TEACHING REPRODUCIBILITY

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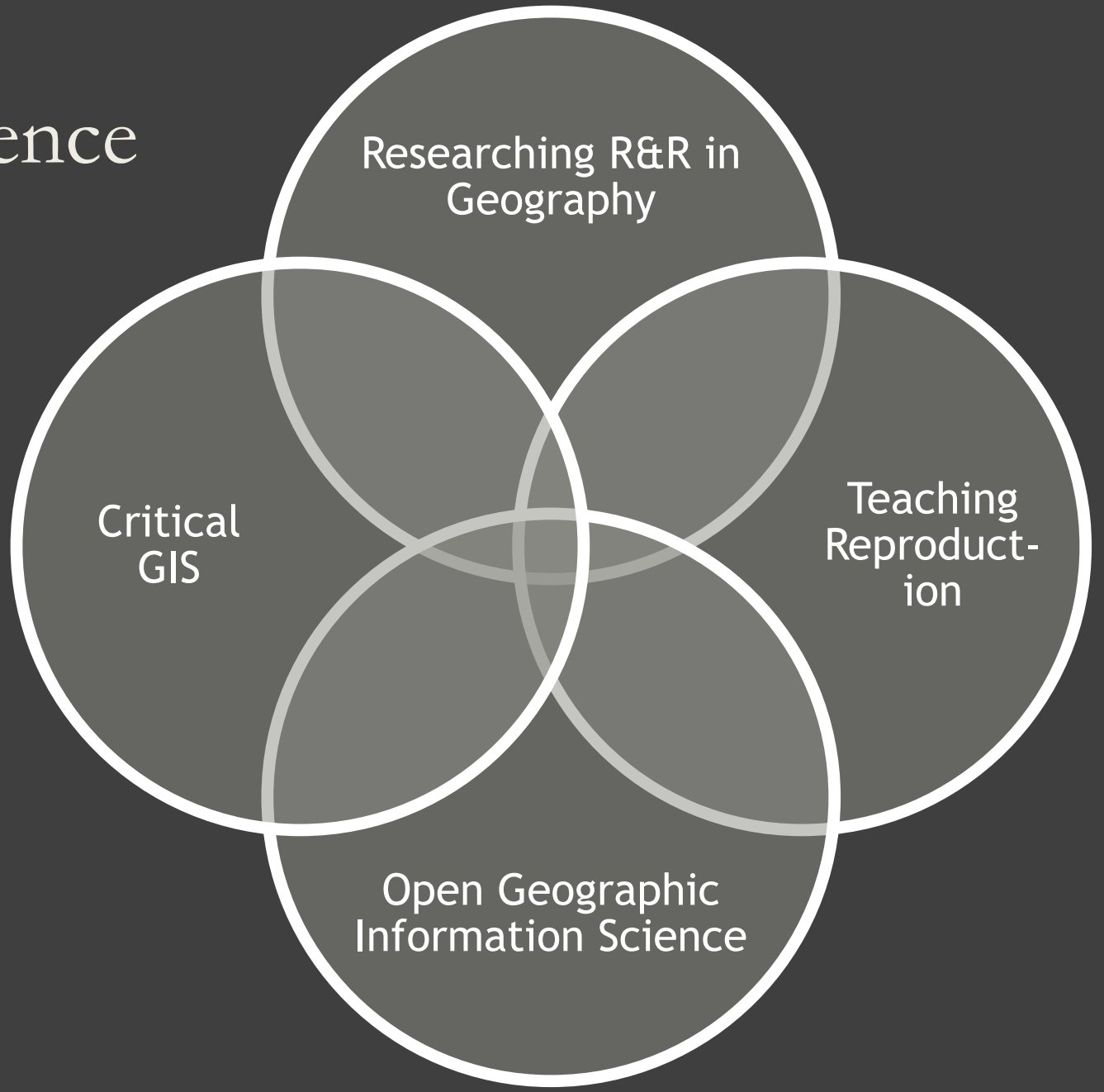
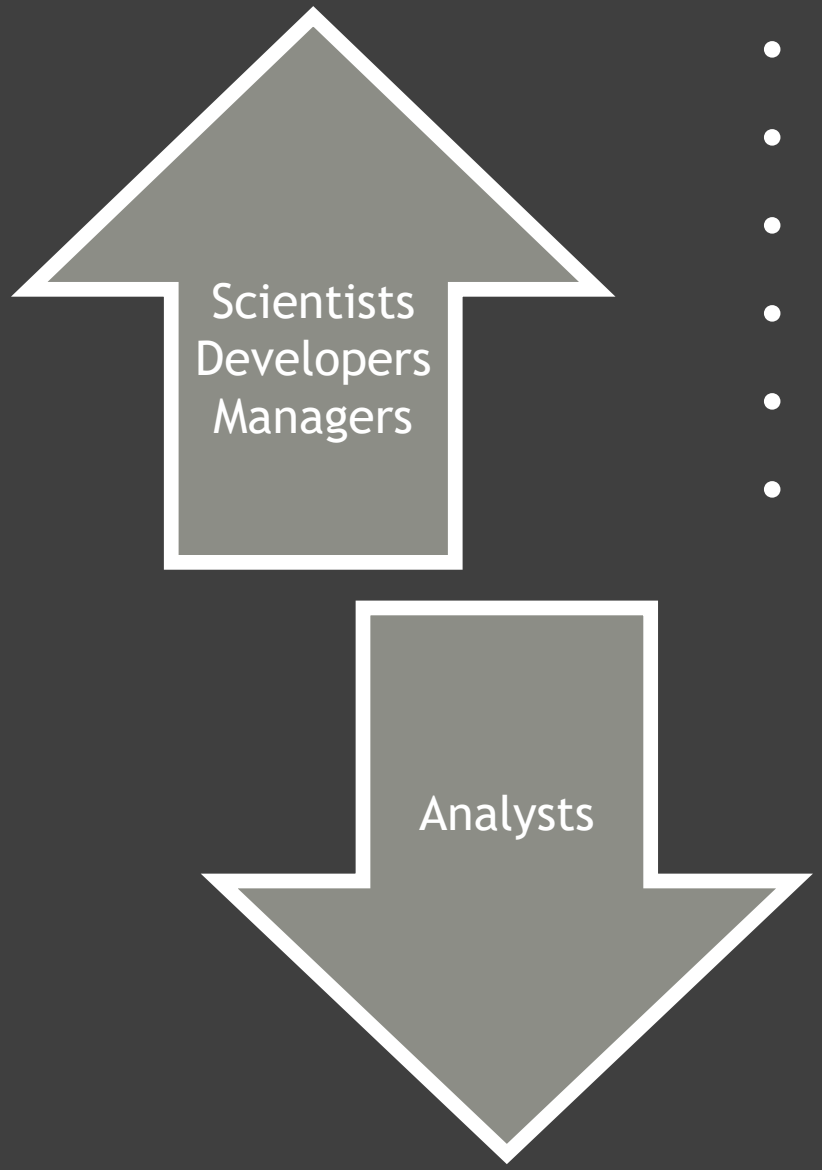
UCGIS 2020

Convergence



Competencies

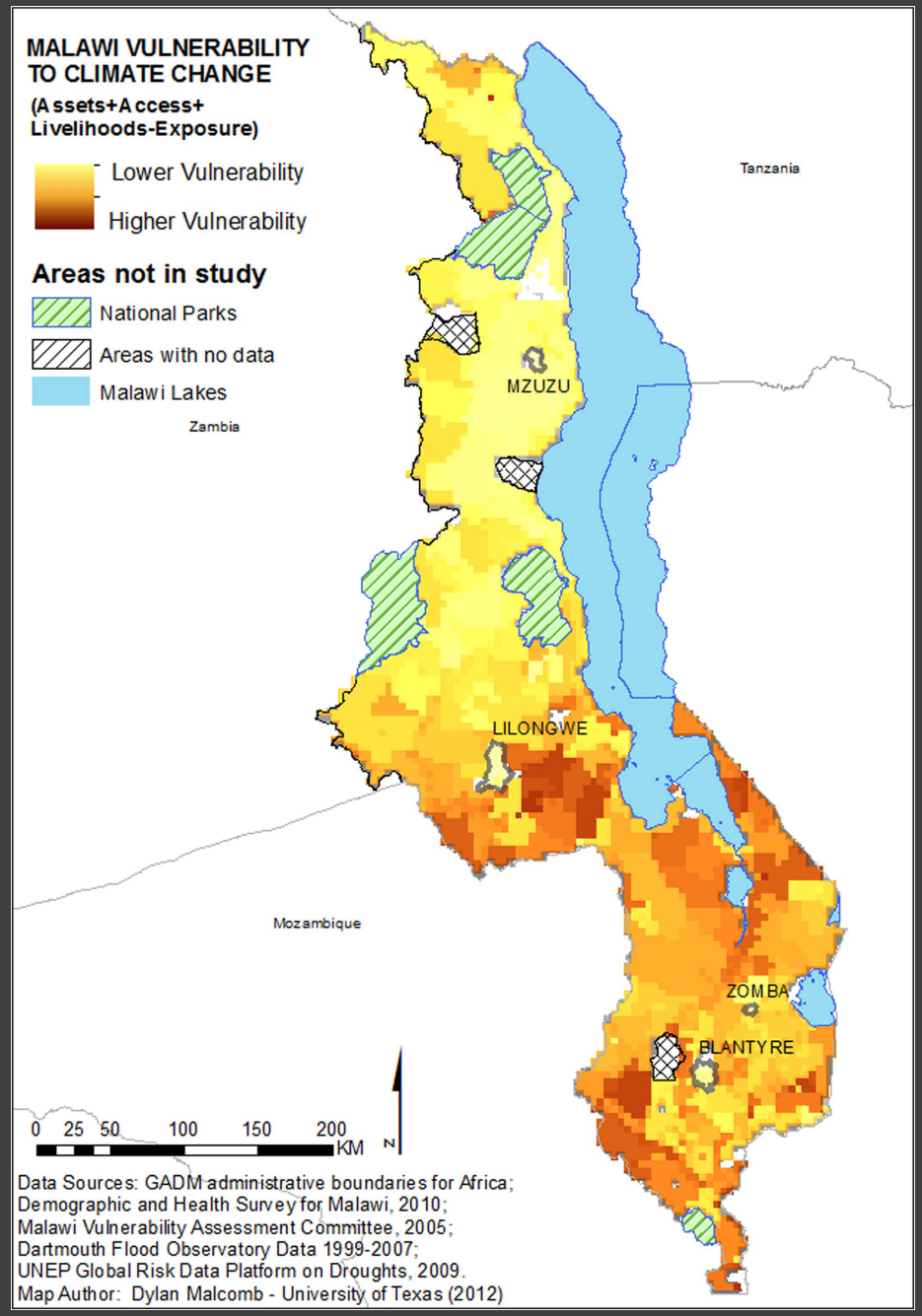


- Literacy: papers + code
- GIS Fundamentals (OGC)
- Spatial Questions
- Problem-solving
- Collaboration
- Communicate Reproducible Research

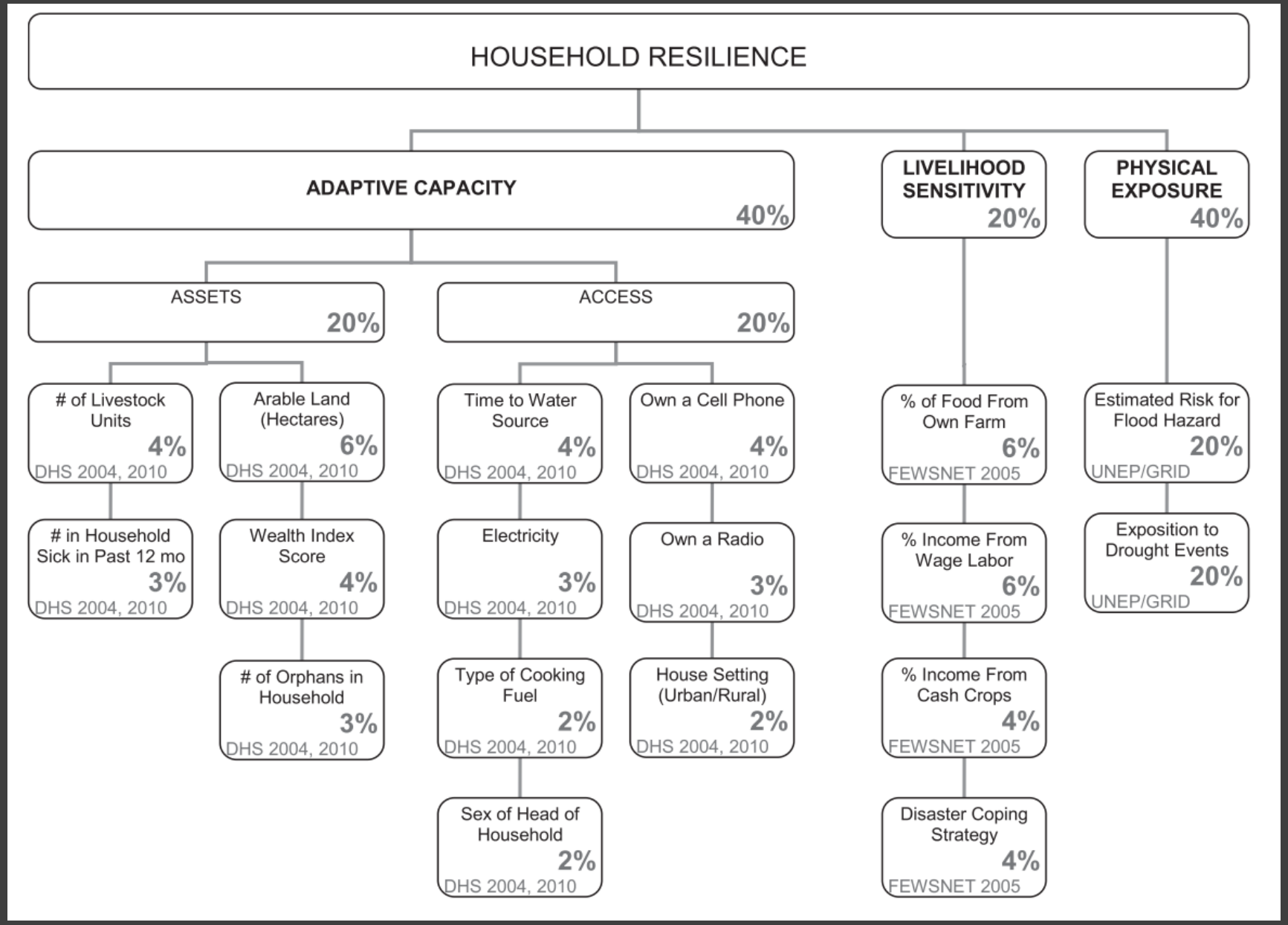
- Teaching GIS
  - Specific Software / Techniques
  - Tutorials

A Convergent Reproducibility Problem

- Malcomb et al 2014
  Vulnerability modeling for sub-Saharan Africa: An operationalized approach in Malawi
  Applied Geography
- Teaching & Research
- Science & Policy
- Multiple Disciplines / Sectors
  - *Flood hazard*
  - *Drought hazard*
  - *Livelihoods*
  - *Adaptive capacity*



Malcomb et al (2014) Vulnerability Model



Achieving the Reproduction

F: Read paper; draft workflow diagram (Malcomb et al 2014)

M: New PostgreSQL techniques (window functions)

W: revise workflow based on specific data sources / metadata;

R lab: Metadata, SQL in Google Doc,

F: Uncertainty analysis & generalized model for multi-criteria analysis (Tate 2012)

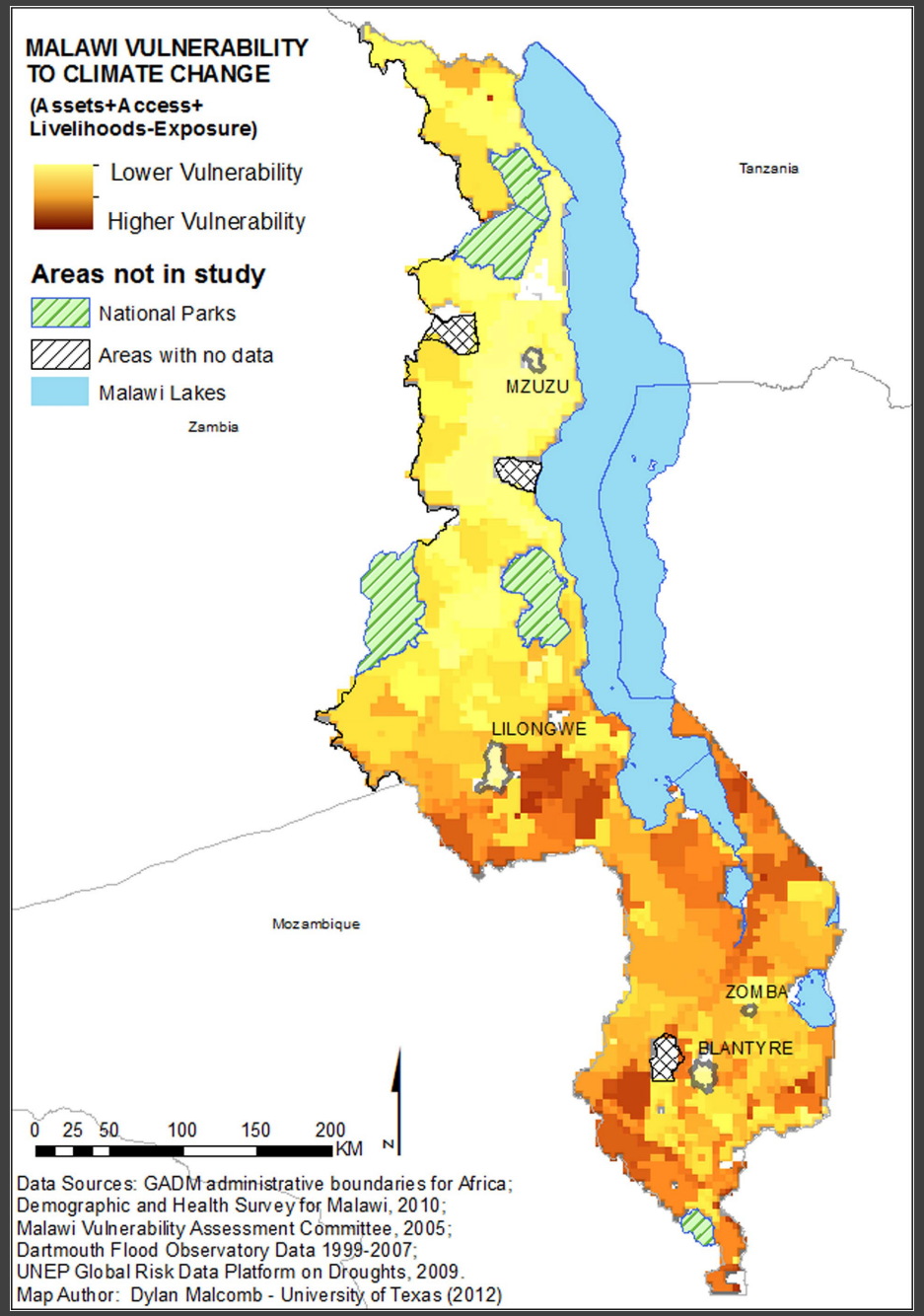
M: Vulnerability mapping science/policy interface (Hinkel 2011)

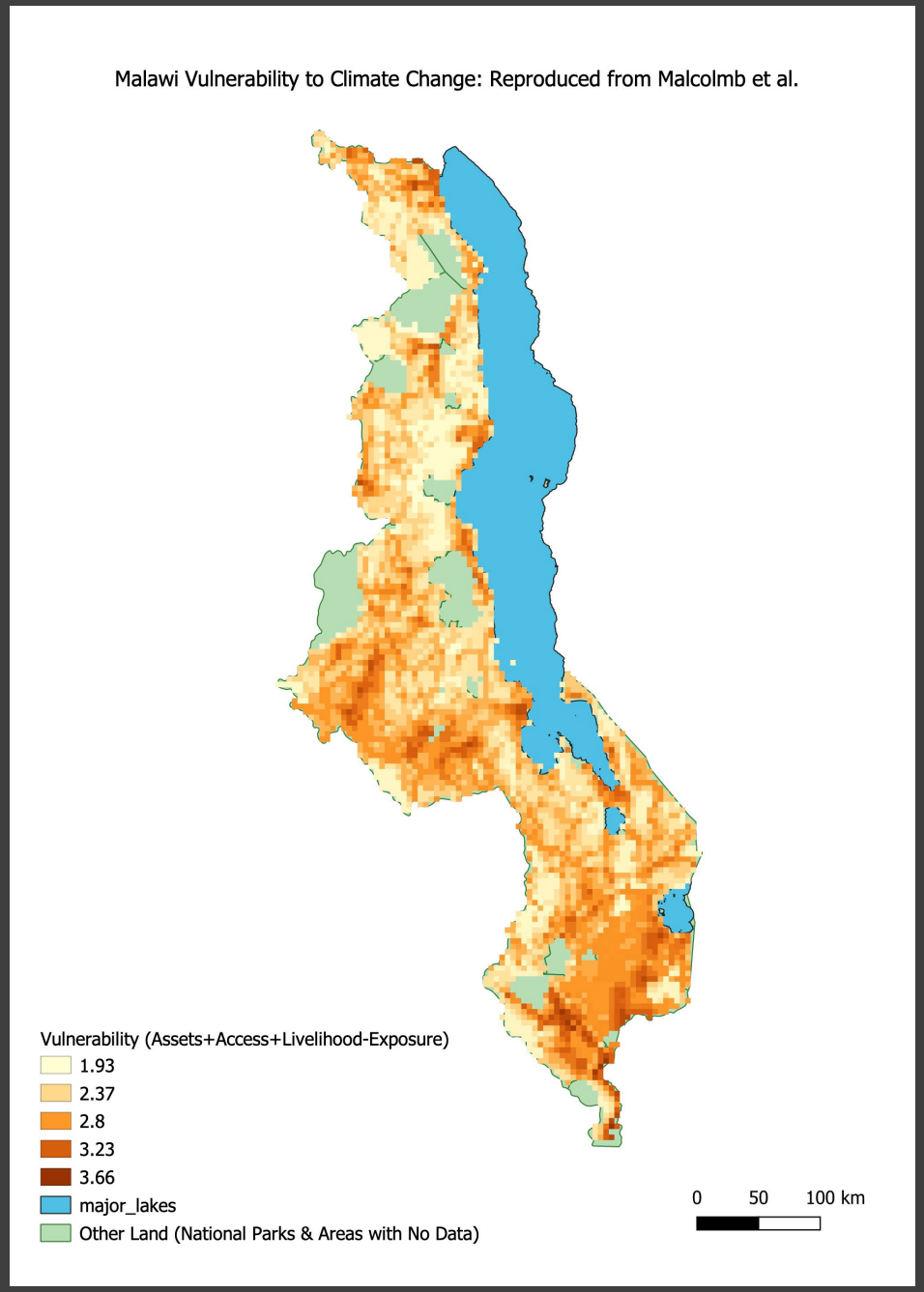
W: Operationalize the collaborative SQL

R lab: Complete the reproduction with PostGIS + QGIS

F: Debrief with Dr. Peter Kedron; write up results on GitHub Pages gis4dev.github.io

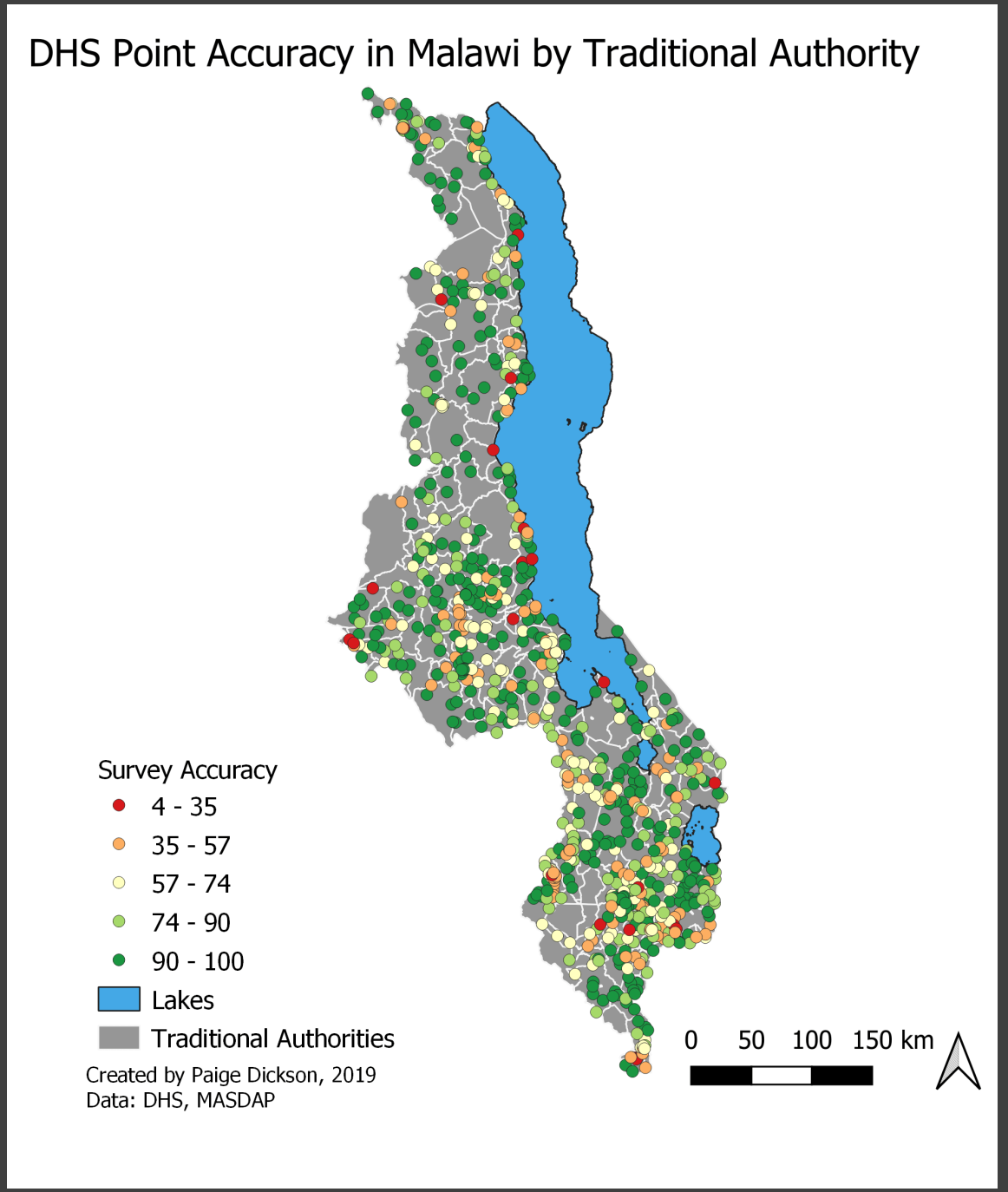
Findings


MALAWI VULNERABILITY
TO CLIMATE CHANGE
(Assets+Access+
Livelihoods-Exposure)
Lower Vulnerability
Higher Vulnerability
Areas not in study
National Parks
Areas with no data
Malawi Lakes
Zambia
Tanzania
Mozambique
MZUZU
LILONGWE
ZOMBA
BLANTYRE
0 25 50 100 150 200
KM
N
Data Sources: GADM administrative boundaries for Africa;
Demographic and Health Survey for Malawi, 2010;
Malawi Vulnerability Assessment Committee, 2005;
Dartmouth Flood Observatory Data 1999-2007;
UNEP Global Risk Data Platform on Droughts, 2009.
Map Author: Dylan Malcomb - University of Texas (2012)


Malawi Vulnerability to Climate Change: Reproduced from Malcolmb et al.
Vulnerability (Assets+Access+Livelihood-Exposure)
1.93
2.37
2.8
3.23
3.66
major_lakes
Other Land (National Parks & Areas with No Data)
0 50 100 km

Findings

- USAID Demographic and Health Surveys are restricted
- UNEP Global Risk Data Platform has errors
- FEWSnet Livelihood Survey data (2005) not publicly available
- Uncertainty in…
  - *methodology ⇔ metadata*
  - *normalization / rescaling*
  - *spatial resolution*
  - *missing data (nodata values)*
  - *survey cluster locations (random 5km)*
  - *qualitative interviews ⇨ indicator selection & weighting*



References

- Hinkel, J. 2011. “Indicators of vulnerability and adaptive capacity”: Towards a clarification of the science-policy interface. *Global Environmental Change* 21 (1):198–208.
- Malcomb, D. W., E. A. Weaver, and A. R. Krakowka. 2014. Vulnerability modeling for sub-Saharan Africa: An operationalized approach in Malawi. *Applied Geography* 48:17–30.
- Tate, E. 2012. Social vulnerability indices: A comparative assessment using uncertainty and sensitivity analysis. *Natural Hazards* 63 (2):325–347.
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- Holler, J. 2019. Teaching critical open GIS. *The Canadian Geographer / Le Géographe canadien* 00 (0):cag.12521. https://onlinelibrary.wiley.com/doi/abs/10.1111/cag.12521.
- gis4dev.github.io

Learning Goals for Open GIScience

- Survey FOSS4G (Free and Open Source for Geospatial) in terms of its landscape of organizations and projects, research applications, and (radically) unique political economy of knowledge production.
- Expand your functional knowledge of the nature of geographic information with respect to data standards, structures, metadata, provenance, error, and uncertainty.
- Creatively apply FOSS4G to address compelling questions in human geography and problems in social and environmental sustainability.
- Critically reflect on emerging opportunities and ethical dilemmas in open-source geographic information science.
- Learn how to reproduce existing geographic research and to produce geographic research that is open, reproducible and replicable.
- Design and communicate research effectively in multiple media, including digital media, reports, presentations, maps, graphs, tables, data, and code.
- Become competent and confident in conducting research, learning new methods, and overcoming errors, uncertainty, and technical difficulties. Learn to "debug" problems and teach yourself new techniques through structured experimentation.