Ralph W. Kiefer and Jonathan Chipman, 2015. Remote Sensing and Image Interpretation, 7th ed. Wiley, p768.

- James Campbell and Randolph Wynne, 2011. Introduction to Remote Sensing, 5th ed. The Guilford Press, p.667.
- Thomas Blaschke, Stefan Lang and Geoffrey Hay, 2008. Object-Based Image Analysis: Spatial Concepts for Knowledge-Driven Remote Sensing Applications (Lecture Notes in Geoinformation and Cartography). 1st ed. Springer, p. 836

Required Readings
UW - ESRM430 Remote Sensing of the Environment is a group in Environmental Sciences on Mendeley

Other Resources:
- Lab software is available (its freeware) from the links in the 'Labs' section of the class website, you can install it on your personal computers, but we do not provide support.
- Aerial photography and 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), and 60% (D= 1.0). You will fail the course if your cumulative % is below 59 % (F = 0.0).

***Annotated Bibliographies (Graduate Students ONLY):**
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 and Final Project (Lab 10 grade) totaling 90% of the graduate student grade; the remanding 10% of the graduate student grade is based on quizzes.

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 Digital Dropbox to submit your labs, midterm, final and 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 till the start of the next lab session to submit your lab.

Course Policies:
- Missed Exams/Quizzes and 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 and plagiarism: http://www.washington.edu/students/handbook/conduct.html. For more information on the University's academic integrity policy, definitions and 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 and 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.

Course Lectures Outline

Week 1 -- Lecture Slides

- What is Hyperspatial Remote Sensing?
- Principles of Image Interpretation
    - Lecture Google Earth Examples
- Principles of Remote Sensing
- Readings: Campbell & Wynne Chapters 1, 5 and 10
- Optional Readings: Chambers et al. 2007, Tatem et al. 2008, Adams et al. 2004, Melesse at al. 2007 -- can be used for for Graduate Student Annotated Bibliography

Week 2 -- Lecture Slides

- Aerial and high resolution imagery
- Research examples using aerial photography and high resolution imagery
- Readings: Campbell & Wynne Chapters 3 and 4; de Leeuw et al. 2011; Gordon, 2005
- Optional Reading(s): Kato et al. 2010

Week 3 -- Lecture Slides

- Natural Resource Management Remote Sensing Examples from Forestry, Landcover Change, Landscape Ecology, Geovisualization, Landuse Planning, and Wildlife Applications
- Readings: Campbell & Wynne Chapters 9, 13, 16 and 17; Franklin et al. 2000

Week 4 -- Lecture Slides

- Natural Resource Management Remote Sensing Examples from Forestry, Landcover Change, Landscape Ecology, Geovisualization, Landuse Planning, and Wildlife Applications Continued
- Stream Mapping Applications with Thermal Remote Sensing Guest Lecture by Dr. Christian Torgersen (USGS/UW)
- Readings: Campbell & Wynne Chapters 20 and 21; Moskal and Franklin 2004; Torgersen 2001

Week 5 -- Midterm Prep Slides

- Midterm Prep Session -- Group Work Exercise
- **MIDTERM** -- This is a take-home exam, ***due beginning of class a week later***

Week 6 -- Lecture Slides

- Accuracy Assessments
- Field Data Collection Guest Lecture by Dr. Jeff Richardson and Meghan Halabisky (both with UW RSGAL)
- Readings: Campbell & Wynne Chapter 14; Halabisky et al. 2011; Sullivan et al. 2009

Week 7 -- Lecture Slides

- Statistical Pattern Recognition and Image Segmentation
- Per-pixel and Object Based Image Classification
- Readings: Campbell & Wynne Chapters 11 and 12; Moskal et al. 2011; Myint et al. 2011

Week 8 -- Lecture Slides

- Active Remote Sensing
- Aerial and Terrestrail LiDAR
- 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

Week 9 -- Lecture Slides (continued from week 8)

- LiDAR Applications
- Class Discussion on Future Trends in Remote Sensing
- Reading: Campbell & Wynne Chapter 8; Moskal and Zheng 2012

Week 10 -- Lecture Slides

- Terrestrial LiDAR Demo
- Hyperspectral Remote Sensing Spectroradiometer Demo
- Final Lecture - New developments in hyper-resolution remote sensing (spatial, temporal and spectral)
- Readings: Campbell & Wynne Chapter 15; Moskal 2005

Final Projects (Lab 10) Due
Week after last lab

Course Labs Outline

Lab 1 Geo-wiki

- Lab 1 Assignment
- Lab 1 Tutorial: Geo-wiki Tutorial

Lab 2 Google Earth

- Lab 2
- Lab 2 Data: Air Photo, Google Earth Link
- Lab 2 Links:

  Puget Sound River History Project

Lab 3 UW Map Library Resources

- Lab 3
- Lab 3 Data
- Lab 3 Photo 257 Hint (Google Earth Link ---need Google Earth Installed to view)

Lab 4 Introduction to Computer Aided Image Segmentation -- SPRING Software

- Lab 4
- Lab 4 Data
- Lab 4 Required Resading: Burnett & Blaschke 2003
- Lab 4 Supporting Materials: Moskal et al. 2011

Lab 5 Advanced Computer Aided Image Segmentation and GIS Integration

- Lab 5
- Lab 5 Data
- Lab 5 Suggested Readings: Notes on Image Segmentation by Jepson and Fleet (2007)

Lab 6 Historical Change Detection and Accuracy Assessment

- Lab 6
- Lab 6 Data
- Lab 6 Supporting Materials: A Change Detection Tutorial by Grey and Gessler 2000
- Lab 6 Suggested Readings: Halabisky and Moskal 2011

Lab 7 Mobile GIS and Remote Sensing (Ground Systems and Unmanned Aerial System) -- Structure from Motion Software (TBD)
Meet in the SEFS Courtyard, guest lab instructor: Dr. Matthew Dunbar from the UW CSDE

- Lab 7
- Lab 7 Suggested Readings: ArcGIS Mobile Applications; FAA UAS

Lab 8 Introduction to LiDAR Data Analysis -- FUSION Software

- Lab 8
- Lab 8 Data
- Lab 8 Supporting Materials
- USDA Forest Service Remote Sensing Application Centre Fusion Tutorials
- Lab 8 Suggested Readings: FUSION/LDV Software Manual by McGaughey 2010

Lab 9 Advanced LiDAR Data Analysis and GIS Integration

- Lab 9
- Lab 9 Data
- Lab 8 Suggested Readings: Zheng and Moskal 2009

Lab 10 - Final Project

- Lab 10
- Lab 10 Data
- Lab 10 Suggested Readings: Richardson and Moskal 2014

Final Projects (Lab 10) Due
Week after the last lab