

## SUMA K4205 GIS for Sustainability Management

### Instructor Information:

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GIS Specialist, CIESIN

### Course Description

Geographic Information Systems (GIS) are a system of computer software, data and analysis methods used to create, store, manage, digital information that allow us to create maps and dynamic models to analyze the physical and social processes of the world. This course is designed to provide students with a comprehensive overview of theoretical concepts underlying GIS systems and to give students a strong set of practical skills to use GIS for sustainable development research. Through a mixture of lectures, readings, focused discussions, and hands-on exercises, students will acquire an understanding of the variety and structure of spatial data and databases, gain knowledge of the principles behind raster and vector based spatial analysis, and learn basic cartographic principles for producing maps that effectively communicate a message. Students will also learn to use newly emerging web based mapping tools such as ArcGIS Online, Google Earth, Google Maps and similar tools to develop online interactive maps and graphics. The use of other geospatial technologies such as Remote Sensing and the Global Positioning System will also be explored in this class. Case studies examined in class will draw examples from a wide range of GIS applications developed to assist in the design, implementation and evaluation of sustainable development projects and programs. This course satisfies the M.S. in Sustainability Management program's quantitative analysis curriculum area requirement.

### Course Objectives

On completion of the course students will:

1. Use a variety of GIS software programs to create maps and reports.
2. Develop a sound knowledge of methods to search, obtain, and evaluate a wide variety of spatial data resources.
3. Develop skills needed to determine best practices for managing spatial data resources.
4. Use GIS to analyze the economic, social and environmental processes underlying the concept of building a sustainable world.
5. Gain an understanding of the limits of these technologies and make assessments of uncertainty associated with spatial data and spatial analysis models.
6. Display an ability to work collaboratively to develop strategies promoting wide ranging sustainable solutions and to effectively communicate these plans in a professional environment

### Required textbook:

**None: all readings will be on CourseWorks.**

For those who need a "security blanket" of a textbook, a list of books will be discussed and posted on CourseWorks.

### Resources and Software Packages

Students will use ArcGIS software available at all CUIT labs.

### Method of Evaluation

Labs and assignments = 40%

Midterm = 25%

Quizzes = 10%

Final Project = 25%

Assignments are due one week after they are assigned in class. Work that is submitted late will be penalized one letter grade.

- Exercises, Readings & Homework

Students will be assigned a series of readings that will be posted on CourseWorks. Students will also be required to complete weekly hands-on GIS exercises and submit answers to questions posed by the instructor based on the assigned readings or other topics discussed in class.

- Review of Journal Articles, maps and map applications

Each student will be responsible for selecting a journal article, map and/or web map application related to their area of interest in GIS applications for sustainable development and be required to present a short summary of the article to the class.

- Project Proposal

A report outlining the goals, objectives, research question, proposed research methods, GIS operations, anticipated results and any obstacles you may foresee.

- Midterm Exam

The midterm will comprise 25% of your final grade. The content of the exam will require students to apply skills from the weekly lab assignments, readings, and class discussions to successfully answer a series of questions.

- Final GIS Project

Students will be responsible for completing and presenting a final GIS analysis project that demonstrates they have mastered the concepts and skills presented in the class. Ideally, the project will allow the students to apply the GIS and spatial analysis skills they have learned to problems discussed in their other classes or internships. The final project will comprise 35% of your final grade.

The deliverables for the final project include:

1. A PowerPoint presentation that you will present to the class during the last week of class
2. A map, series of maps, or web map illustrating the findings of your research
3. A 5-7 page report outlining the research question and detailing research methods, GIS operations and a summary of your research conclusions

All project materials must be printed in color. Electronic copies of the document must also be emailed.

### Grading Policies:

The following identifies how points awarded to individual assignments translate into letter grades for the course:

A= 93-100, A- = 90-92, B+ = 87-89, B = 84-86, B- = 80-83, C+ = 77-79, C = 74-76, C- = 70-73, D = 66-69, F = 65 or fewer

### Late Assignment Policy:

Assignments are due on the dates/times identified. One letter grade will be deducted from any assignment submitted after the due date/time. Assignments not received by the time final grades must be submitted will receive zero points for the assignment.

### Incompletes:

As outlined in the School's grading and academic starts policy, "A grade of 'I' (incomplete) is a temporary

grade indicating failure to complete assigned work. The mark is given only upon the request of the student and at the discretion of the instructor. The student and faculty member must sign a completed 'Request for Grade of Incomplete Form' before the final class session. The 'I' must be removed within one year after the end of the semester in which the student received the grade. Students seeking an extension of this time limit must have the approval of the instructor and successful petition of the director of their program. If no petition is made, or if the petition is unsuccessful, the grade is changed to an N-Permanent Incomplete- which remains on the student's permanent record."

## **Policies**

### **Academic Integrity**

The School of Continuing Education does not tolerate cheating and/or plagiarism in any form. Those students who violate the Code of Academic and Professional Conduct will be subject to the Dean's Disciplinary Procedures. The Code of Academic and Professional Conduct can be viewed online: <http://ce.columbia.edu/node/217>

Please familiarize yourself with the proper methods of citation and attribution. The School provides some useful resources online; we strongly encourage you to familiarize yourself with these various styles before conducting your research: <http://library.columbia.edu/help/howto/endnote.html>

Violations of the Code of Academic and Professional Conduct will be reported to the Associate Dean for Student Affairs.

### **Accessibility Statement**

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process.

For more information regarding this service, please visit the University's Health Services website: <http://health.columbia.edu/services/ods/support>

## **Course Schedule (*Subject to Change*)**

### **Week 1**

#### **Topics:**

- Overview of Course & Objectives
- History and future of Mapping and GIS

### **Week 2**

#### **Topics:**

- Cartographic communication and geospatial visualization

### **Week 3**

#### **Topics:**

- Organizing geographic data
- Spatial data models and formats
- Intro to the Geodatabase

#### **Week 4**

##### **Topics:**

- Spatial Referencing Systems (Geodetic datums, projections, and coordinate systems)

#### **Week 5**

##### **Topics:**

- Journal Review Presentations Begin
- Classification & Thematic Mapping
- Principles of Cartographic Design
- Understanding and using census data for mapping and spatial analysis

#### **Week 6**

##### **Topics:**

- Journal Review Presentations
- Creating and Editing Spatial Data and Databases

#### **Week 7**

##### **Topics:**

- Journal Review Presentations
- Spatial Analysis I - Vector Based, Geoprocessing

#### **Week 8**

##### **Topics:**

- Journal Review Presentations
- Geoprocessing
- Mid-Term Review
- Final Project Proposals Due

#### **Week 9**

##### **Topics:**

- Journal Review Presentations
- Raster Based Analysis

#### **Week 10**

##### **Topics:**

- Journal Review Presentations

##### **Mid Term DUE**

#### **Week 11**

##### **Topics:**

- Developing Environmental Indicators using GIS
- Journal Review Presentations

#### **Week 12**

**Topics:**

Guest speaker

**Week 13****Topics:**

- Understanding Landuse/Landcover data
- Site Suitability Modeling Exercise
- A Review of Open Source GIS Options
- Final Project Workshop

**Week 14 Final Project Presentations**