NTNU – Trondheim
Norwegian University of
Science and Technology

NTNU, Trondheim (Norway) June 15 – June 19 2020

GIS and the Geography of Armed Conflict: Applying Geographical Information Systems (GIS) and georeferenced data for Peace and Conflict Research

1. General

Time: 15 June 2020 - 19 June 2020

Place: NTNU Trondheim, Campus Dragvoll

Organizer:

Department of Sociology and Political Science, NTNU. The course is organised at NTNU in collaboration with the Research School on Peace and Conflict.

Coordinators: Associate Professor Ole Magnus Theisen, Department of Sociology and Political Science, NTNU , Senior researcher Andreas Forø Tollefsen, PRIO, and Professor Jan Ketil Rød, Department of Geography, NTNU.

Credits: 10 ECTS

Examination: Essay (pass/fail)

Application deadline: April 30

For practical information and application to the course, please contact:
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Political Science, NTNU einar.syrstad@ntnu.no

2. Instructors details

First name, last name: Researcher Andreas Forø Tollefsen
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First name, last name: Professor Jan Ketil Rød
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Short Bios:

Andreas Forø Tollefsen (Ph.D.) is Senior Researcher at the Peace Research Institute Oslo (PRIO). His research focuses on the use of georeferenced data such as surveys and event data, to explore the local causes and consequences of armed conflict. He has an extensive experience with ArcGIS and QGIS, as well as open-source GIS databases such as PostGIS and the use of spatial data in the statistical software package R.

Professor Jan Ketil Rød, Department of Geography, NTNU has a wide experience in the use of Geographical Information System (GIS). Since GIS is a technology which facilitates inter disciplinary research, he uses GIS for a variety of topics including the study of civil armed conflicts, environmental hazards and vulnerability mapping, urban and land use planning, and educational geography.

3. Short outline

As a research tool in the social sciences, GIS has not been used to nearly the same depth relative to applications in the natural science, where GIS have a longer history dating back to the late 1960s. Current and future opportunities for the application of GIS in the social sciences are considered tremendous. This course aims to point at some of the many opportunities. Whether the research design is based on qualitative or quantitative methods, GIS can provide the researcher with added analytical capabilities. Examples on how GIS can support both qualitative and quantitative methodologies will be given during the course, but with an emphasis on the latter.

4. Long outline

The course aims to give participants an extensive hands-on experience with the use of GIS operations and to apply georeferenced data. A number of exercises will be given to allow students to become familiar with the essential GIS functionalities. Many of these exercises will provide students a model on how to populate a data table (that can later be used for a statistical analysis) with geographic or disaggregated variables. Lectures will be balanced between the theoretical and the practical with several examples. Examples are mostly drawn from the use of GIS for the study of civil armed conflict, but as the techniques are generic, course participants should be able to see their relevance for other purposes.

The course further aims to give participants and understanding on what GIS is as well as to provide participants with the necessary understanding of basic GIS concepts and tools, such as:

- GIS as Geographical Information System, Science and Studies.
- The nature of geographical data, the measurement levels after Stevens (nominal, ordinal, interval and ration) and some of their shortcomings when applied to geographical data. Spatial autocorrelation and how this may be problematic for conventional statistics.
- Representation of geographical data in GIS, discrete and continuous geographic data as well as their associated common representation: vector and raster data. Topological properties for vector data and how these facilitate spatial analysis.
- Representing statistical surfaces and terrain surfaces
- Coordinate systems; both coordinate system at the globe (geographical co-ordinates or latitude / longitude) and Cartesian (‘flat’) coordinate system
- Map projections and their properties, how measurements on a global scale becomes distorted because of map projections.
- Data capture methods (Global Positioning Systems (GPS), Remote Sensing, Screen and table digitizing, scanning, from table to map. Georeferencing a satellite image, aerial photograph or a scanned map)

- Queries based on attributes, queries based on location
- Area and distance measurement. How to measure distance and area correctly on a global scale? Eulidean distance versus geodesic distances.
- Basic vector based GIS tools: buffer and overlay
- Basic raster based tools: map algebra. Local, focal, zonal, and global map algebra functions. - Spatial modelling
- Presenting geographical data, thematic mapping (choropleth maps), map design - Geovisualization and participatory GIS

The course participants will be working with geographic representations of armed conflicts as well as phenomena often related to conflict. Dataset on armed conflicts could include geocoded conflict data from Uppsala/PRIO (point), localized Military Interstate Disputes (MID) data, conflict zones (polygon), Armed Conflict Location and Event Data - ACLED (points). Examples of other relevant georeferenced datasets that will be mentioned in lectures and may be used in exercises during the course include diamond sites, petroleum fields, ethnic groups, forests, and mountainous terrain and population density.

Lecture and lab constitute five days of teaching where tentatively more than half of these teaching hours will be lab hours. Examples of exercises would be:

- Understanding map projections
- From table to map – convert a table with coordinates with the 'add events' tool. Examples of tables with geographical coordinates that we can use are dataset on armed conflicts (the Uppsala/PRIO dataset), dataset on locations of military intrastate disputes (MIDLOC), and Armed Conflict Location and Event Data – ACLED.
- Representing the extension of internal armed conflicts by applying buffer and overlay operations.
- Combining dataset on the extension of internal armed conflicts with a population raster in order to estimate the number of people living in conflict affected areas with the use of zonal map algebra function (zonal statistics).
- Distance measures – how to get the measurement correct on a global scale by using geodesic distance measures
- Thematic mapping – how to make appealing and understandable maps
- Use of scripting to automate work-flows and to manage large dataset (for instance by batch processing)

As GIS also is a technology and since there are many different formats involved, some focus on the more technical side of GIS will also be covered. When working with other software for statistical analysis or word processing, course participants may be used to be working with one single file (or a limited number of files). Working with GIS, for one GIS project, it is not uncommon that the number of files becomes several hundred or more. For native users, this is often challenging, and the course therefore also aims to make course participants able to manage huge amount of GIS data.

5. Preliminary Tuition plan – GIS course at NTNU, Trondheim.

	Mon 15. June	**Tue 16. June**	**Wed 17. June**	**Thu 18. June**	**Fri 19. June**
09:00-10:00	Welcome, presentation, technical matters.	Representing reality in GIS (L3)	Vector tools in GIS (L6)	Map algebra (raster tools in GIS) (L8)	Surfaces and spatial interpolation (L10)
10:00-11:00	Introduction to GIS (L1)	GIS data collection and georeferencing images (L4)	Map design and thematic mapping (L7)	Distance measures in GIS (L9)	Prospect and problems (L11)
11:00-12:00	Map projection and coordinate systems (L2)	Georeferencing a raster image (scanned map on ethnic groups) (E3)	Extensions of Armed Conflict (E6)	Demo 1: WMS and Data Capture Demo 2: Solar energy potential Populations at risk (E9) (zonal statistics)	Distance to capital (E10) (fishnet)
12:00-13:00	Lunch	Lunch	Lunch	Lunch	Lunch
13:00-14:00	Map projection (E1)	Vector data properties and queries (L5)	… cont. E6	Paper sketch presentations	Distance to borders (E11) Optional exercises and /or working on own projects
14:00-15:00	Add events – from georeferenced table to map (E2)	Data collection using screen digitizing (ethnic groups) (E4)	Thematic Mapping (E7) (Joining map and tabular data)		
15:00-16:00		Topology (E5)	Using WMS in QGIS / ArcGIS (E8)		

L1, L2, … Lectures – pdf versions of slides will be available from DropBox (or eLearning system).

E1, E2, … Lab practicum (exercises). Exercise text and data available from Dropbox (or eLearning system). Optional exercises for Friday afternoon:

- batch processing large GIS data (python scripting)
- Virtual Campus Courses

6. Requested prior knowledge

Participants should be computer literate, knowing how to pack and unpack zip or tar files and knowing how to navigate, copy, and paste files in a file manager program. A minor basic knowledge of statistics and mathematics is useful.

7. Software used

The software used will be ArcGIS Desktop (version 10.4) with the Spatial Analyst extension. Possibly also QGIS. Students should have ArcGIS and QGIS installed already at course start. A free trial version of the ArcGIS software is available from here:

http://www.esri.com/software/arcgis/arcgis-for-desktop/free-trial

NB! You need ArcMap – not ArcGIS Pro!

8. Reading List

Basic assignments:

Longley, P. A., M. F. Goodchild, D. J. Maguire and D. W. Rhind 2015. *Geographic Information Systems and Science*. 4th ed. Chichester, Wiley.

For those reading Norwegian:
Rød, J.K. 2015. GIS: Verktøy for å forstå verden. Bergen, Fagbokforlaget.

Further reading:

[TBA]