Hugh Graham CV

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Personal Statement

[who am I?]

I work as a Researcher/PhD student in the Geography department at the University of Exeter. I Now in the latter stages of writing up my PhD, I am looking to find work with a strong focus on software and programming in scientific research. My key areas of research have involved the assesment of the impact of the Eurasian beaver on hydrological flow regimes, riparian woodland strucure and predicting the distribution of habitat and dam building activty (Graham, et al. 2020).

[section on programming]

Since learning to code, during my MSc, I have developed passion for it. Initially, my interests were in statistics and data visualisation but, as I developed as a programmer, the value and importance of structured, reproducible workflows and open source software became clear. The power of science is in its deployment and without code can only be finite. I also thoroughly enjoy helping others to find coding solutions; both in terms teaching others how to solve their issues but I also find that this dramatically improves my own learning through exposure to novel challanges.

I predominantly use R and Python for data analysis and software development. However, I would jump at any opportunity to learn new languages. The access to new problems and learning is one of the aspects of software development that I enjoy the most.

As a researcher working within a large group, I believe I have a strong understanding of the ways in which many in academia use programming software and In particular, the ways in which this can be improved.

[examples]

Within our research group, I collaborate with many others across a diverse range of fields to improve the development of software, access to open source datasets and reproducible workflows. For example:

- I have recently developed the R package {EAlidaR} which enables users to download high resolution LiDAR data, produced by the Environment Agency, directly into R. As a research group we all use this data to undertake hydrological and vegetation modelling; however, manually downloading the data from DEFRA's portal has always been a time-consuming and limiting factor. This package helps to overcome these issues.
- Many of us within the research group use drone imagery to construct 3D models using Structure from Motion (SfM) Photogrammetry. In order to improve the reproducibility and accuracy of datasets, I have developed two Python packages to streamline processing. Firstly {sfm_precision}, a python module for Agisoft Metashape, which calculates SFM precision

entirely within Metashape, building on James et al., 2017, who devised the method, but without the need for multiple different programs and with improved speed and storage efficiency. Secondly, {sfm_gridz} a python package to compute differences between elevation models, with consideration of each model's precision and error.

- There is also a need, within out group, to utilise Met Office NIMROD rainfall radar data. This dataset provides rainfall estimates at a 1km resolution nationally at 5 minute time steps. I have developed a workflow to download this data from the Centre for Environmental Data Analysis (CEDA) FTP server and then process this for a user-specified region to retrieve rainfall time-series data which our group use for hydrological analysis/modelling.

Education

2015-ongoing, University of Exeter
PhD, Understanding the Impact of reintroducing the Eurasian Beaver (Castor fiber) in Great Britain.
I am currently working part time on my PhD alongside other research projects.

2013-2014, University of Birmingham
MSc, River environments and their management (Dist.)
Dissertation - 78%: An investigation into the impact of the Demon Shrimp (Dikerogammarus haemobaphes) on the benthic invertebrate community of the River Cherwell. Link to thesis

2009 -2012, University of Exeter
BSC (Hons), Geography (2:1)
Dissertation - 78%: A laboratory flume experiment investigating the interaction between bed-load transport, erosion and channel geomorphology.

Employment

University of Exeter – Researcher
01/03/2019 – present
I am working in partnership with Natural England, The Environment Agency, Natural Resources Wales and Scottish Natural Heritage to model Eurasian beaver habitat and estimate the distribution and density of their dams for Great Britain. This has required the upscaling of our previous work (Graham, et al. 2020), developed as part of my PhD, to a national scale. This requires the calculation of numerous hydrological, topographic and vegetation metrics from a range of remotely-sensed datasets using geospatial processing. Moving this workflow from the landscape to national scale has been very challenging but but hugely rewarding. Alongside this work, I have also produced an ArcGIS plugin which enables those using the model outputs to interrogate and extract relevant data and statistics. This process has required me to work closely with the geospatial teams across the partnership to develop a stable and user-friendly tool.

APEM ltd., Cardiff - Aquatic Consultant
15/10/2014 - 01/10/2015
APEM ltd. is an aquatic consultancy specialising in both freshwater and marine environments. I worked within the freshwater side of the company, undertaking a range of different projects

including diffuse pollution/fine sediment investigations, habitat mapping and evaluation, geomorphological surveys and drought permit assessments. My key roles included: data analysis and visualisation, geospatial analysis and mapping with ArcGIS, report writing and field work.

RMA environmental limited, Tiverton – Work Placement
01/05/2013 – 14/06/2013
RMA environmental ltd. is a consultancy which specialises in Environmental impact assessments (EIAs), flood risk assessments, water quality monitoring and hydrology. During my placement at RMA, I was responsible for writing EIA chapters and flood risk assessments, proposing sustainable urban drainage designs, mapping with QGIS software and interpreting water chemistry and biological data in relation to river water quality.

Other Qualifications/Skills

Full and clean driving License

Programming with R and Python

Mapping and spatial analysis in QGIS, GRASS GIS and ArcGIS

Conference Presentations

- Presenter at 8th International Beavery Symposium 2018, Nørre Vosborg, Denmark
- Presenter at State of Beaver Conference 2017, Canyonville, Oregon.
- Poster Presentations at European Geosciences Union 2018, Vienna Austria:
  - Graham, H., Puttock, A., Benaud, P., Cunliffe, A., Elliott, M., Anderson, K., Brazier, R.E., 2018a. Determining the impact of the Eurasian Beaver (Castor fiber) on the vegetation and wetland structure of a riparian system using structure from motion (SFM) photogrammetry. 20, 796. Link
  - Graham, H., Puttock, A., Wheaton, J.M., Macfarlane, W., Elliott, M., Anderson, K., Brazier, R.E., 2018b. Predicting the expansion and impact of the Eurasian Beaver (Castor fiber) at catchment scales. 20, 782. Link

Publications

Brazier, R. E., M. E. Elliott, E Andison, R. E. Auster, S Bridgewater, P Burgess, J Chant, et al. 2020. "River Otter Beaver Trial: Science and Evidence Report. River Otter Beaver Trial, Devon." https://www.exeter.ac.uk/creww/research/beavertrial/.

Brazier, R. E., A. K. Puttock, H. A. Graham, R. E. Auster, K. H. Davies, and C. M. Brown. 2020. "Beaver: Nature's Ecosystem Engineers." https://doi.org/https://doi.org/10.1002/wat2.%201494.

Campbell-Palmer, Roisin, A. K. Puttock, H. A. Graham, K Wilson, G. Schwab, M. J. Gaywood, and R. E. Brazier. 2018. "Survey of the Tayside Area Beaver Population 2017-2018." *Scottish Natural Heritage* Commissioned Report No. 1013.

Cunliffe, A. M., K. Anderson, F. Boschetti, R. E. Brazier, H. A. Graham, I. H. Myers-Smith, T. Astor, et al. 2020. "Drone-Derived Canopy Height Predicts Biomass Across Non-Forest Ecosystems Globally." Preprint. Ecology. https://doi.org/10.1101/2020.07.16.206011.

Graham, Hugh A., Alan Puttock, William W. Macfarlane, Joseph M. Wheaton, Jordan T. Gilbert, Róisín Campbell-Palmer, Mark Elliott, Martin J. Gaywood, Karen Anderson, and Richard E. Brazier. 2020. "Modelling Eurasian Beaver Foraging Habitat and Dam Suitability, for Predicting the Location and Number of Dams Throughout Catchments in Great Britain." *European Journal of Wildlife Research* 66 (3): 42. https://doi.org/10.1007/s10344-020-01379-w.

Puttock, Alan, Hugh A. Graham, Donna Carless, and Richard E. Brazier. 2018. "Sediment and Nutrient Storage in a Beaver Engineered Wetland." *Earth Surface Processes and Landforms* 43 (11): 2358–70. https://doi.org/10.1002/esp.4398.

Puttock, Alan, Hugh A. Graham, Andrew M. Cunliffe, Mark Elliott, and Richard E. Brazier. 2017. "Eurasian Beaver Activity Increases Water Storage, Attenuates Flow and Mitigates Diffuse Pollution from Intensively-Managed Grasslands." *Science of the Total Environment* 576 (January): 430–43. https://doi.org/10.1016/j.scitotenv.2016.10.122.

References

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