DEPARTMENT: Environmental Health
COURSE NUMBER: EH  SECTION NUMBER: 587  SEMESTER: Spring 2015
CREDIT HOURS: 3
COURSE TITLE: Introduction to satellite remote sensing of the environment and its applications in public health

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INSTRUCTOR CONTACT INFORMATION
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SCHOOL ADDRESS: CNR Bldg. 2031  217 Woodruff Library
OFFICE HOURS: By appointment

BRIEF COURSE DESCRIPTION
Geospatial information collected from satellite remote sensing has become a powerful tool in environmental and public health science and policy making. However, public health researchers usually lack training to benefit from this rapidly evolving technology. This introductory course provides students a broadened view of environmental sciences with satellite remote sensing technologies, and basic skills for geospatial data analysis. It covers the history, major instruments, and capabilities of satellite remote sensing as well as the basic scientific principles behind it. Students will learn (1) the terminology and data products of both land and atmospheric remote sensing such as those from MODIS and Landsat, and (2) the basic strategies and techniques to analyze geospatial data in free (e.g., Echo Reverb, GIOVANNI and HDFView) and professional grade (ENVI and ArcGIS) software packages. Training modules for ENVI and spatial analysis tools in ArcGIS will be provided. Various case studies and lab exercises demonstrate the applications of satellite remote sensing in land use change and air pollution characterization, climate change and other areas related to public health. The final project allows the students to apply satellite data together with other information to solve a problem of their interest.

SCHOOL LEVEL, DEPARTMENT, AND/OR PROGRAM COMPETENCIES
The course is designed to address the following RSPH core and EH department MPH, MSPH, and PhD competencies:

RSPH core:
- Use analytic reasoning and quantitative methods to address questions in public health and population-based research;
- Describe environmental conditions, including biological, physical and chemical factors, that affect the health of individuals, communities and populations; and
- Develop the capacity for lifelong learning in public health

EH MPH and MSPH:
- Describe major environmental risks to human health ranging from the local to global scale
- Assess the sources and movement of contaminants through the environment
- Characterize the magnitude, frequency and duration of environmental exposures

EH PhD in EHS:
- Utilize advanced methods in exposure assessment of environmental contaminants
- Design novel research projects to examine key challenges in field
- Disseminate research findings in multiple formats
LEARNING OBJECTIVES ASSOCIATED WITH THE COMPETENCIES

This course contributes to the following learning objectives for the MPH students in Environmental Health:

(1) Explain general principles of environmental sciences and apply them to environmental pollution exposure studies related to human health;
(2) Identify and explain environmental pollution risks to human health ranging from urban to the global scale, and explain how to assess the magnitude of these hazards.

This course also contributes to the following learning objectives for the MPH students in Global Environmental Health:

(1) Identify and describe environmental health problems in developing countries;
(2) Assess the source and movement of contaminants in the environment; and
(3) Characterize and quantify exposures to environmental pollution.

In addition, this course can broaden students’ view when designing their practicum and thesis.

EVALUATION

Labs: 30 points (10 each)
Homework: 30 points (10 each)
Final project: 40 points (study design 10, data and tools 10, discussion 10, presentation 10)

Grading:

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<th>Points</th>
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<tr>
<td>≥ 90</td>
<td>A</td>
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<td>85 – 89</td>
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<td>80 – 84</td>
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<td>75 – 79</td>
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<td>70 – 74</td>
<td>B-</td>
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<tr>
<td>50 – 69</td>
<td>C</td>
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<td>&lt; 50</td>
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For the project, students will be expected to work independently or form small groups depending on the class size, select a research topic related to environmental pollution and public health, search for available satellite data, analyze the data, and report their findings in a report and an oral presentation. Further details will be provided in class.

ACADEMIC HONOR CODE

The RSPH requires that all material submitted by a student in fulfilling his or her academic course of study must be the original work of the student.
EH 587: INTRODUCTION TO SATELLITE REMOTE SENSING OF THE ENVIRONMENT AND ITS APPLICATIONS IN PUBLIC HEALTH

Class Time: Tuesday 8:30 am – 9:50 am, Thursday 10:30 am – 11:50 am
Locations: Math and Science Center Library (E301A).

PREREQUISITES:

Experience with GIS at the level of INFO 530 or INFO 532 is important for successful completion of this course. Contact course instructor if unclear about the GIS requirements. Basic knowledge of physics is helpful but not required.

TEXT AND READINGS:

There are no required textbooks. Optional texts:


Text books, other reading materials, lecture sides, and lab materials will be put on hold in the library or distributed via course Blackboard site.

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
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| 1    | 1/13 | Course Introduction (Liu, Page)  
Concept of remote sensing, behavior of light  
**Homework 1: ENVI tutorials**  
1/15 ArcGIS/ENVI hands-on exercise (Liu, Page) |
| 2    | 1/19 | Geospatial tools for remote sensing (Page)  
1/22 History and terminology of satellite remote sensing (Liu) |
| 3    | 1/27 | Introduction to land remote sensing (Page)  
1/29 **Lab 1: Exploring Landsat imagery (Page)** |
| 4    | 2/3  | **Homework 1 due in class**  
Image processing & classification (Page)  
**Homework 2: image classification using ENVI**  
2/5 **Lab 2: Image processing & classification (Page)** |
| 5    | 2/10 | Research design for remote sensing (Liu, Page)  
2/12 Case study using Landsat, ENVI and ArcGIS: Vegetation Reclamation on Surface Mines in Appalachia - introduction |
| 6    | 2/17 | **Homework 2 due in class**  
Case study using Landsat, ENVI and ArcGIS: Vegetation Reclamation on Surface Mines in Appalachia - data and methods  
2/19 Case study using Landsat, ENVI and ArcGIS: Vegetation Reclamation on Surface Mines in Appalachia - results and discussion |
| 7    | 2/24 | Introduction to atmospheric remote sensing: theories (Liu)  
2/26 Atmospheric remote sensing technology and data products (Liu) |
| 8    | 3/3  | Introduction to MODIS and VIIRS (Liu)  
**Homework 3: MODIS data access using LAADS and Echo Reverb** |
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<th>Date</th>
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<tr>
<td>3/5</td>
<td>Lab 3: Satellite air pollution data exploration with GIOVANNI (Liu)</td>
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<td>9</td>
<td>3/10 Spring break</td>
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<td>3/13 Spring break</td>
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<td>10</td>
<td>3/17 Working with elevation data (Page)</td>
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<td>3/19 <strong>Homework 3 due in class</strong></td>
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<td>Elevation data hands-on exercise (Page)</td>
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<td>3/31 <strong>Final project proposal presentation</strong></td>
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<td>13</td>
<td>4/2 Case study using MODIS, ENVI and ArcGIS: State Line Power Plant Closure: Effects on air quality of Chicago - results and discussion</td>
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<td>4/7 Case study using MODIS, ENVI and ArcGIS: State Line Power Plant Closure: Effects on air quality of Chicago - discussion</td>
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<td>4/9 Analysis of the 2003 European heat wave with NEO</td>
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<td>4/14 Explore NetCDF data with Panoply, real-world applications of satellite remote sensing (Yang)</td>
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<td>4/16 Group discussion / in-class office hour on project development</td>
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<td>15</td>
<td>4/21 <strong>Term Project: final presentations / discussion</strong></td>
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<td>4/23 Individual appointment with instructors for final grade</td>
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