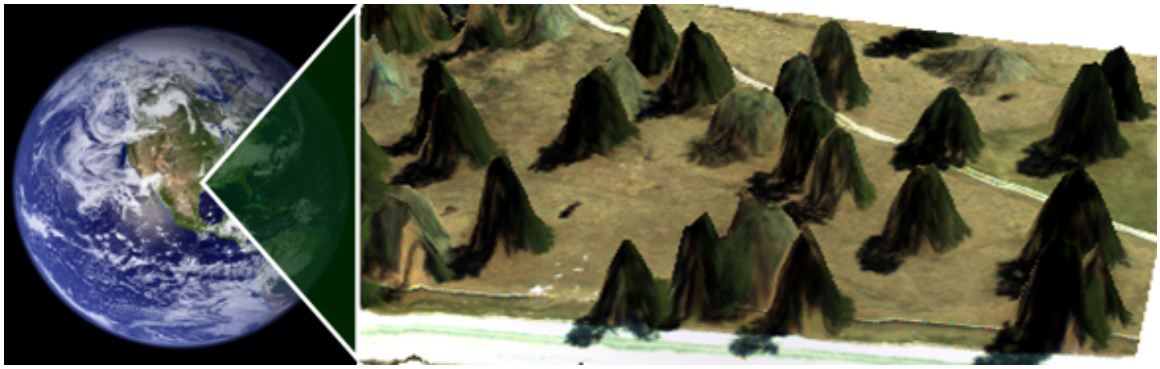

Texas A&M University **Dept. of Ecosystem Science and Management**

Course title	**ESSM 444 and 655: Remote Sensing of the Environment**
Course number	**ESSM 655 & ESSM 444**
Course date	**Fall Semester 2016**
Location	Lecture: **HBSB 105**; Lab: **HFSB 124 (computer lab)**
Meeting day(s)	Monday, Wednesday
Meeting time(s)	Lectures: MW: **12:40 - 1:30pm** Labs: W: **2:00 – 4:50pm**

Course description

The main **objective** of this course is to introduce students to the principles and techniques necessary for applying remote sensing to diverse issues in natural resources. The course emphasizes a **hands-on learning environment with theoretical and conceptual foundations in both aerial and satellite remote sensing.** Primary focus will be placed on digital image interpretation, analysis, and processing for a broad range of applications. The course, through the class project, discussions, student presentations, and lab exercises, is based on inquiry-type activities, such as discovery, case studies, model-building, design, research, creating, and environmental problem-solving with remote sensing techniques.

Prerequisites: Good academic standing

Learning outcomes

Upon completion of the course, students are expected to:

1. Compare sensor characteristics and select appropriate sources of imagery and image characteristics for environmental analysis
2. Understand aerial photo scale, orthorectified imagery, image resolution, and derive direct and indirect measurements on aerial and satellite imagery
3. Perform aerial image interpretation, satellite image visual analysis, preprocessing and processing for identifying landscape features
4. Perform image classification by selecting appropriate classification algorithms
5. Generate maps from remote sensing imagery and report the accuracy assessment
6. Understand principles of lidar remote sensing and point clouds, display data, and process lidar data
7. Report in writing and orally present the remote sensing approach to problem solving

Instructor Information

Name	Dr. Sorin C. Popescu, Professor
Email &Phone	s-popescu@tamu.edu; 862-2614
Office location	Centeq B 221D
Online resource	http://ecampus.tamu.edu/
Office hours	**Open door policy**, though I recommend emailing or calling for appointments. Please put "**655**" or "**444**" in the subject of email messages regarding this class to receive prompt attention.
Teaching Assist	Nian-Wei (Tony) Ku, PhD Candidate, goofno17@tamu.edu, Centeq 217; TA Office hours: Thursday, 1:00-2:00pm; Centeq 214 or by appointment

Textbooks

Required	*Introduction to Remote Sensing*, 5th Edition, James B. Campbell and Randolph H. Wynne, The Guilford Press, 2011 ISBN-10: 160918176X | ISBN-13: 978-1609181765
Recommended supplemental texts	*Remote Sensing and Image Interpretation*, Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman, Wiley, 7th ed., 2015, ISBN-10: 111834328X *Introductory Digital Image Processing, A remote Sensing Perspective*, John R. Jensen, Prentice Hall, 4th ed., 2015, ISBN-10: 013405816X

Grading policy

10 point brake-out system	90.0 – 100 = A	Excellent	Lab assignments	25 %
	80.0 - 89.9 = B	Good	Quizzes	10 %
	70.0 – 79.9 = C	Satisfactory	Project	20 %
	60.0 – 69.9 = D	Passing	Midterm exam	20 %
	00.0 – 59.9 = F	Fail	Final exam	25 %

Lab assignments: All lab work is due at the **beginning** of the following lab period. All laboratory and homework assignments are to be completed in a neat, logical, and clear fashion.
Late assignments: A 10% reduction in grade, up to a maximum of 50%, will be assessed for each weekday an assignment is handed in late. Assignments will not be accepted if more than 5 weekdays late, unless documented excuse is presented as per University rules.

Important dates		% of project grade
Midterm exam: Oct 5th, Wednesday (week 6), during lecture time		
Project proposals due (week 7):	Oct 12	5%
Project progress report (week 10):	Nov 2	5%
Project presentations (week 14):	Nov 28 and 30	20%
Project paper due (week 15):	Dec 5	70%

Final exam: Dec 12, Monday, 10:30 AM-12:30 PM, in lecture room

Tentative course outline

Week	Topic	Reading
1	Syllabus; Definition of terms; History and future of remote sensing; electromagnetic spectrum	Chapter 1 and 2
2	The remote sensing process; RS sensors, aerial photographs, photogrammetry, Unmanned Aerial Systems (UAS)	Chapter 3 and 4
3	Image interpretation, statistics, image resolution, data visualization	Chapter 5 and 10
4	Land observation satellites, Active microwave (radar)	Chapter 6 and 7
5	Active sensors: LIDAR	Chapter 8
6	Image preprocessing; Geometric and radiometric correction Midterm exam	Chapter 11
7	Image classification	Chapter 12
8	Field Data, Accuracy assessment	Chapter 13, 14
9	Hyperspectral remote sensing; Digital change detection	Chapter 15, 16
10	Advanced image processing; GIS	Chapters 10
11	Hyperspectral remote sensing	Chapter 11
12	Remote Sensing Applications	Part IV
13	Remote Sensing Applications	Part IV
14	Final exam review	

Tentative laboratory schedule

Week	Topic
1	Introduction to Image Interpretation, Geometry of Aerial Photos, and Google Earth
2	Determining distance and heights on aerial photographs, measuring relief displacement and parallax, orthophotos, Web sources of remote sensing data.
3	Introduction to ENVI and use of orthophotos with ArcGIS. Multispectral remote sensing imagery. Image display; subsetting. GPS integration with digital imagery.
4	Image preprocessing: Initial statistics extraction; geometric correction; Radiometric correction
5	Band rationing, image filtering
6	Principal component analysis
7	Unsupervised classification; Project proposals due
8	Supervised classification
9	Accuracy assessment; Project work
10	Spectral change detection; Project progress reports due
11	Introduction to LIDAR, point cloud concepts and processing
12	Project work
13	Introduction to hyperspectral data analysis; Project work
14	Student project presentations

Laboratory, Quiz, and Exam policy

The University policy on Scholastic Dishonesty will be enforced in this course. While you are encouraged to help each other understand concepts and techniques, **all work submitted should**

be your own. Exceptions to this policy will be explicitly noted by the instructor and should not be assumed by students. Make-up exams will not be offered. If you are going to miss an exam for a valid reason (per University rules), **contact the instructor** well in advance.
Save every lab session's work in your home drive and, highly recommended, onto a USB drive. Every student should have a copy of the completed lab work, although the work may be done in a team, with one student logged in. Keep your TAMU/lab account password secure.
Quizzes will be administered through eCampus and announced in class and on the class notes. In-class quizzes will be given occasionally.

Laboratory reports - Format Guidelines

When specifically indicated, laboratory exercises must contain a **brief** report following the format guidelines given below (1-2 pages for section 500 and 3-4 pages for section 600; double-spaced using a 12-point proportionally-spaced font, with 1 inch margins all around.) Captions, references, footnotes, appendices, tables, etc. may be single-spaced. The report should be divided into **Introduction (with background and objectives), Methods, Results, Discussions, and Conclusions** sections, and should tie together and synthesize the lecture, readings, and practical exercises. A bullet-type format is accepted for students in section 500, but all the report sections mentioned above must be included. In the Methods section do not include a list of ENVI commands that you have used. Instead, give the big picture of your approach and the remote sensing/image processing methods that you have used. You are encouraged to explore and pursue methods beyond the lab handout procedures – do research! You may include an appendix of ENVI commands used, for future references. Figures and tables inserted in the text are encouraged. When appropriate, include snapshots of your imagery in the report, mainly in the Results section, but no larger than half a page. Each laboratory exercise will be due the following laboratory period, at the beginning of class, unless otherwise indicated. Instructor may give extra credit to students who further develop the lab exercise and use a solid list of references.

Each page following the first full page of text should have a page number. A title page may be supplied. In text citations and references should follow the guidelines for manuscripts submitted for publication to the *American Society of Photogrammetry and Remote Sensing* (http://www.asprs.org/publications.html), for *Photogrammetric Engineering and Remote Sensing (PE&RS)*. Final projects must be printed using the same criteria. Students are required to keep **electronic** copies of all work submitted.

Projects

Students are required to design and implement a class project. The project must use digital image source data for an environmental application. Students must develop a specific output product useful to natural resource managers or researchers. When the instructor gives out project data, the data should not be used for any other purpose without instructor's permission. The project is designed to (1) build upon and synthesize techniques or concepts demonstrated in class, and (2) let you explore your own data sets and research objectives using your developing remote sensing "toolkit." For graduate students in section 600, work that contributes to their thesis research or current employment is encouraged. **All students, graduates and undergraduates, are required to team up in groups of 3 members and pursue group projects, with each student bringing a contribution to the final project.** Single-student projects are **not** accepted. Groups of 2 students require instructor's approaval. All projects require instructor approval given on the project proposals.
A proposal (approximately 150-250 words) and outline describing the project and **proposed methods** must be turned in by the date indicated in the *Important dates* section. However, students are encouraged to turn in proposals as soon as is feasible. The proposal/outline should

contain at least **five** preliminary references (section 600), peer-reviewed articles are preferred, or **three** preliminary references (section 500). The final report must be no more than twenty pages in length including figures and references, and the final report and summary/outline must follow the format guidelines for papers and laboratory reports. Failure to follow these guidelines will result in the paper not being accepted. The final report must include an **abstract** of approximately **150 words** that is succinct and informative without reference to the text. This should be followed by the **Introduction (with a background** subsection containing the literature review **and objectives**), **Methods, Results, Discussions, and Conclusion**.
Keep in mind that these are semester projects. The expected content and effort that goes into the project should be generally equivalent to **at least three laboratory topics that are connected and make sense in an operational or research context**. Laboratory time may be provided for work on your project during the semester, but will be insufficient by itself. A 2-5 page project progress report is required at the start of class as indicated in the *Important dates* section. Well-chosen student projects may be suitable for **subsequent publication** in either conference proceedings or the peer-reviewed literature. Please keep this goal in mind as you develop and carry out your projects, and particularly as you prepare your final reports.

Academic Integrity - Aggie Code of Honor

Aggies do not lie, cheat, or steal,
nor do they tolerate those who do.

The Aggie Code of Honor functions as a symbol to all Aggies, promoting understanding and loyalty to truth and confidence in each other.

For additional information please visit: http://www.tamu.edu/aggiehonor

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Office of Support Services for Students with Disabilities in Room 126 of the Student Services Building. The phone number is 845-1637.

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