

GEO837: Remote Sensing of the Biosphere

Syllabus

Fall 2018

M/W, 10:20 – 11:40 am

Geography Building Rm 219

Instructor

Dr. Kyla M. Dahlin,
Department of Geography,
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Contact

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Office Location & Hours

Mon 2-3 pm in GEO 121A
Mon 3-5 pm in GEO 219
or by appointment

1 General Information

GEO837 is a graduate level applied remote sensing (RS) course with a focus on building skills for quantitative environmental remote sensing using freely available data sources. We will primarily discuss vegetated terrestrial ecosystems. This class will meet in a computer lab and most days we will spend some time on lecture and discussion and some time working on the computers. Students will learn a number of common image analysis techniques and will have the opportunity to develop these skills further with an independent project. This course will build on skills developed in previous RS courses, and we will introduce more advanced techniques like image processing in R (an open source statistical programming language) and new data types like LiDAR and imaging spectroscopy. This course will also emphasize essential 'soft' skills: reading and understanding the primary literature, finding and analyzing data, writing clearly and concisely, and presenting one's work in a clear and engaging manner.

Prerequisites: GEO 424, *or* approval of Department.

Evaluation: Students will be evaluated by a research project, several short homework assignments, one midterm exam, and in-class presentations.

On D2L: FS18-GEO-837-001-Remote Sensing Biosphere

2 Course Materials

2.1 Required Reading

Peer Reviewed Literature: posted on D2L, order listed in section 7, readings may be added or changed as necessary.

2.2 Recommended Reading

Green K, Congalton RG, & M Tukman (2017) *Imagery and GIS: Best practices for extracting information from imagery*. ESRI Press. pp. 436 (\$63 online)

Lillesand T, Kiefer RW, & J Chipman (2015) *Remote Sensing and Image Interpretation*. 7th Ed. Wiley. 804 pp. (\$110 online)

(1 copy of each on 24 hr reserve at the Main Library)

These books are not assigned, but if you are relatively new to remote sensing it is HIGHLY recommended that you take a look at one of them to provide more background on the topics discussed in class. The first half of the semester we will somewhat follow the Green et al (2017) book, so the chapters are noted in Section 7 of this syllabus.

3 Course Policies

3.1 Email

If you have questions or issues, please contact me! Students should not expect immediate responses to email messages, however, if you do not receive a response within 48 hours please email again or talk to me before or after class. Please include "GEO837" in the subject line of your email for a faster response.

3.2 Sending Attachments

Homework assignments in this class will often involve uploading a document to D2L via an 'Assignment Submission Folder' (see module of the same name on D2L). If, for some reason, this does not work for you, email Kyla and please include "GEO837" in the subject line of the email and your name in the body of the attachment and in the filename itself. Ideally the file name would look like: GEO837_yourname_assignment#_YYYYMMDD.docx. Assignments should be sent or uploaded as MS Word documents (.docx), PDFs (.pdf), or, if all else fails, raw text documents (.txt) with images attached separately in a non-proprietary format (.jpg, .tif, .bmp). If files are received "corrupted" or with other issues, the onus is on you to correct this problem, and if it isn't dealt with promptly the assignment will be considered late.

3.3 Electronics in Class

Computers and cellphones are permitted in class, however, if they become a distraction to other students the instructor may ask you to put them away. We will be using Geography Department computers for the bulk of this course – using these computers appropriately and maintaining off site access (if necessary) is your responsibility.

3.4 Academic Honesty

Article 2.3.3 of the [Academic Freedom Report](#) states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, Dr. Dahlin adheres to the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See [Spartan Life: Student Handbook and Resource Guide](#)) Therefore, unless authorized by your instructor, you are expected to complete all course assignments, including homework, lab work, quizzes, and exams, without assistance from any source. You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use the www.allmsu.com web site or other similar to complete any course work in this course. Students who violate MSU academic integrity rules may receive a penalty grade, including a failing grade on the assignment or in the course. Contact Dr. Dahlin if you are unsure about the appropriateness of your course work. (See also the [Academic Integrity](#) webpage.)

3.5 Accommodations for Students with Disabilities

MSU is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. Please present this form to Dr. Dahlin at the start of the term and/or two weeks prior to the accommodation date (test, project, etc.). Requests received after this date may not be honored.

If you have any challenges or issues related to your ability to succeed in this class, please let Dr. Dahlin know as soon as possible.

3.6 Diversity

In order to learn, we must be open to the views of people different than ourselves. Each and every voice in the classroom is important and brings with it a wealth of experiences, values and beliefs. In this time we share together over the semester, please honor the uniqueness of your fellow classmates, and appreciate the opportunity we have to learn from each other. Please respect your fellow students' opinions and refrain from personal attacks or demeaning comments of any kind.

3.7 Attendance & Participation

Students are expected to attend the majority of class meetings, to show up on time, and to contribute intellectually to the class by asking questions and sharing thoughts and opinions. While Dr. Dahlin won't take strict attendance, this is a small class, so your absence will be noticed. Five of the 10 participation points listed under grading will be awarded based on the above criteria. The other 5 will be awarded if you simply come to my office hours at least once throughout the semester **BEFORE THANKSGIVING**.

Students whose names do not appear on the official class list for this course may not attend this class without permission of the instructor. Students who fail to attend the first four class sessions or class by the fifth day of the semester, whichever occurs first, may be dropped from the course. If you miss an exam you will be expected to provide proof of a legitimate emergency before a makeup is allowed. Students seeking a grief absence should be directed to the Grief Absence Request Form found on the RO home page (<https://reg.msu.edu/>) under 'Student Services - Grief Absence Request Form' OR to StuInfo (<https://stuinfo.msu.edu/>) under 'Academics - Enrollment Information and Services - Grief Absence Request Form.' If a grief absence is approved, accommodations will be made. **Late assignments will not be accepted.**

3.8 Field Trip

If all goes according to plan, we will have one on-campus field trip to collect spectral data from an agricultural field. This field trip may go beyond normal class time - Dr. Dahlin will coordinate this to try to maximize participation. More details will be provided in class.

3.9 Social Media

Yep, Dr. Dahlin is on twitter (@bristleweed), LinkedIn, ResearchGate, and a few other social media type things. You're welcome to follow her, of course (she tweets 90% work/science related stuff), but with very few exceptions she will not follow/friend/link back to you. Please do not take this

personally. Dr. Dahlin's Ecological Remote Sensing and Modeling Lab is online at www.ersamlab.com and on twitter (@ERSAM_Lab) and Instagram (@ERSAM.Lab).

3.10 Emergencies

In the event of an emergency, our primary goal will be to stay safe. There is a wide variety of situations we could potentially face as a class, so please be prepared to stay calm, and never hesitate to interrupt the instructor if something seems awry.

4 Other Resources & a Note

Being a university student comes with many opportunities and challenges. Just a reminder of some of the many great resources MSU has available to help you maximize the opportunities and address the challenges.

Spartan Life OnLine - <http://splife.studentlife.msu.edu/> - Lots of great info here including the graduate student rights and responsibilities

Office of the University Ombudsperson - <http://ombud.msu.edu/> - If you have an issue (like with an advisor or professor) and do not feel comfortable trying to resolve it with the person/department, the Ombuds Office can offer you advice.

MSU Title IX Program - <http://www.titleix.msu.edu/> - If you have questions about gender discrimination or harassment, this is a good place to look for resources.

MSU Office of Institutional Equity - <https://oie.msu.edu/> - If you have questions about other forms of discrimination or harassment, this is a good place to look.

MSU Inclusion and Intercultural Initiatives - <http://www.inclusion.msu.edu/> - Differences are our strength! This is a good place to look for inclusion-related opportunities and support.

MSU Counseling & Psychiatric Services - <https://caps.msu.edu/> - Free! Just walk in or connect virtually via the website.

NOTE on Confidentiality: Students should be aware that MSU employees, including instructors, may not be able to maintain confidentiality when it conflicts with their responsibility to report certain issues based on external legal obligations or that relate to the health and safety of MSU community members and others. Dr. Dahlin must report the following information to other MSU offices if you share it:

- Suspected child abuse/neglect, even if this maltreatment happened when you were a child,
- Allegations of sexual assault or sexual harassment when they involve MSU students, faculty, or staff, and
- Credible threats of harm to oneself or to others.

These reports may trigger contact from a campus official who will want to talk with you about the incident that you have shared. In almost all cases, it will be your decision whether you wish to speak with that individual. If you would like to talk about these events in a more confidential setting you are encouraged to make an appointment with the MSU Counseling Center.

5 Evaluation

5.1 Midterm Exam

There is only one exam in this course. Questions may come from lectures, class discussions, and readings. The exam will primarily use short-answer and graphical questions, but some other question types may be incorporated.

5.2 Class Project

Students are required to complete a research project that will culminate in a 10-20 page (double spaced, 12 pt font, references and figures do not count towards the page requirement) paper about a geographic location. More details will be provided in class, but the general idea will be to produce a short research paper similar in structure to many of the papers we will be reading throughout the course. You have the *option* of turning in a draft of your paper early to get feedback before submitting the final draft, however this is not graded and not required. Details of the project and expectations will be discussed in class on 9/10.

5.3 Reading Summaries

A fraction of the assigned reading will involve a reading summary. Each summary should include (1) a 3-5 sentence summary of the paper you read (can be any of the ones listed up to that date); (2) a description of the coolest figure in the paper, in your opinion; and (3) two or three questions that you were left with at the end of the paper, either about the work itself or the broader field. You'll notice that there are seven places where reading summaries are assigned on the course schedule, but only five listed under "Grading" - this means you can either skip any two of the assigned readings, or do them to earn extra credit. Reading summaries will not be accepted late, however (i.e. if you are 2 points away from a higher grade at the end of the semester you can't add a summary to up your grade then. So think ahead!)

5.4 Presentations

Each student will give a short (< 2 min) presentation describing their research topic at the beginning of the semester, and a longer presentation of their research project at the end of the semester. Presentations should be no more than 8 minutes long, including ~1 minute for questions. Dr. Dahlin will provide more guidance on the presentations as they approach.

6 Grading

Assignment	Points	Final Grade Scale	
Participation	10	450 - 500	4.0
Project Location Description	40	420-449	3.5
Short presentation	20	390-419	3.0
Reading Summaries (5 x 10 pts)	50	350 - 389	2.5
Midterm Exam	100	320 - 349	2.0
Final project	200	290 - 319	1.5
Final presentation	80	260 - 289	1.0
TOTAL	500	< 260	0

7 Course Schedule

The following lecture schedule remains subject to modifications. If significant changes do occur, students will be notified and an updated syllabus will be posted on D2L.

All written assignments are due 15 minutes BEFORE class on the due date.

Wk	#	Date	Topic(s)	Reading (by this date)	Imagery and GIS Book	Assignment Due
1	1	29-Aug	Introductions, Course description, getting on computers, account on earthexplorer, kml of landsat	--		
2	2	5-Sep	Review of 424 & imagery fundamentals	Wulder et al 2012 RSE	Ch 1-3	
3	3	10-Sep	Project Description - more formal - plus other data sources	Jiang et al 2018 App Geo	Ch 4	
3	4	12-Sep	Image Processing & Download an Image	Becknell et al 2015 BioSci	Ch 5 & 6	Paper Summary (1)
4	5	17-Sep	Indices, PCA, and tasseled cap	Baig et al 2014 RSL	Ch 9	Project Location description due
4	6	19-Sep	Cluster Analysis & Image Classification	Silva et al 2013 ERL	Ch 7 & 10	
5	7	24-Sep	Time Series Analysis	Dahlin & Ault 2018 IJAEQG		
5	8	26-Sep	Paper Discussion Day	Kim et al 2014 RSE		Paper Summary (2)
6	9	1-Oct	Accuracy assessment	Foody 2002 RSE	Ch 12	
6	10	3-Oct	2 minute presentations & Ancillary Data	Carlson et al 2005	Ch 8	2 min project summary due (5 slides max)
7	11	8-Oct	Land cover change analysis	Tewkesbury et al 2015 RSE	Ch 11	Request a Google Earth Engine account
7	12	10-Oct	Google Earth Engine Intro	Complete 'Get Started with GEE' - https://developers.google.com/earth-engine/getstarted		Paper Summary (3)
8	13	15-Oct	Google Earth Engine Classification	Xiong et al 2016 RS		

Wk	#	Date	Topic(s)	Reading (by this date)	Imagery and GIS Book	Assignment Due
8	14	17-Oct	Google Earth Engine more	Yu & Gong 2012 IJRS		
9	15	22-Oct	Paper Discussion Day	Hansen et al 2013 Science (including methods)		Paper Summary (4)
9	16	24-Oct	MIDTERM ASSESSMENT	--		
10	17	29-Oct	Intro to R, Data wrangling	rforcats.net		
10	18	31-Oct	Spectroscopy in R & Assessment Review	Serbin et al 2014		
11	19	5-Nov	Raster data in R (MODIS data from AppEEARS)	Hijmans et al 2016 Raster (x2)		Paper Summary (5)
11	20	7-Nov	Raster data in R (MODIS time series)	Cooper et al 2017		
12	21	12-Nov	more Raster data in R (catch up or...?)	Detto et al 2015 JGR Biogeo		
12	22	14-Nov	Guest talk from JJ Kerski (ESRI) in McDonel Hall rm C107 (10:20 to 11:10)	Kerski 2015 Geo Compass		Paper Summary (6)
13	23	19-Nov	Paper Discussion Day & decide plan for last 3 classes	Asner et al 2017 Science (including methods)		Project draft due (optional)
13	24	21-Nov	LiDAR & Active RS	Lefsky et al 2002 Bioscience		
14	25	26-Nov	Hyperspectral Imagery	Ustin et al 2004 Bioscience		
14	26	28-Nov	Fused HSI + LiDAR	Asner et al 2017 Science (including methods)		Paper Summary (7)
15	27	3-Dec	In class presentations + evals			In Class Presentations
15	28	5-Dec	In class presentations			
FINAL EXAM DAY		14-Dec	Final Papers Due			PROJECT!!!