University of Exeter

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GEOM184 - Open Source GIS

Group Project

Project B - Mapping peat depths in Bodmin Moor

Deadline: 3rd May 2024 at 12:00

Module: Open Source GIS
Module code: GEOM184
Academic Year: 2023/2024

Assessment guide

This assignment is a group project (with individual report assessment). The main aim of this assignment is for you to be able to independently apply the capabilities of open-source GIS tools to real-world environmental problems. It is also important to note that the research questions that you are asked to work on are current live projects that have been carried out at the University of Exeter by academics and researchers based at the Centre for Resilience in Environment, Water and Waste (CREWW). CREWW has been established to undertake research into some of the most pressing environmental challenges in our time - namely how we can manage our precious natural resources in ways which are sustainable, innovative and resilient in the face of climate change and population growth. Thus, this project will have very practical applications that can be helpful for your own professional career.

You are provided a research question that you will need to fulfil, some guidance, and some background data and/or technical data. As a general principle, you are welcome to use any open-source GIS tool (whether these have been covered in the lectures/practicals or not), but you must not use any GIS proprietary software (e.g., ArcGIS).

How to present this project This assignment should be written as a technical report or a technical paper. Although this assignment is a group project, you will need to write your report individually, based on your own critical analysis and understanding of the project problem, methods, results, and analysis. You will need to use references and citations when appropriate and you must adhere with the University principles of Academic conduct and practice.

Your report should have (approximately) 2400 words (excluding references). Whilst there is no specific limit on the number of figures you can produce and show, it is recommended (and indeed good practice) to condensate information in figure and reduce the overall number. Thus, it is expected that you will produce no more than 8 figures, unless absolutely necessary.

A suggested way to structure your report is as follows:

1. **Introduction** a section describing the problem statement and a brief overview of the existing literature;
2. **Methodology** a section describing the methods you used to carry out your work, a description of the study site(s), etc. This section needs to contain all of your choices, including the GIS tools that you have used;
3. **Results** a section that described the results of your work (it is important to avoid any speculation in this section);
4. **Analysis & Discussion** a section where you critically analyse your results, discuss consequences and limitations, suggest further work;
5. **Conclusions** a section to wrap up your work.

At the end of your document you should also add a section titled *Group contribution and self-reflection* where, briefly, you describe the individual contributions to the group (i.e., yours and

those of your peers), and a reflection on your experience about this project (challenges, skills acquired, interest development, etc.). In this section you should also add a link to your GitHub repository and a comment on how version control supported your group work and how you intend to implement it for the future. This section will not count towards the word limit.

One of the most crucial outputs of your assignment will consist of maps. Figures that include maps will need to have at least:

- X and Y grid with coordinates;
- A North arrow;
- A legend;
- A scale bar;
- Acknowledgement for any copyright and/or ownership (in some cases this is also possible in the figure caption).

You are welcome to use this structure as a reference, or use your own structure.

You are allowed (and encouraged) to use LLM (large language models), such as ChatGPT or Copilot (formerly Bing AI). If you do use LLMs, please mention that in the relevant methods section, how you used it, and what benefits (or not) it provided to you. For best efficiency in using LLMs (especially with support with coding) please look up *incremental prompting*. Use of LLMs or other AI tools without critical analysis will not be considered and will have a negative impact on your marks.

Marking The overall marking scheme can be found here.

Project B - Mapping peat depths in Bodmin Moor

Globally, peatlands have a critical role in the carbon balance of our atmosphere due to their substantial carbon stocks, ~500 ±100 gigatonnes of carbon (*Yu et al.*, 2011). A functioning peatland will, over time, sequester carbon from the atmosphere. However, in a damaged state, peatlands release carbon into the atmosphere. Identifying where peatland are is a critical step in trying to protect these ecosystems. Often peatlands are overlain by non-peat forming vegetation (e.g., acid grassland, heathland) making their identification difficult. An emerging remote sensing method that has shown potential to map peat depth over landscape extents is airborne gamma-ray spectrometric survey (*Beamish*, 2013; *Gatis et al.*, 2019).

Bodmin Moor in Cornwall has been a key site for peatland restoration in the South West of England. For this assignment, you need to provide a map of peatland depths in Bodmin Moor. You are provided with peat depth measurements (with attributes including Easting, Northing, depth in cm) measured by probing in the field (`Bodmin_Probed_Peat_Depths.shp`) and gridded radiometric data for Bodmin Moor (`Dose_B`, `K_B`, `Th_B`, `Tot_Count_B`, `Ur_B`). You should use at least one additional openly available data and any products derived from them (National LiDAR programme, geology, land cover, Sentinel-1, Sentinel-2, climate). Justify any selection of additional data. You could use the work by *Gatis et al.* (2019) as a reference. Please note, though, that the method used for Dartmoor (*Gatis et al.*, 2019) is not appropriate for Bodmin, most likely due to more extensive human disturbance, therefore you will need to trial alternative models. You can use any regression model if the choice is justified. It is important to assess uncertainty to accompany any remotely sensed product.

References

Beamish, D. (2013), Gamma ray attenuation in the soils of Northern Ireland, with special reference to peat, *Journal of Environmental Radioactivity*, 115, 13-27. DOI: 10.1016/j.jenvrad.2012.05.031.

Gatis, N., D. Luscombe, D. Carless, L.E. Parry, R.M. Fyfe, T.R. Harrod, R.E. Brazier, and K. Anderson (2019), Mapping upland peat depth using airborne radiometric and lidar survey data, *Geoderma*, 335, 78-87. DOI: 10.1016/j.geoderma.2018.07.041.

Yu, Z., D. W.Beilman, S.Frolking, G. M.MacDonald, N. T.Roulet, P.Camill and D. J.Charman (2011), Peatlands and Their Role in the Global Carbon Cycle, *Eos Trans. AGU*, 92(12), 97-98, DOI: 10.1029/2011EO120001