Observing the Earth from Space

Spring 2014

ANTH 434

Dr. Sarah Parcak, Associate Professor, Department of Anthropology
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Office hours: T-TH 1230-2-or by appointment
Office location: Heritage Hall Building, Room 314
Course lecture location: HHB 225
Course lab location: HHB 4th floor
Course times: T-TH 2-3:15pm (plus lab times)
Lab time: will choose a lab time from a series of preset times, to be decided in class on Day 1. Additional lab times can be decided if necessary depending on student scheduling needs.

Course Introduction:

The Earth is ever changing. Scholars and artists, throughout recorded history, have found a myriad of ways to interpret the world surrounding them: poetry, articles, painting, photography, movies, newspaper columns, books, sculpture—the list is endless. How we interpret the visual world is a combination of perception and comprehension: perception may differ from person to person, yet the scientific laws by which the Earth is observed are immutable. It is the crossroads of perception and comprehension where we can place the field of satellite remote sensing. While the science behind satellite remote sensing is fairly well understood, how researchers can interpret the meaning behind what is seen on the computer screen is completely different. Scientists across a wide array of disciplines are leaning just how much observing global patterns via satellites can enrich their research endeavors, in particular in the social and health sciences.

This course will focus on the applications of remote sensing to both health and the social sciences, while providing students with the opportunity to gain hands on experience using satellite remote sensing. This will take the form of a series of weekly labs, to introduce students to a variety of satellite imagery types and analytical techniques in diverse landscapes. Students will be responsible for producing a group term project in one of four areas.

This is an advanced course with limited enrollment (30 students) open to those with Junior standing or higher. This is due to the nature of the work required for the course. It is expected that the students will have strong backgrounds in science (preferably physics) and mathematics, as well as computing. Programming is not needed, but it will certainly help. On the first class there will be a sheet to fill out where you will describe your major as well as why you wish to take the course. This is to assist Dr. Parcak. Should the course be oversubscribed or spaces appear, preference will be given to Anthropology and SOPH students. The course is required for students to work as work-study/research assistants in the remote sensing lab, as well as those students who wish to continue on to the advanced research seminar.
Description:

The course will give students the chance to learn about a wide range of remote sensing applications in both classroom and lab settings. The course will progress from basic remote sensing analysis techniques to the point where the students are responsible for their own research projects.

On Tuesdays, it is likely that the lectures will take around an hour to complete plus time for discussion. These lectures will describe applications of remote sensing, remote sensing in broader contexts and specific techniques that the students will be learning in the laboratory. This will give 2 hours to complete the lab part of the week, and it is expect that students will need the full two hours for the lab. For each lab, the student will be given detailed instructions, as well as a series of questions they will need to complete. This is due no later than Thursday at 5pm. Dr. Parcak will be in the lab to answer all questions and to supervise each lab session.

Attendance:

Students are responsible for attending every class. We are limited with time, and will be moving very quickly through the material. An “excused absence” is one that approved by UAB: illness with Dr.’s note, death in the family, or an officially recognized UAB event. If you have an unexcused OR an excused absence, it is very likely that you will not be prepared for the lab that week, and it is your responsibility to find out what you missed. If you have an unexcused absence (final decision is with Dr. Parcak), for each class missed, you will be docked 3% of your final mark (equal to a half letter grade). There are NO exceptions.

Course Goals:

After completion of this course, students will gain an introductory knowledge of satellite imagery in diverse fields, but focusing on health science and anthropology, including usage, methods and applications. Students will be able to outline key approaches in the analyzing of remotely sensed data and its overall applications to the fields of health science and anthropology. Students will also be able to apply a wide range of remote sensing analysis techniques to different types of satellite imagery. Students will be able to evaluate the appropriate applications of satellite imagery in problem-solving activities, as well as select the most appropriate satellite imagery to use in particular instances. Students will be able to apply remote sensing to diverse health science and anthropological research questions. Students will have the opportunity to choose a project for their term literature review and basis analysis. As part of this project, they must define a specific remote sensing research question and evaluate the overall application of remote sensing to that research questions. They will present their results in a literature review and a presentation, which will be critiqued by the students and the professor.
Learning Outcomes:

Students will have the knowledge needed to develop their own health/anthropological research questions for future work; be able to develop their own projects after analyzing satellite data, use remote sensing programs to evaluate complex algorithms, and learn how to do advanced labs to analyze satellite data.

Course evaluation:

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<th>Component</th>
<th>Weight</th>
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<tr>
<td>Class attendance and participation</td>
<td>10%</td>
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<tr>
<td>Midterm</td>
<td>20%</td>
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<tr>
<td>Labs (cumulative: 10 x 4% each)</td>
<td>40%</td>
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<tr>
<td>Final project (due on the last day of class)</td>
<td>30%</td>
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Midterm: The midterm will be a combination of multiple choice, fill in the blank, short answer/formula solving and an essay question. It will be based on the class lectures, readings and labs. There will be a study guide given out in class the week before.

Labs: PDFs of the labs will be available on the BlackBoard Learn website. Students are responsible for coming to the lab during assigned times and completing their work on time. Each lab should take no more than 2 hours. Each lab is due NO LATER than 5pm on Friday—it is suggested that students complete the lab write-up after their lab time. It will not be possible for you to do the lab later in the week unless there is a valid UAB-sanctioned excuse.

Final project: The final project will take the form of a 10-page paper (undergraduate) or 15-page paper (graduate student) and a 10-minute presentation to be given on the final day of class. It is possible to choose from any region of the world for your project. You will use two techniques you learn in class/lab to analyze remote sensing imagery data, to compare and contrast the techniques and findings. More information will be given out on the project in class, with suggested research avenues. Each student will need to meet with Dr. Parcak to discuss this. The projects will be done in groups of *3*. More on this as the semester develops.

Late work: For each day a lab is late, it will be docked 1%. You are still responsible for turning in all the labs. At the end of term, any labs not received will result in the final mark of “incomplete” for the class.

Course marking scheme:

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<tr>
<th>Grade</th>
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<tbody>
<tr>
<td>A</td>
<td>90-100</td>
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<td>B</td>
<td>80-90</td>
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<td>C</td>
<td>70-80</td>
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<td>D</td>
<td>60-70</td>
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<tr>
<td>F</td>
<td>59 and below</td>
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Accessibility:

Any student with a disability that may need accommodations in order to successfully complete all requirements of this course should visit the Office of Disability Support Services, located in Room 516 of the Hill University Center, extension 4-4205 or at dss@uab.edu. This office is responsible for registering students and ensuring the University’s compliance with Section 504 of the Rehabilitation Act and the American with Disabilities Act. Once registered, this office will then inform Dr. Parcak and the specific nature of any accommodations required. Any student requiring such accommodation should discuss this with Dr. Parcak and assure that the appropriate correspondence is sent from the Office of Disability Support Services. Dr. Parcak is glad to accommodate all student needs.

UAB Honor Code: Academic misconduct undermines the purpose of education. Academic misconduct will not be tolerated in this class including

- **ABETTING** is helping another student commit an act of academic dishonesty. Allowing someone to copy your quiz answers or use your work as their own are examples of abetting.
- **CHEATING** is the unauthorized use or attempted use of unauthorized materials, information, study aids, the work of others, or computer-related information.
- **PLAGIARISM** means claiming as your own the ideas, words, data, computer programs, creative compositions, artwork, etc., done by someone else. Examples include improper citation of referenced works, the use of commercially available scholarly papers, failure to cite sources, or copying another person’s ideas.
- **FABRICATION** means presenting falsified data, citations, or quotations as genuine.
- **MISREPRESENTATION** is falsification, alteration, or the misstatement of the contents of documents, academic work, or other materials related to academic matters, including work substantially done for one class as work done for another without receiving prior approval from the instructor.

For a detailed description of these offenses and university penalties on academic misconduct, please visit: [http://www.app.uab.edu/progress_conduct_Griev.html](http://www.app.uab.edu/progress_conduct_Griev.html)

Instructor’s Policy on Academic Misconduct for this course: The penalty for abetting, cheating, plagiarism, fabrication, or misrepresentation is a failing grade (F) in the course.

Course readings:


(referred to as L-K in weekly reading assignments)

Online articles/PDF readings: There will be PDFs posted online for all the course readings as well as links to websites with articles. Students are responsible for coming to
class having read the materials.

**Course lab expectations:**

Each student will need to read and sign the UAB Laboratory for Global Observation user’s guide. No one will be allowed to use the lab without reading and signing this form. There are a series of rules and regulations each lab user will need to be aware of before commencing research. This may include IRB training for individuals conducting health research projects.

**Web resources**

* Tutorials
  - [http://rst.gsfc.nasa.gov/Front/tofc.html](http://rst.gsfc.nasa.gov/Front/tofc.html)
  - [http://earth.esa.int/applications/data_util/SARDOCS/spaceborne/Radar_Courses/](http://earth.esa.int/applications/data_util/SARDOCS/spaceborne/Radar_Courses/)
  - [http://ccrs.nrcan.gc.ca/glossary/index_e.php](http://ccrs.nrcan.gc.ca/glossary/index_e.php)

* Other resources
  - NASA [www.nasa.gov](http://www.nasa.gov)
  - [http://visibleearth.nasa.gov/](http://visibleearth.nasa.gov/)
  - [http://earthobservatory.nasa.gov/](http://earthobservatory.nasa.gov/)
  - European Space Agency [www.esa.int](http://www.esa.int)
    - [http://www.esa.int/esaEO/SEM9UELY17E_index_0.html](http://www.esa.int/esaEO/SEM9UELY17E_index_0.html)
  - NOAA [www.noaa.gov](http://www.noaa.gov)
  - Remote sensing and Photogrammetry Society UK [www.rspsoc.org](http://www.rspsoc.org)

**Journals**

Remote Sensing of the Environment


IEEE Transactions on Geoscience and Remote Sensing:

**Lecture and lab schedule:** Please note that the exact order of the lectures and labs are subject to change based on class needs.

**Week 1 Jan 7/9:** Introduction

Review of syllabus, time signups, general discussion of the course

Lecture: Overview of satellite remote sensing and applications across diverse fields, who does remote sensing?
Lab preview (with assignment): Overview of Google Earth and NASA Worldwind

Week 2 Jan 14/16

Lecture: Remote sensing: not just another pretty picture (History, background and general applications)

Mapping foundations: Geodetic principals, datums, reference systems, distortions, vertical datums

Lab #1 Introduction to satellite imagery, how to load images, zooming in and out, how to use the ER Mapper tutorial.

Readings L+K Ch.1: 1-53

Estes, John: Some Important Dates in the Chronological History of Aerial Photography and Remote Sensing

Week 3 Jan 21/23

Lectures: How and why satellites work, Global Navigation satellite systems, principals of airborne mapping, terrestrial photogrammetry, LIDAR

The physics of remote sensing: why the grass is always redder on the other side

Lab #2 Creating algorithms, saving images to disk

Readings L+K 58-124


Week 4 Jan 28/30

Lecture: Pixels, pixels everywhere: digital numbers and visualization of remotely sensed data

Lab #3 Creating image layers

Readings L+K 126-190

Week 5 Feb 4/6

Lecture: Aerial photogrammetry, different types of satellite images and their applications

Lab #4 Image contrast
Readings L+K 397-486

**Week 6 Feb 11/13**
Lecture: Interpreting and enhancing satellite images
Lab #5 Formulas
Readings L+K 193-226

**Week 7 Feb 20/22**
Lecture: Multispectral satellite imagery and radiation equations
Lab #6 Georeferencing images
Readings: L+K 330-393

**Week 8 Feb 25/27**
MID TERM EXAM (in class)
Lab #7 Vector data integration and Ground truthing class exercise
Readings L+K: 493-497

**Week 9 March 4/6**
Lecture: Ground truthing
Lab #8 Thematic raster overlays
Readings L+K 491-562
Harini Nagendra; Madhav Gadgil, 1999 "Biodiversity Assessment at Multiple Scales: Linking Remotely Sensed Data with Field Information," Proceedings of the National Academy of Sciences of the United States of America 96 (16): 9154-9158

**Week 10 March 11/13 TERM RESEARCH PROPOSALS DUE IN CLASS**
Lecture: Putting things in good order: Supervised and unsupervised classification
Lab #9 Unsupervised classification
Readings: L+K 573-624

**Week 11 March 18/20**
Lecture: General applications of remote sensing to health sciences

Lab: #10 Supervised classification and creating maps

Readings L+K 237-302


**MARCH 24-28 BREAK**

**Week 12 April 1/3**
Lecture: Remote sensing and archaeology

Lab: start research projects

Readings: Review in detail the online website of SERVIR: [http://servir.nsstc.nasa.gov/](http://servir.nsstc.nasa.gov/)

Visit and read: [http://weather.msfc.nasa.gov/archeology/](http://weather.msfc.nasa.gov/archeology/)


**Week 13 April 8/10**
Lecture: Remote sensing and health 1

Lab: research projects

Readings: Term research readings


**Week 14 April 15/17**

Lecture: Lecture: Hyperspectral imagery and the future of remote sensing
Lab: Research projects

Readings: Term research readings

**Week 15 April 22 final paper**

Final: Research Presentations and papers due
Each class member is required to attend all presentations.