

School of Geography

FACULTY OF ENVIRONMENT



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Conceptualising wildness in marine protected areas: new geographies for evaluating wild seascapes

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Outline



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- The importance of MWPAs
- New challenges for mapping/modelling
- MWPAs in the UK
- Methods: mapping remoteness
- Results
- Applications & conclusions



MWPA Definition



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IUCN Protected area management categories

Ib. Wilderness areas:

Areas in the marine environment should be sites of relatively undisturbed seascape, significantly free of human disturbance, works or facilities and capable of remaining so by effective management.

World Commission on Protected Areas

Importance of MWPA's



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-
- To protect and manage substantial examples of marine and estuarine systems
 - To protect depleted, threatened, rare or endangered species and populations
 - To protect outside activities from detrimentally affecting the marine protected areas
 - To provide for research and training, and for monitoring the environmental effects of human activities

Threats to marine wilderness



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- Offshore oil and gas development
- Commercial fishing
- Ocean outfalls of wastewater, pollutants
- Windfarms
- Shipping and other vessel traffic
- Damage by boats and tourists to reef ecosystems
- Pollution: flotsam, debris, oilspills
- Coastal developments

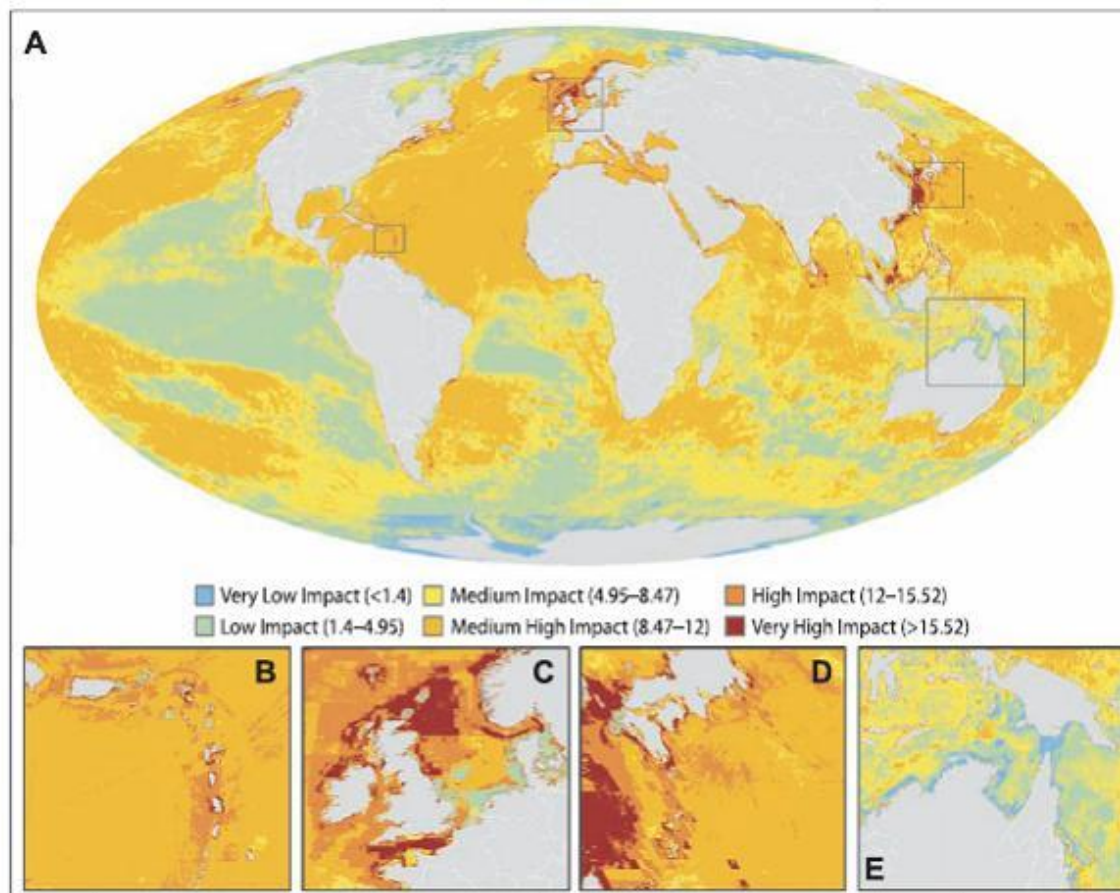
Global Mapping



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Halpern et al's Global Map of Human Impact on Marine Ecosystems:

Fig. 1. Global map (A) of cumulative human impact across 20 ocean ecosystem types. (Insets) Highly impacted regions in the Eastern Caribbean (B), the North Sea (C), and the Japanese waters (D) and one of the least impacted regions, in northern Australia and the Torres Strait (E).



Global Mapping



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- No area is unaffected by human influence
- However, large areas of relatively little human impact remain (particularly near the poles).
- Analytical process and maps provide flexible tools for regional and global efforts to allocate conservation resources:
 - to implement ecosystem-based management
 - to inform marine spatial planning, education and basic research.

Local Mapping



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- Scales differ greatly
- Limited to specific studies
- Many existing marine parks and protected area boundaries and zones are coarsely defined with basic blocks or buffers
- Lack of understanding of what is to be protected?

New challenges



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- 2D/3D nature of marine areas – underwater environment?
- No fixed points- sea is fluid, tidal
- Need for new GIS models
- E.g. access/remoteness by mixed craft

Kayaks



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RIBs



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Yachts



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MWPAs in UK



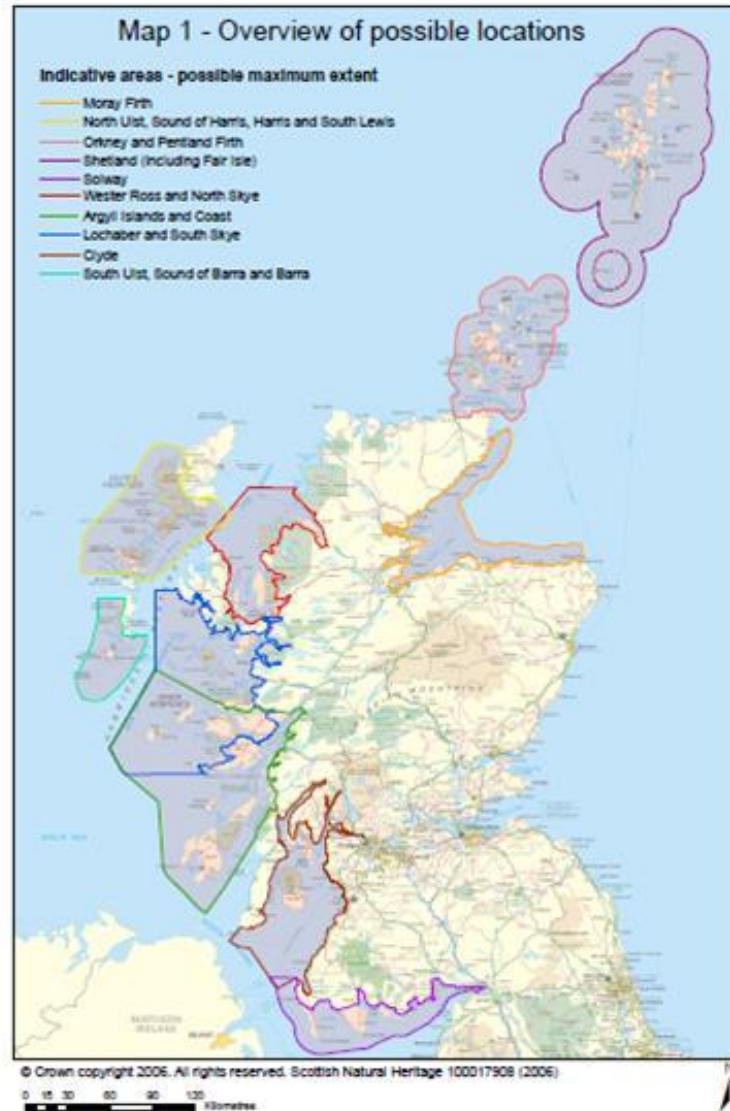
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- UK has signed up to international agreements that aim to establish an 'ecologically coherent network of MPAs' by 2012.
- In England and Wales, the MPA Network will be made up of the current MPAs such as SSSIs, SACs, MNRs, plus a new type called Marine Conservation Zone
- In Scotland there will be a different type of MPA to be designated under the Scottish Marine Bill (2009).
- This bill includes developing MPA criteria for all waters adjacent to Scotland and is currently considering a number of sites for coastal and marine National Park designation.

MWPAs in Scotland?



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MWPAs in Scotland



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Unique:

Scotland has nearly one tenth of Europe's coastline, which is considered a world-class coastal and marine environment (Neville & Tooth, 2007)

- Rugged coastline with hundreds of islands
- Unique habitats of wildlife
- A low human population density
- Large parts are remote/accessed by ferries
- Weather/Midges

MWPAs in Scotland



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Is there a case for establishing marine wilderness protected areas in Scotland?



Case study



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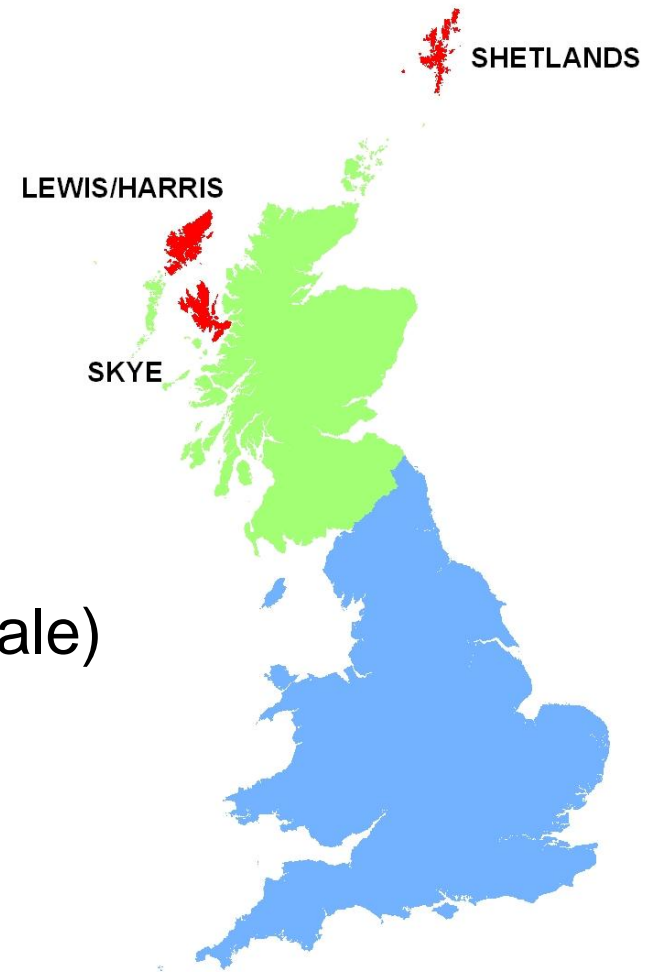
- Harris & Lewis
 - Context of wind farm proposals
- Extended to other areas
 - Skye (investigate effects of lower scale)
 - Shetlands

Study Areas



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- Harris & Lewis
 - Context of wind farm proposals
- Extended to other areas
 - Skye (investigate effects of lower scale)
 - Shetlands



Methods



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- Used an existing terrestrial remoteness model developed by Carver and Fritz (1998).
- Model based on Naismith's Rule (1892), used to obtain a rough estimate of walking routes.
- Model uses a
 - shortest path algorithm
 - estimates walking speeds based on horizontal and vertical moving angles across the terrain surface
 - incorporates appropriate cost or weight factors incurred by crossing different land cover types
 - effects of barrier features such as lochs and very steep ground

Remoteness model



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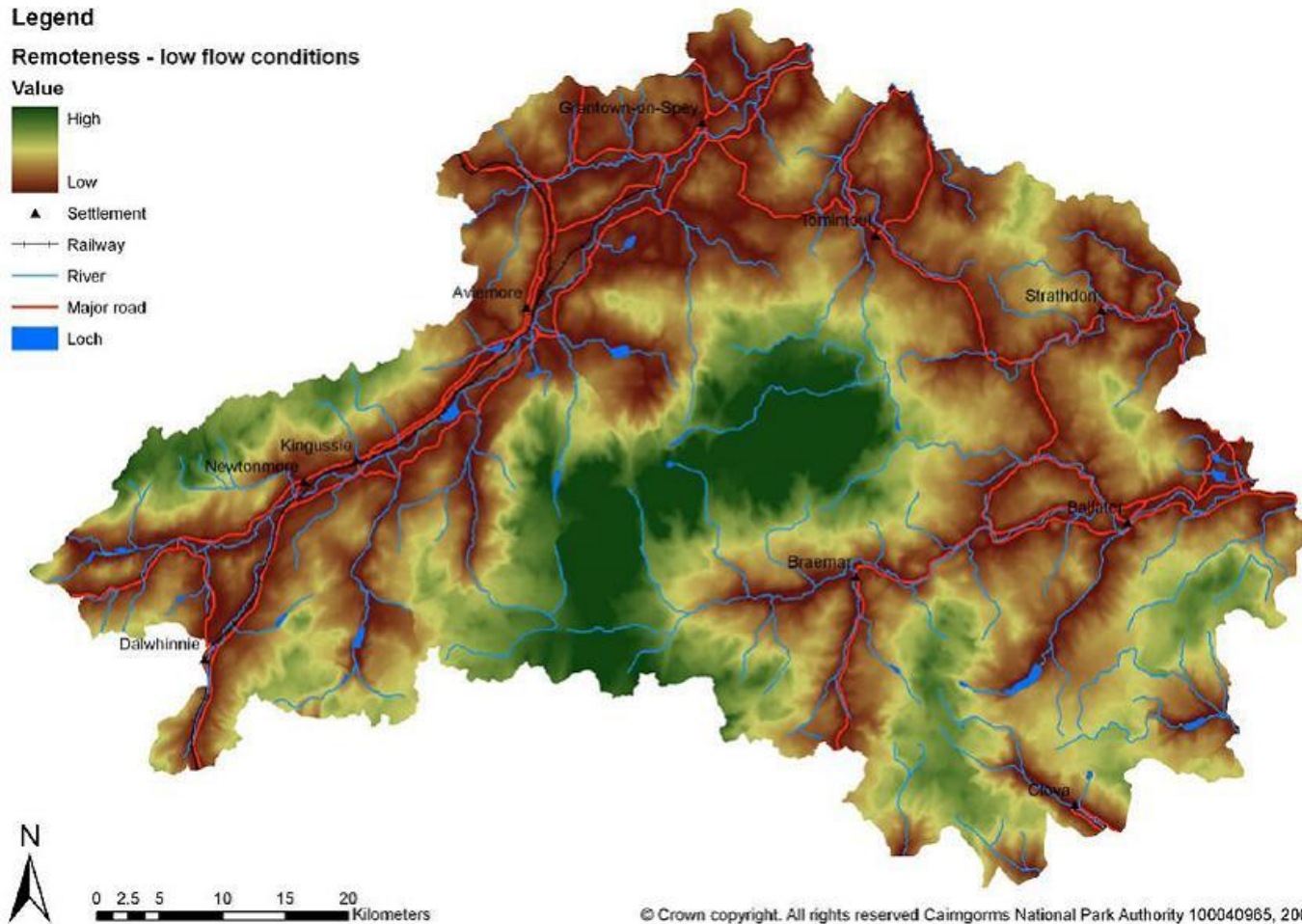


Figure 4.15 Remoteness under low flow conditions

Methods



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- Original remoteness model based on vehicular access from roads
- Model adapted to include access from water to land with a variety of water craft
- Different methods were developed to depict water to land access
 - Feasible RIB and yacht landing points digitised from Google Earth
 - Kayak landing points determined by reclassing and buffering DTMs to model information provided by experienced kayakers
- PATHDISTANCE was also used to explore water remoteness with land to water access points (such as slipways, harbours/moorings and roads close to shorelines that will facilitate the launching of kayaks.

Assumptions



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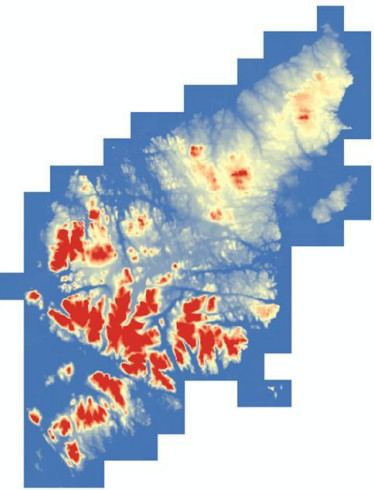
- A number of assumptions were made in the methods:
 - Naismith's Rule- walker based on person with average level of fitness carrying a day pack
 - Water craft users are experienced and can land their vessels in a expected areas
 - Sea conditions assumed to be relatively calm
 - Launching water craft and coming ashore

Data prep

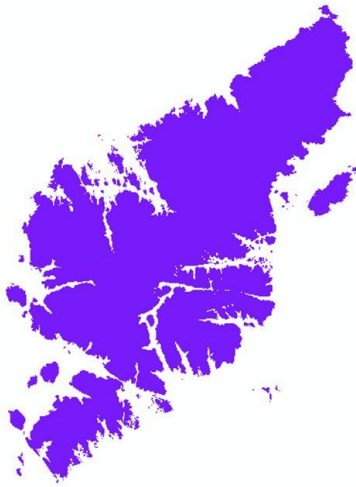


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DTM



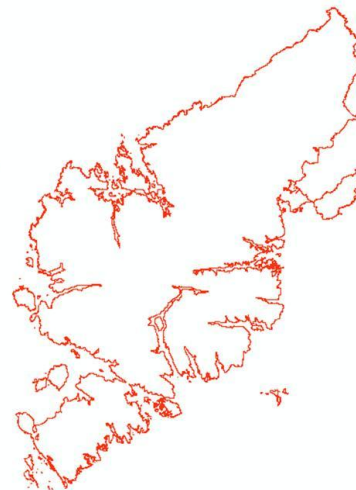
DTM reclassified to 18m and above



18m reclass buffered by 50m



Coastline



Coastline erased by 50m buffer



In practice



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Harbours/slipways



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Harbours/slipways



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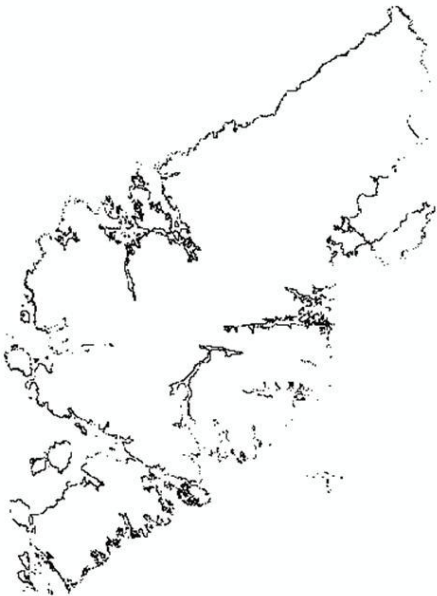


Naismith's Rule

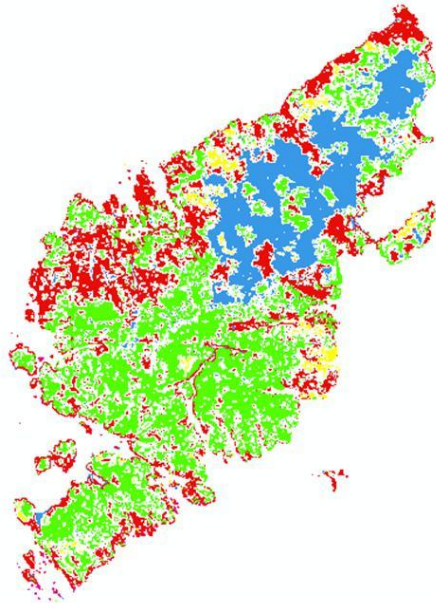


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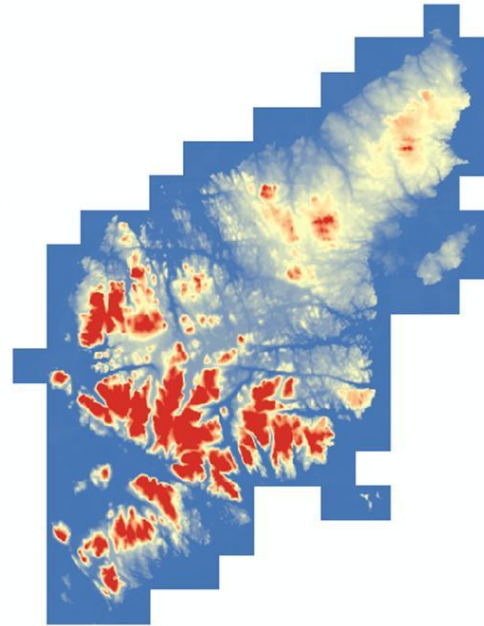
Kayak land accessibility



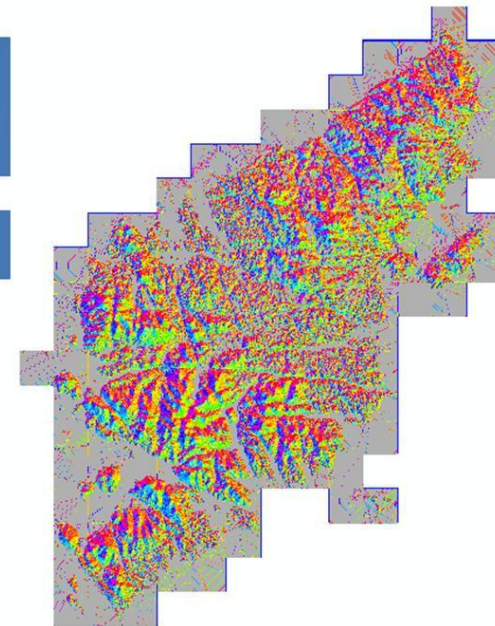
Land cover



DEM



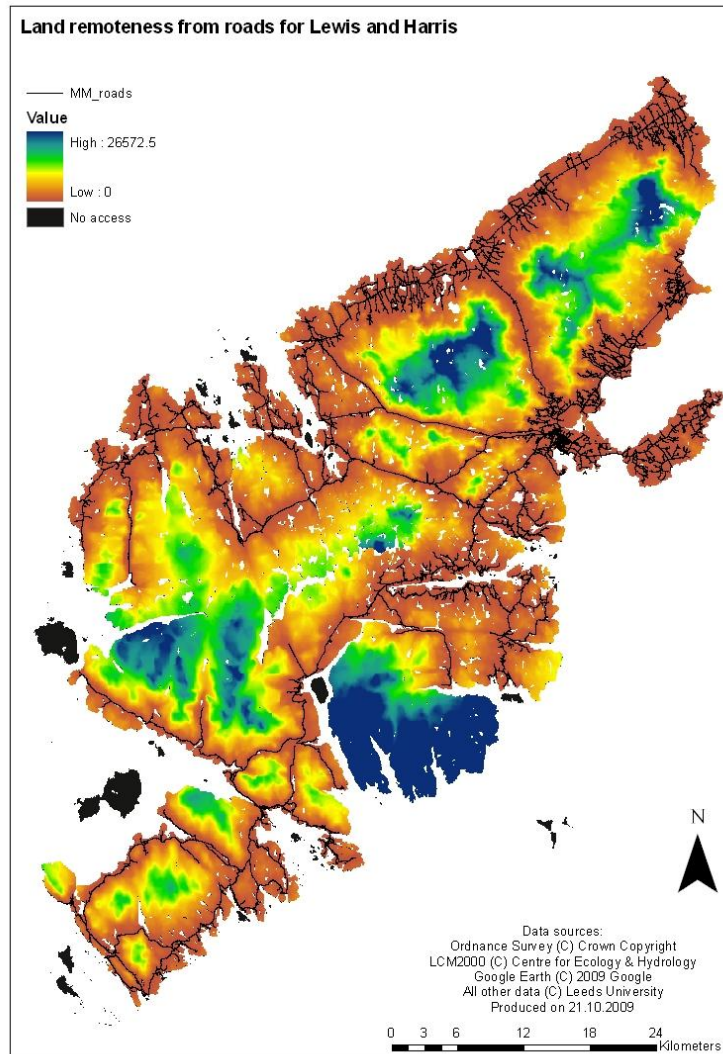
Aspect



Results- roads



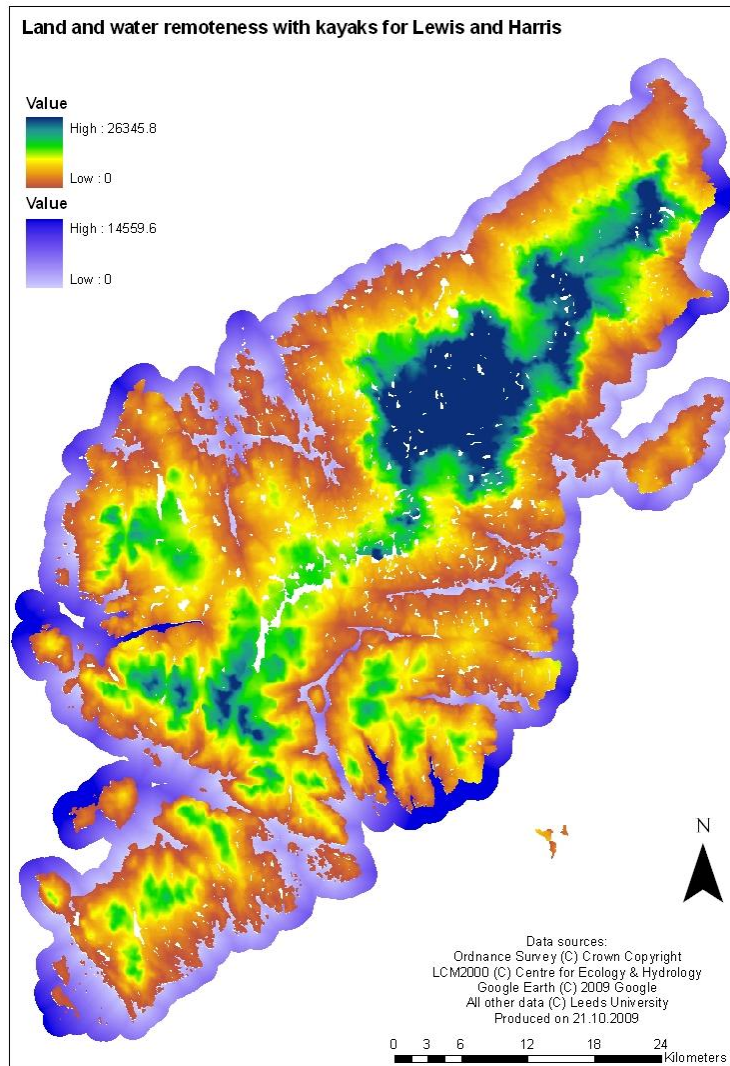
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Results- kayaks



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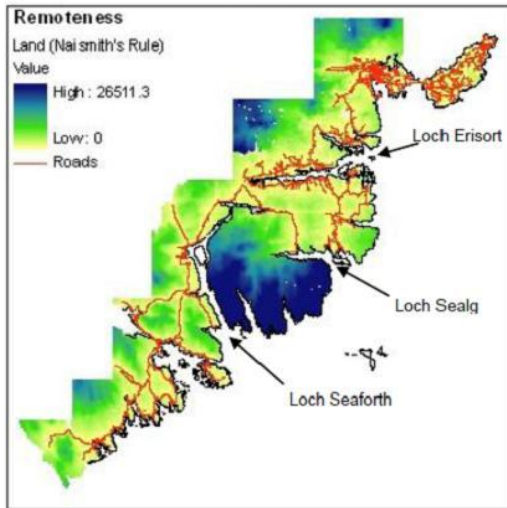


Land and sea remoteness for Lewis/Harris

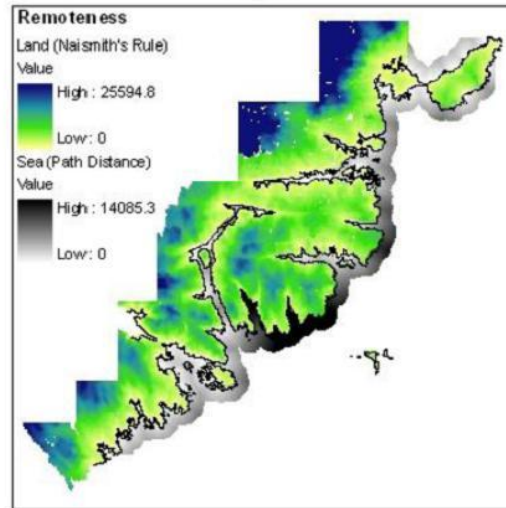


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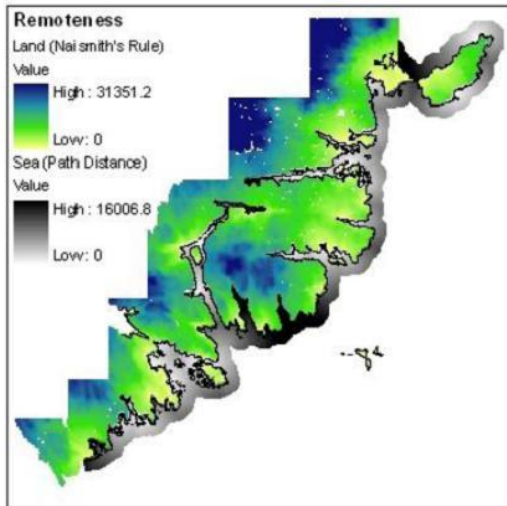
Roads



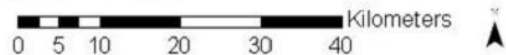
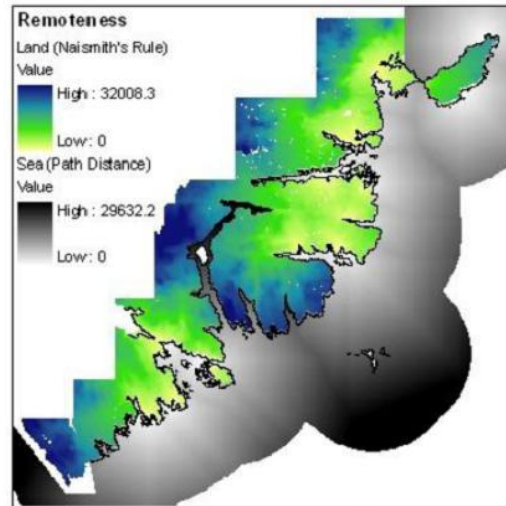
Kayaks



RIBs



Yachts



Data sources:
Ordnance Survey (C) Crown Copyright
LCM2000 (C) Centre for Ecology & Hydrology
All other data (C) Leeds University
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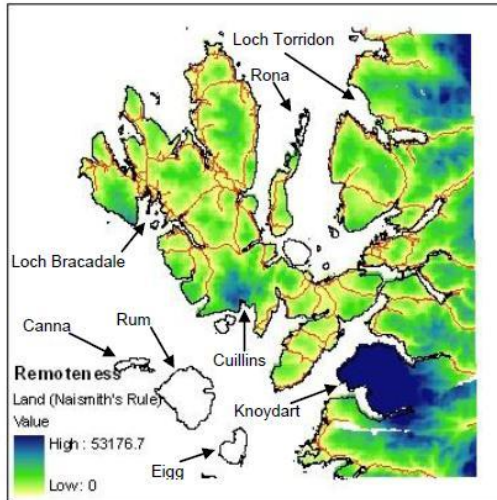
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Land and sea remoteness for Skye/Knoydart

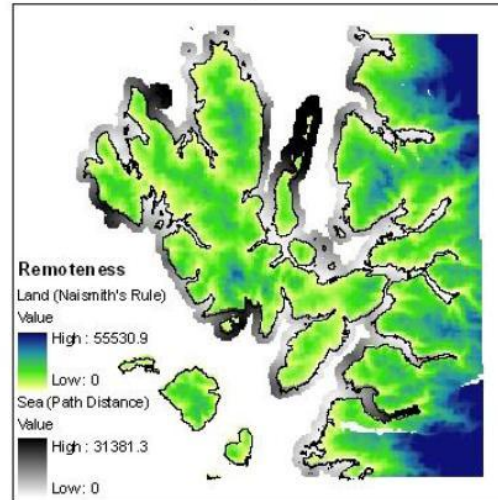


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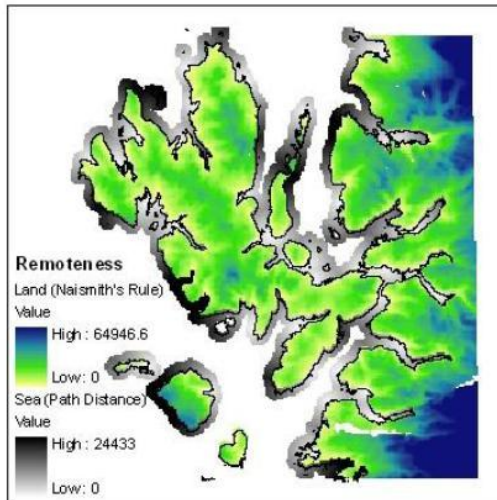
Roads



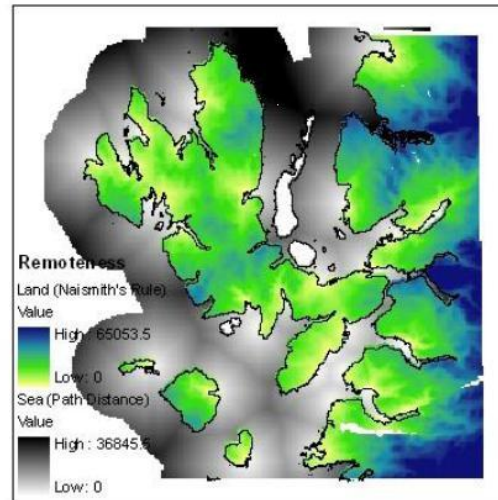
Kayaks



RIBs



Yachts



0 5 10 20 30 40 Kilometers

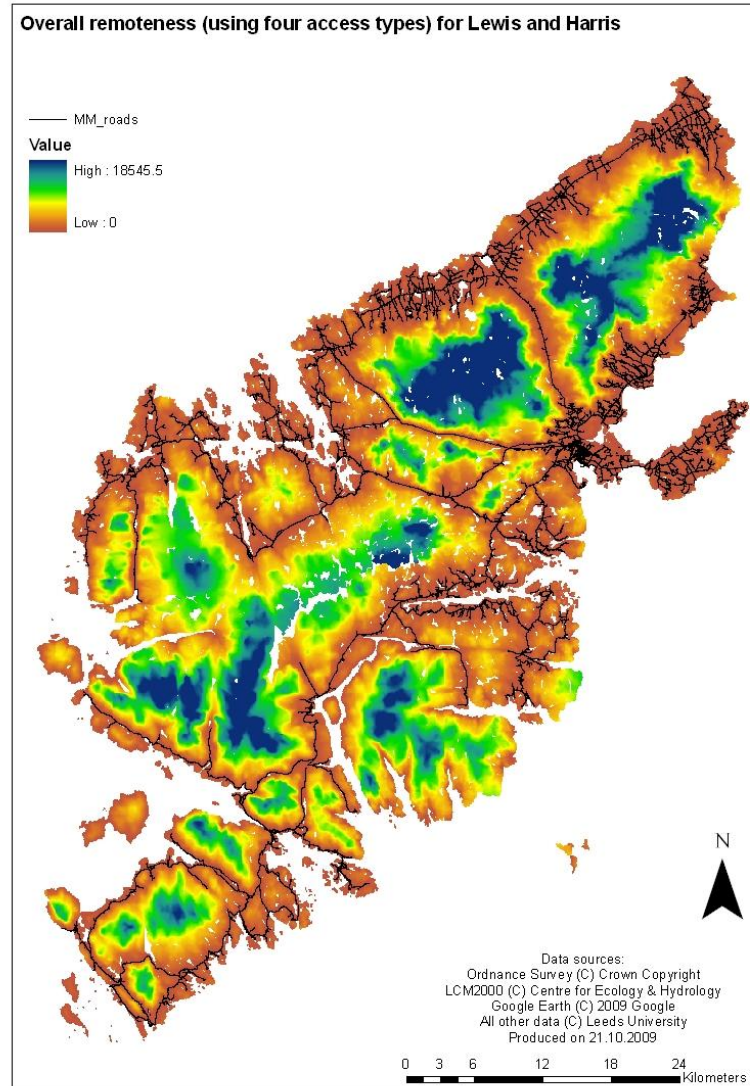


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Results MIN



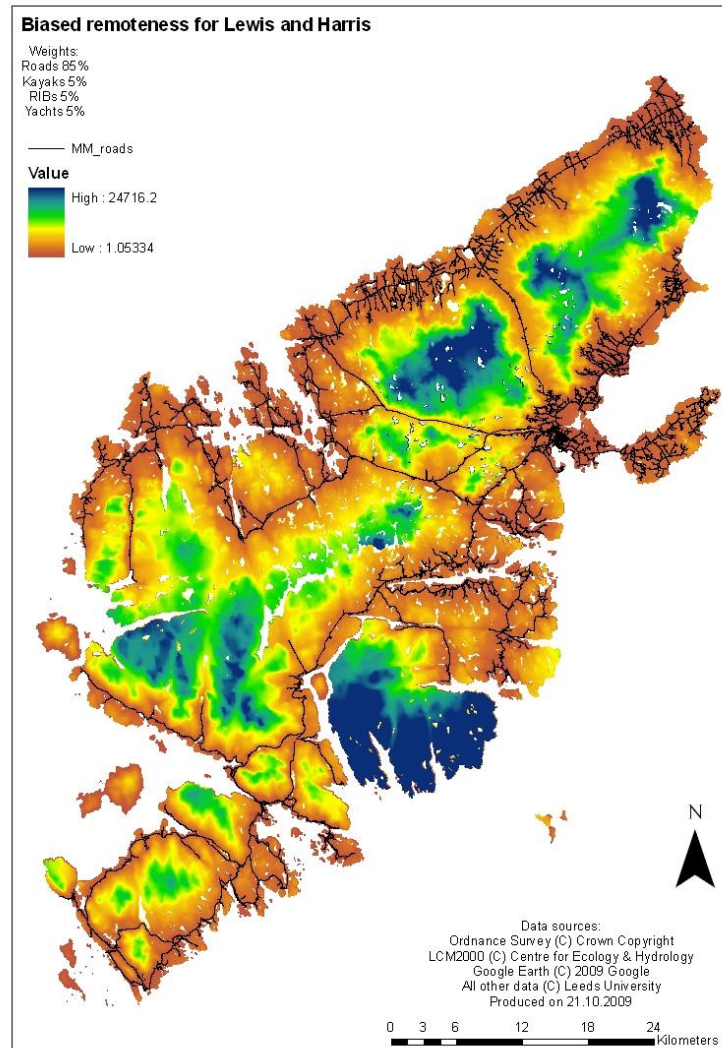
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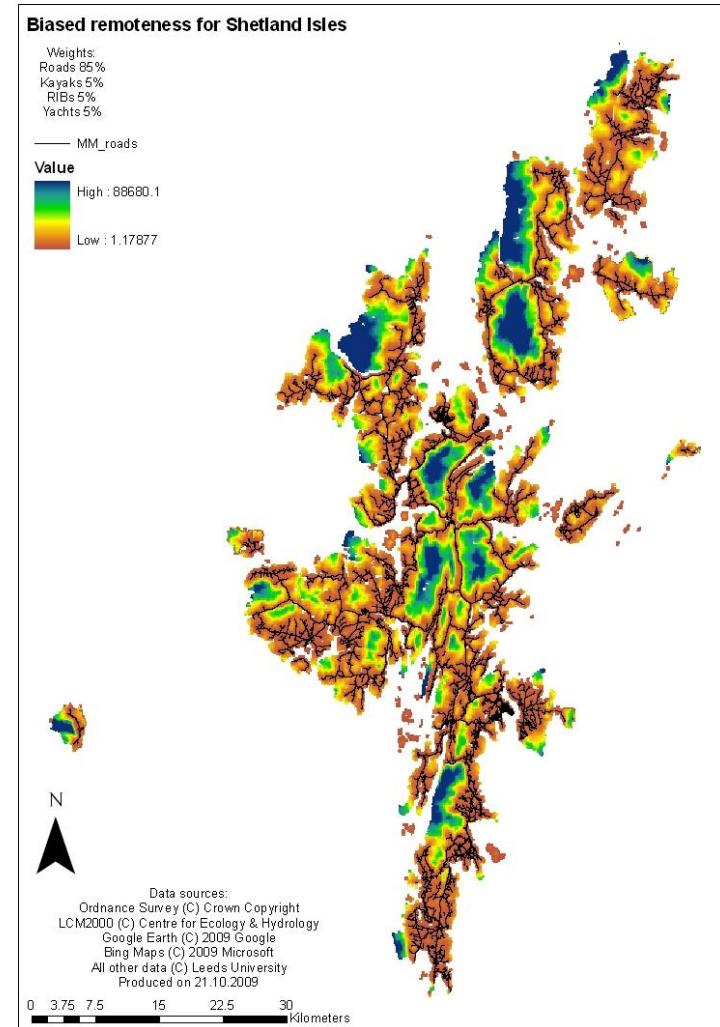
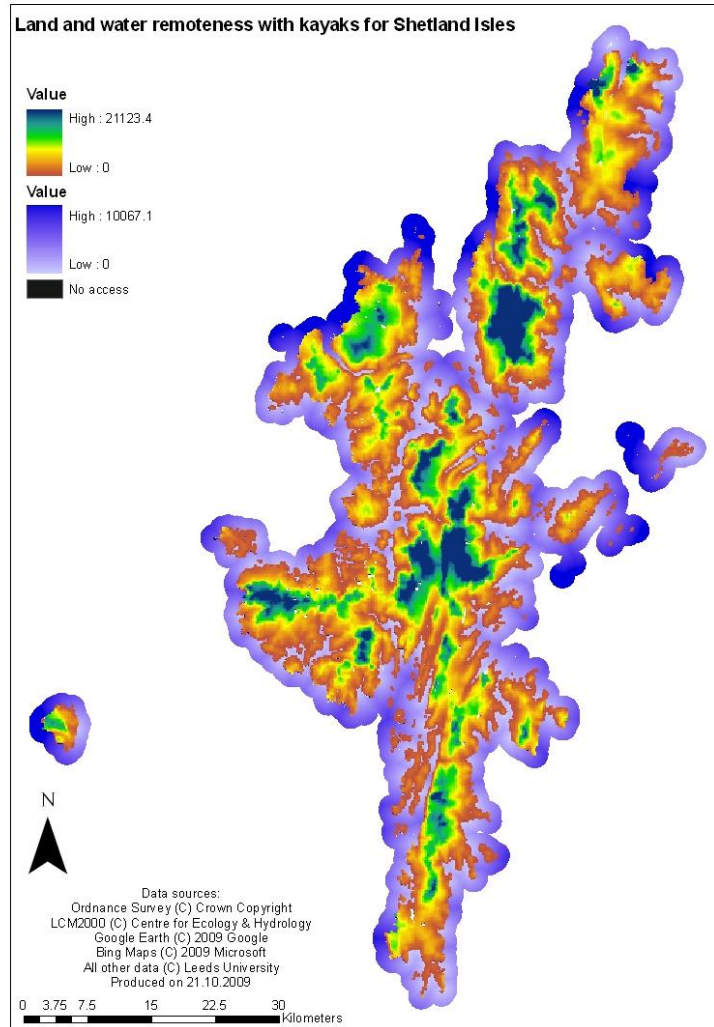
Results- weighted



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Other areas

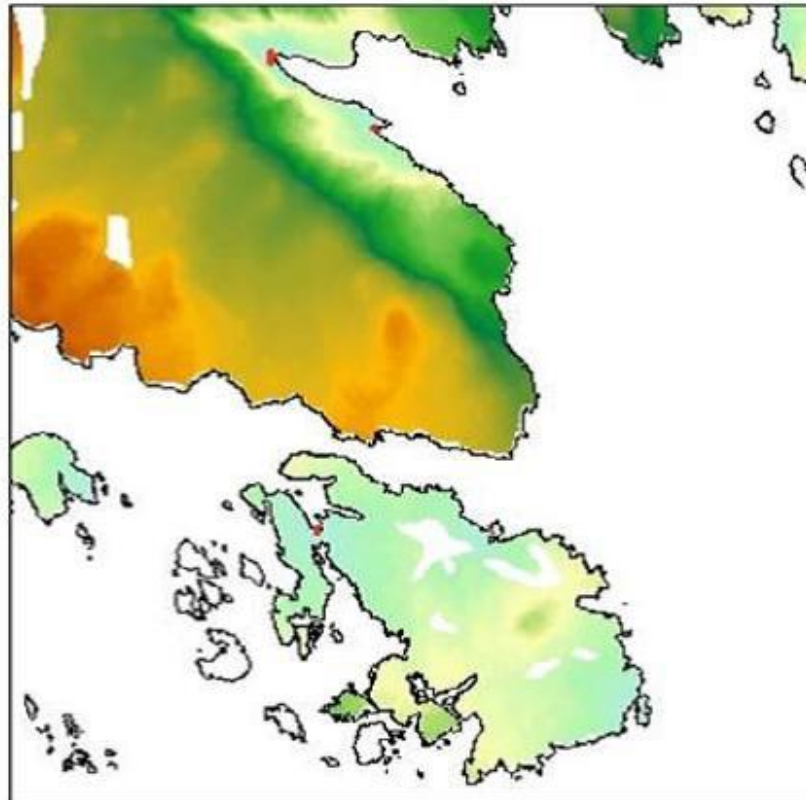


Quality control - bridges

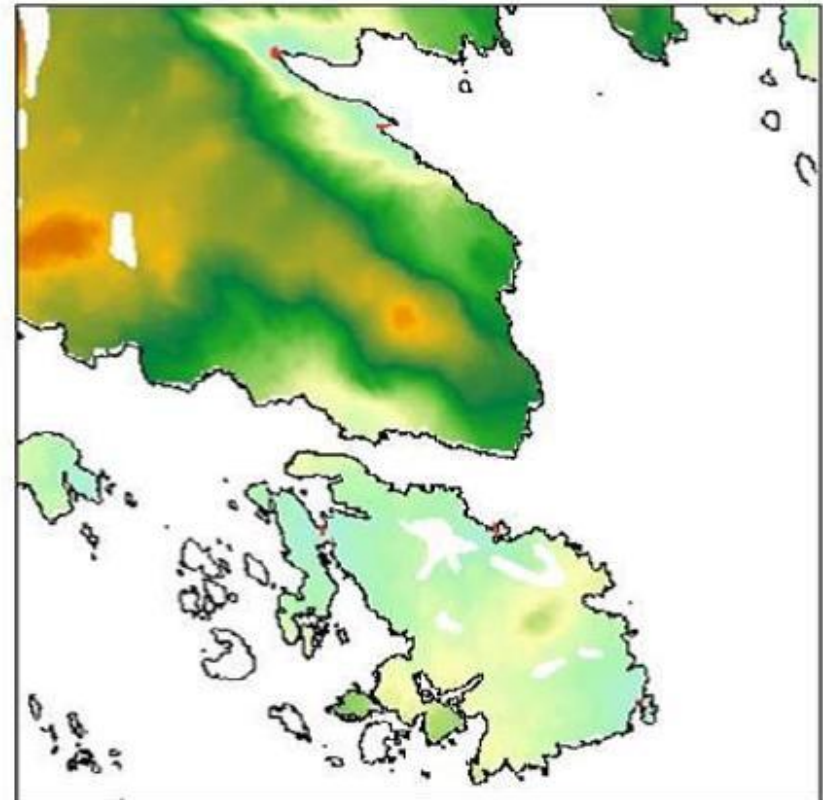


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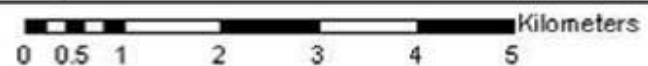
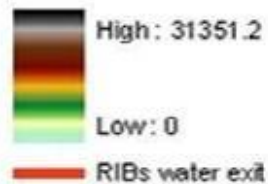
Naismith's Rule without bridge



Naismith's Rule with bridge



Remoteness



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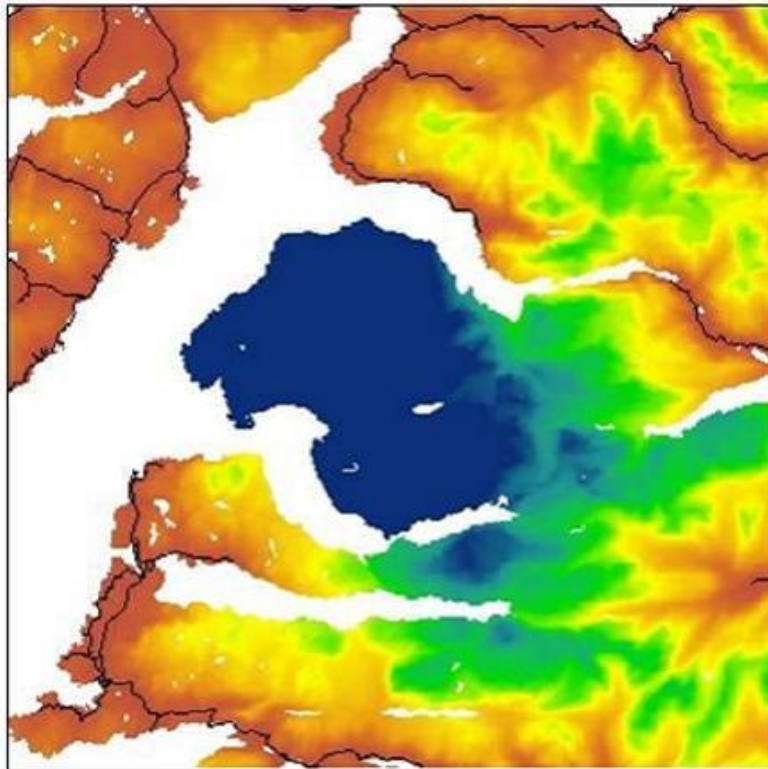
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Quality control- ferries

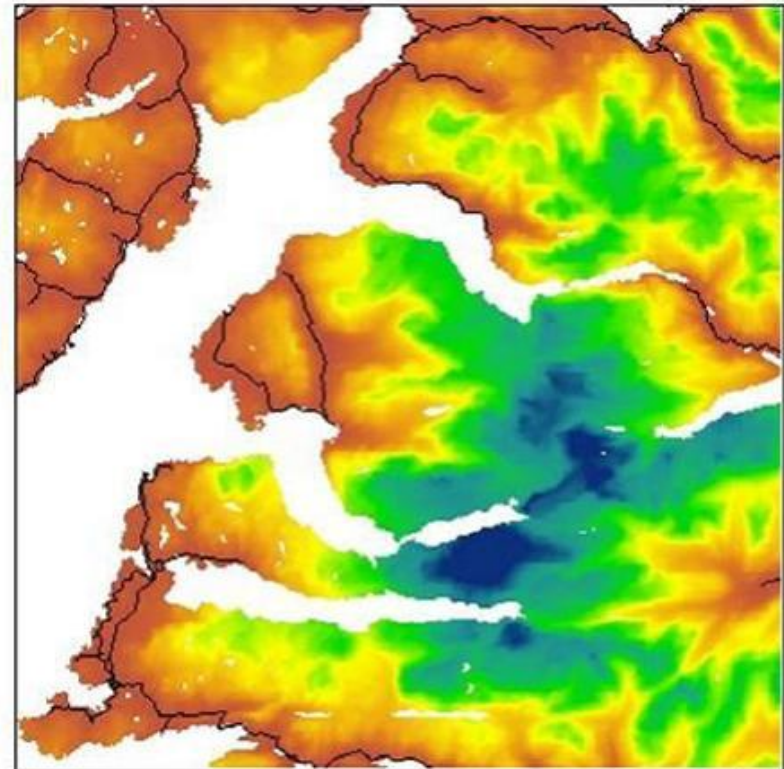


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Naismith's Rule without Knoydart roads



Naismith's Rule with Knoydart roads



Remoteness

Value



Data sources:

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Issues



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- How to quantify effort of catching ferries from mainland?
- Ground truth?
- Underwater obstacles- reefs/seaweed?
- Effect of tidal range?
- Currents and riptides

Applications: mWQI



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- Compiling a marine Wilderness Quality Index (mWQI) – would involve mapping and weighting together other attributes such as:
 - Perceived naturalness
 - Absence of modern human artefacts
 - Rugged and challenging nature of the terrain/sea/access points

Applications: planning



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- MWPA delimitation and zoning
- Development (for and against)
- Land purchase (JMT)
- Trip planning for recreation

Conclusions



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- Important to remember model is not set but is customisable.
- Possible improvements may include:
 - Investigate further accessibility techniques such as reclassifying bathymetry to create high and low tide draught limits.
 - Use existing marine weather data to average wave height/wind speed for different areas of coastline.
- Other areas/UK wide?

Questions...



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