Geographical Information Systems and Science  
(L7407; CL961)

Lecture: Tuesday, 9.30 – 10.30 am (Lecture Room 613, Graham Hills Building)  
Practical: Tuesday, 10.30 am – 12.30pm (Colville Building computer lab - 309A)

Class Outline and Reading List  
Session 2012/2013

Principle Tutors and class managers

Dr Elsa João, Senior Lecturer, Department of Civil and Environmental Engineering, room 605,  
Level 6, Graham Hills Building; Tel: 0141 548 4056; email: elsa.joao@strath.ac.uk  
OFFICE HOUR: Please see note on my door, though I prefer that you arrange a meeting via email.

Dr Anna McLauchlan, Teaching Associate and Lecturer, School of applied Social Sciences,  
Level 6, Lord Hope Building; Tel.: 0141 548 8625; email: anna.mclauchlan@strath.ac.uk  
Meetings: Please arrange meetings via email.

Aims and Objectives:

This module provides a thorough introduction to the rapidly growing field of Geographical Information Systems and Science. GIS are spatial databases, developed from earlier cartographic forms, which can handle spatial information in a far greater variety of ways than was previously possible with paper maps. By capturing, manipulating, integrating and displaying digital spatial data, a wide range of different analyses can be carried out and questions addressed. GIS is used in everything from social research - how standard of living in different geographical areas can be related to health and disease - to environmental work - linking maps of different farming practices with environmental models of soil erosion. GIS also has a very public presence: many people carry mobile phones that use satellite navigation Global Positioning Systems to display locational information.

The class covers the key theoretical principles of GIS but it also provides practical hands-on exercises using current state-of-the-art Geographical Information Systems (GIS), providing training both raster (IDRISI Andes) and vector (ArcGIS) based software. GIS is a crucial analytical tool in geography and environmental science. However, GIS also had a major impact in other subjects (business, civil engineering, community studies), as well as outside universities (local councils, utilities, consultancies). This class demonstrates how GIS can be used for spatial query and analysis, while at the same time allowing assessment of the quality and the effectiveness of the resultant products in terms of their use. Therefore, this class enables critical awareness of the models we use to represent and navigate our world.
Learning outcomes:

Upon successful completion of this module, the student will be able to:

- Identify the key principles of the field of Geographical Information Science.
- Be familiar with how to navigate at least two state-of-the-art Geographical Information Systems (GIS).
- Evaluate the potential of using GIS in answering spatial questions in a variety of applications and fields.
- Evaluate the quality of GIS results and how to deal with error and scale issues.
- Understand the main principles of fuzzy logic and know how to handle natural objects with indeterminate boundaries.
- Understand the main principles and theoretical implications of generalisation.

Class Assessment:
The class will be assessed by have two assignments only (i.e. there is no exam). The assignments require you to report on what you did and what you found but also necessitate critical engagement with topic.

Assignment 1: Report on GIS-based spatial analysis using IDRISI
(The assignment should make reference to relevant literature and be approximately 2,500 words (UG) and 3,000 words (PG); worth 50% of the final grade; a separate handout will be provided)

Submission deadline of Assignment 1 - 10am, Monday, 11th March 2013

Assignment 2: Report on GIS-based spatial analysis using ArcGIS
(The assignment should make reference to relevant literature and be approximately 2,500 words (UG) and 3,000 words (PG); worth 50% of the final grade; a separate handout will be provided)

Submission deadline of Assignment 2 - 10am, Monday, 22nd April 2013

General advice for assignments:

a) Please make sure you mix, compare and contrast your references. It is not acceptable for example to have three pages drawn completely from a single reference – even if you are paraphrasing, it may run the risk to be marked as plagiarism.

b) Please impose an explicit structure by having numbered sub-headings that are closely linked to the overall argument.

c) Please use the Harvard system of referencing for all references, i.e. including all electronic references – as shown the Geography House Style guide available on myplace (also http://education.exeter.ac.uk/dll/studyskills/harvard_referencing.htm)

d) Don't write the assignments for the marker – instead write them for an averagely educated reader. So for example, it is not enough to say “in the fieldtrip it was observed that ...”. The reader does not know what the fieldtrip was about, or where and when it took place; therefore you need to explain it (either in the main text, appendix or footnote).

e) See “advice for essays and referencing” in the Learn-Online space for this class.
**Important notes regarding the course assessment:**

All students should submit a hardcopy and an electronic version of their assignments, with electronic versions submitted via Myplace (for turnitin check). Submission instructions together with penalties related to late or non-submission are included below.

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<tr>
<th>Geography 4th year (L7407)</th>
<th>Postgraduate (CL961)</th>
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<tr>
<td>All hardcopy submissions should be delivered to the Courses Support Team Reception area on level 6 of the Lord Hope Building. A common front cover sheet can be downloaded from Myplace and must be attached to all hardcopy assignments. The cover sheet includes a Declaration of Authorship which must be ticked by students before work will be accepted for marking. Failure to submit an essay (IN BOTH ELECTRONIC AND HARD COPY) on the due date will result in a deduction of 5 marks per day up to a maximum of five working days, after which the essay will receive a mark of 0, unless the late submission is supported by medical evidence submitted to Registry. Failure to submit an assignment will lead to you being ineligible to continue (NQ’d). Loss of material due to a failure to back-up work is not deemed an acceptable reason for extension. Remember to back up all your assignment work regularly by keeping a second electronic copy. Extension to a deadline are granted only in exceptional mitigating circumstances and for valid medical or other reasons, based on evidence submitted to Registry. Requests for extensions must be made in advance of the assignment deadline as follows. Students must contact the Class Co-ordinator (Dr Anna McLauchlan) and Courses Support Team Manager (Ms. Fiona Drummond) if they require an extension. If permission for late submission has been granted, it is crucial that the student includes a copy of a written confirmation of an authorized late submission (e.g. email communication) together with the (late) submitted piece of work, clearly specifying the new deadline.</td>
<td>A Submission/Assessment sheet should be completed for each assignment and attached to the work. The assignment (plus Submission/Assessment sheet) should then be placed in the PG submission box outside room 729, level 7, John Anderson Building. Note that the Submission/Assessment sheet is used by the marker to write comments and does not replace a proper title page. Please note that email submissions will not be accepted. The penalty for unauthorized late submissions is 5% of assessed mark deducted per working day, up to a maximum of 10 working days (i.e. 2 weeks) equating to less 50% of the assessed mark. After that, no marks awarded. Requests for extensions will be evaluated in case-by-case basis but normally will only be granted for illness or similarly extreme circumstances. Poor time management does not warrant favourable treatment. Please note that work submitted on the due day but not at the specified time will be given one day late submission penalty. No extension will be granted on technical/computing grounds or retrospectively. Please note that only MSc/MRes course leaders (for postgraduate students) and year tutors (for undergraduate tutors) can give extensions. Students need to contact the course leader/year tutor directly to discuss the reasons for extension.</td>
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N.B In a change to previous years, we are instituting a system of anonymous marking of coursework this year, it is therefore important you remember to leave your name off essay scripts. You will be identified by your student ID number which you will write on the front cover sheet before submission.
References:
There are many references related to GIS. A joint Geobase and Inspec search of “GIS or GEOGRAPHIC* INFORMATION SYSTEM* or GEOGRAPHIC* INFORMATION SCIENCE” found 74,895 English language references (between 1969 and Jan 2012). To access both Geobase and Inspec at Strathclyde, go to Engineering Village here: http://www.engineeringvillage.com/controller/servlet/Controller?CID=quickSearch&database=1

Some references available at Strathclyde University [(*) = key reading]:


Further references will be supplied with the individual assignments and during lectures.
Web sites:

- **Association for Geographic Information** - [http://www.agi.org.uk/](http://www.agi.org.uk/)
  The AGI exists to represent the interests of the UK’s geographic information (GI) industry; a wide-ranging group of public and private sector organisations, suppliers of GI software, hardware, data and services, consultants, academics and interested individuals.

- **The NCGIA Core Curriculum in GIScience** - [http://www.csiss.org/learning_resources/content/giscc/giscc_contents.html](http://www.csiss.org/learning_resources/content/giscc/giscc_contents.html)
  CSISS (Center for Spatially Integrated Social Science) recognizes the growing significance of space, spatiality, location, and place in social science research. It seeks to develop unrestricted access to tools and perspectives that will advance the spatial analytic capabilities of researchers throughout the social sciences. It incorporates the NCGIA Core Curriculum in GIScience with the following key content:
  - What is GIS?
  - Fundamental Geographic Concepts for GIScience
  - Implementing Geographic Concepts in GISystems
  - Geographic Information Technology in Society
  - Application areas and case studies

### Class Structure

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic of lecture</th>
<th>Topic practical</th>
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<tbody>
<tr>
<td>1</td>
<td>22 Jan 2013</td>
<td>Intro to the course and the two assignments.</td>
<td><em>Idrisi Exercises A + B</em></td>
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<td></td>
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<td>Introduction to GIS: What is a Geographical Information System (GIS)? Difference between a GIS and an automated mapping package. Spatial data structures. Brief historical development of GIS and GIScience from earlier cartographic forms. Examples of GIS applications. (Elsa João and Anna McLauchlan)</td>
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<tr>
<td>2</td>
<td>29 Jan 2013</td>
<td>Raster and Vector data structures. (Elsa João)</td>
<td><em>Idrisi Exercises B + C</em></td>
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<td>3</td>
<td>5 Feb 2013</td>
<td>Spatial query and analysis; Environmental modelling using GIS. Interfacing models with GIS. (Elsa João)</td>
<td><em>Part A of Idrisi-based assignment</em></td>
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<td>4</td>
<td>12 Feb 2013</td>
<td>READING WEEK – No Lecture and no practical - but students should continue the assignment in their own time</td>
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<td>5</td>
<td>19 Feb 2013</td>
<td>The importance of data in GIS. What is special about spatial data? How to handle natural objects with indeterminate boundaries. Main principles of fuzzy logic. (Elsa João)</td>
<td><em>Part B of Idrisi-based assignment</em></td>
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<td>Week</td>
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<td>6</td>
<td>26 Feb 2013</td>
<td>ArcGIS Online/ Using GIS for windfarm site selection and operation</td>
<td>ArcGIS Exercise A + B (1.5 hour only)</td>
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<td>[Emma Sandison - ESRI (UK)] (1 hour lecture)</td>
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<td>Introduction to ArcGIS (<a href="#">Anna McLauchlan</a>) (30 min lecture)</td>
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<td>7</td>
<td>5 Mar 2013</td>
<td>Error and data quality of spatial data. Data quality parameters. Types of error:</td>
<td><a href="#">ArcGIS Exercise B+C</a></td>
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<td>random, gross &amp; systematic errors. Error propagation by GIS analysis. Legal</td>
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<td>aspects of mapping and GIS. Digitising error and how to combine it with other</td>
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<td></td>
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<td>sources of error. (<a href="#">Anna McLauchlan</a>)</td>
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**Assignment 1 (IDRISI Project) is due: 10am, Monday, 11th March 2013**

| 8    | 12 Mar 2013 | Different methods of spatial data input into a GIS. Data modelling; representing | Part A of ArcGIS-based assignment                                                 |
|      |            | the world in a GIS. Scale and generalisation. The Modifiable Areal Unit Problem  |                                                                                  |
|      |            | (MAUP). Zone design solutions. Automating map generalisation. ([Anna McLauchlan](#)) |                                                                                  |
| 9    | 19 Mar 2013 | The use of GIS by MapAction and the Scottish Government                           | Part B of ArcGIS-based assignment (1.5 hour only)                                 |
|      |            | [James Steel - Historic Scotland](#)                                             |                                                                                  |
|      |            | (40 min lecture)                                                                  |                                                                                  |
|      |            | Summary of the course. State-of-the-art applications of GIS. Main challenges to  |                                                                                  |
|      |            | be solved. Advice on a career in GIS. ([Anna McLauchlan and Elsa João](#))       |                                                                                  |

N.B. There are no lectures and no practicals in weeks 10, 11 or 12 of the term.

**Assignment 2 (ArcGIS Project) is due: 10am, Monday, 22nd April 2013**