

Columbia University, MPA ESP ENVPU 6246

Analytics for Environmental Science and Policy, Part II

Introduction to GIS Methods

July 17 – August 7 (4 sessions)

Lecturer

Dr. Fabien Cottier, Adjunct Assistant Professor, fcottier@ciesin.columbia.edu

Office hours: 4pm – 6pm (405A)

Teaching assistant:

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Location & Time of classes: room:

Group A

Time: Monday 1pm – 3.30pm

IAB 404 (July 17th)

Computer lab IAB 510A (July 24th - August 7th)

Group A

Time: Monday 10am – 12.30pm

IAB 404 (July 17th)

Computer lab IAB 510A (July 24th - August 7th)

“Everything is related to everything else, but near things are more related than distant things.”

(First Law of Geography; Tobler 1970 : 236)

Overview

The use of maps to display, convey and examine spatial information has been a recurrent feature since the dawn of history and is ubiquitous for scientific research from natural sciences to the human and social sciences. Maps provides an attractive mean to summarize spatial information, convey information and identifying trends and patterns in the data. Similarly, most of our data (from google maps entries to tabular

data to texts and speeches) are explicitly or implicitly geo- referenced. The ability to leverage these spatial reference allows us to identify patterns in the data.

Geographic Information Systems (GIS) are a set of tools to collect, store, analyze and display spatial information. As part of the class, students will be taught basic notions of cartography and map projections, well as receive a broad overview of GIS principles and techniques, and introduced to simple GIS operations on both vectors-based data and raster data, including spatial join, overlay analysis and zonal statistics. The course will put a special emphasis on the creation of thematic maps to represent and summarize spatial information in an efficient manner.

The course will feature a mix of in-class lectures (session 1) and practical exercises in the computer lab (sessions 2-4). As part of the course, students will be introduced to ArcGIS Online.

Students are encouraged to contact Fabien, if they have particular topics or questions, they would like to address during the short-courses. Likewise, in view of increasing the utility of the short-course, participants are welcome to bring their own data to the short-course to discuss how GIS tools may be useful for describing their own data and research results, as well as conducting analyses.

Course objectives:

As the end of the class students are expected to be able to:

- Understand map projection and be able to select an appropriate projection for the problem that they are examining.
- Distinguish between vector-based and raster data and understand their respective advantages and limitations.
- Perform spatial queries on vector-based spatial, as well as spatial join to combine information from different sources of spatial data.
- Make appropriate use of symbology to visually represent spatial information and produce maps.
- Able to use ArcGIS StoryMap to produce elegant report and presentation on a subject of their choice.

Grading:

In order to succeed the class (Pass/Fail), the students will have met the following requirements:

- (1) Active participation in-class (5pt)
- (2) Timely completion of weekly assignment (30pt)
- (3) Group-based project (65pt)

To succeed, the class students must obtain at least 70pt (out of 100pt possible). Note: students must pre-notify the class instructor in case of absence (emergency situations excepted).

Weekly assignment:

Students are required to complete and submit weekly assignments. Weekly assignments are a mix of short quizzes on coursework and online ESRI GIS class. Students are required to submit their certificates of class completion on coursework.

Group-based project

In groups of 2-4, students will be required to complete a group project and present the results to the class. This group project will involve the following tasks:

- (1) Annotated bibliography (3 articles / students) on theme chosen by the students (5pt) (*due Friday July 28, 8am*). [Individual assignment]
- (2) Identifying research questions to be answered with the help of GIS tools, and which data will be used (10pt) (*due Friday August 4, 8am*). [group assignment]
- (3) Prepare an ArcGIS StoryMap, which presents the research question, identify which spatial data will be used and why, discuss how the analysis will be conducted and present the findings with the help of maps (60pt) (*due August 16th, 12pm*). [group assignment]

Program of the class:

July 17th: **Session I: Introduction to GIS concepts** **[In-Class]**

Content:

- What are *Geographical Information Systems*?
- How GIS can be useful for social sciences research and policymaking?
- A brief overview of map projections.
- GIS architecture & types of spatial data
- Practical session
 - o Introduction to ArcGIS Online on your personal laptop.

Assignment (due July 24th 8am)

- Quiz (see coursework)
- *ArcGIS Online Basics* [Online class]

July 24th: **Session II: Vector-based spatial objects** **[Computer Lab]**

Content

- Feedbacks on previous week assignments
- Practical introduction to ArcGIS (e.g. Navigating the software, creating a project, add a basemap and add spatial data).
- Vector-based data :
 - o Type of vector-based data
 - o Attribute tables feature classes (incl. tables join)
 - o Querying vector-based data (inc. SQL language)
- Practical session

Assignment (due July 31st 8am)

- *Quiz* (see coursework)
- *Getting Started with Spatial Analysis* [Online class]

Group-based project (due July 28th 8 am)

- Annotated bibliography

July 31st: **Session III: *Spatial join and map symbology***

[Computer Lab]

Content:

- Feedbacks on previous week assignments
- Vector-based data:
 - o Spatial join
- Introduction to map symbology
- Practical session
- Introduction to *ESRI StoryMaps*

Assignments (due Aug 7th 8am):

- *Quiz* (see coursework)
- *Symbolizing Map Layers* [Online class]
- *Get Started with ArcGIS StoryMaps* [Online class]

Group-based project (due Friday August 4, 8am):

- Research questions and data

August 7th: **Session IV: *Overlay analysis & Raster data***

[Computer Lab]

Content

- Feedbacks on previous week assignments
- Vector-based data
 - o Overlay analysis
- Introduction to raster data:
 - o Type of raster data
 - o Map Algebra
 - o Zonal statistics
- Practical session

August 16th Final exam:

[IAB 404]

- ArcGIS StoryMap due 12pm
- Presentation of group project: 2-5pm