Assessment of habitat associations of threatened upland wading birds using remote sensing and GIS

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1. Background

Why are Britain's wading birds threatened?
- Several wader species have internationally important breeding populations in the U.K., but are suffering from severe population declines (Figure 1).
- Habitat loss due to land management changes, overgrazing and afforestation is suspected to be one of the key threats to nesting waders in the U.K. (Hayhow et al., 2017).

Figure 1 The U.K. hosts critical populations of several breeding waders, including (left to right, top to bottom) snipe, golden plover, curlew, dunlin, oystercatcher and lapwing. Credits: MK Car Rental, Shetland Nature, Bird Aware Solent, Marina Parha, Tim Melling, Wild Scotland.

What are habitat associations and why are they important?
- Habitat associations are the environmental variables which are correlated with the presence of a species.
- Knowledge of a species' habitat associations is essential for identifying areas vital for its survival.
- There is currently a need for accurate information on habitat associations of waders in the North Pennines, home to around 22,000 pairs of breeding waders (North Pennines AONB, 2004).

How can remote sensing and GIS help?
- Many habitat variables are retrievable using satellite imagery.
- GIS is a powerful tool for analysing the habitat variables with respect to species presence.
- Together, remote sensing and GIS provide better spatial coverage and access to remote areas compared to traditional ground-based species monitoring methods.
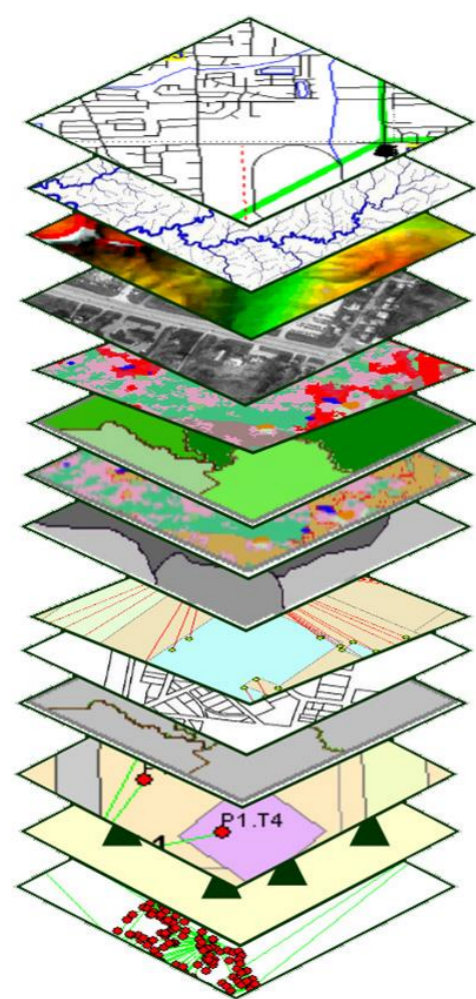
Figure 2 Remote sensing and GIS are powerful tools for monitoring and managing species conservation at large spatial scales. Credit: Friends of the Verde River

2. Study Aim

Explore the potential for using multispectral satellite imagery and GIS datasets to assess habitat associations of six upland wader species.

3. Methodology

Study Sites
- Twenty 1 km^2 blocks within the North Pennines AONB were selected as study sites (Figure 3), representing the range of variability in the habitat associations being investigated (altitude, slope, vegetation composition and proximity to roads).

Field surveys
- Blocks were surveyed at the end of June to record the number of breeding waders present.
- Soil moisture measurements were collected at regular intervals within each block.

Data analysis
- Scatter plots were produced to identify patterns indicative of relationships between wader presence/absence in a block and the potential habitat associations attributed to the block.
- Soil moisture measurements were regressed against vegetation index values from a concurrent Sentinel-2 satellite image to identify empirical relationships between vegetation health and soil moisture.
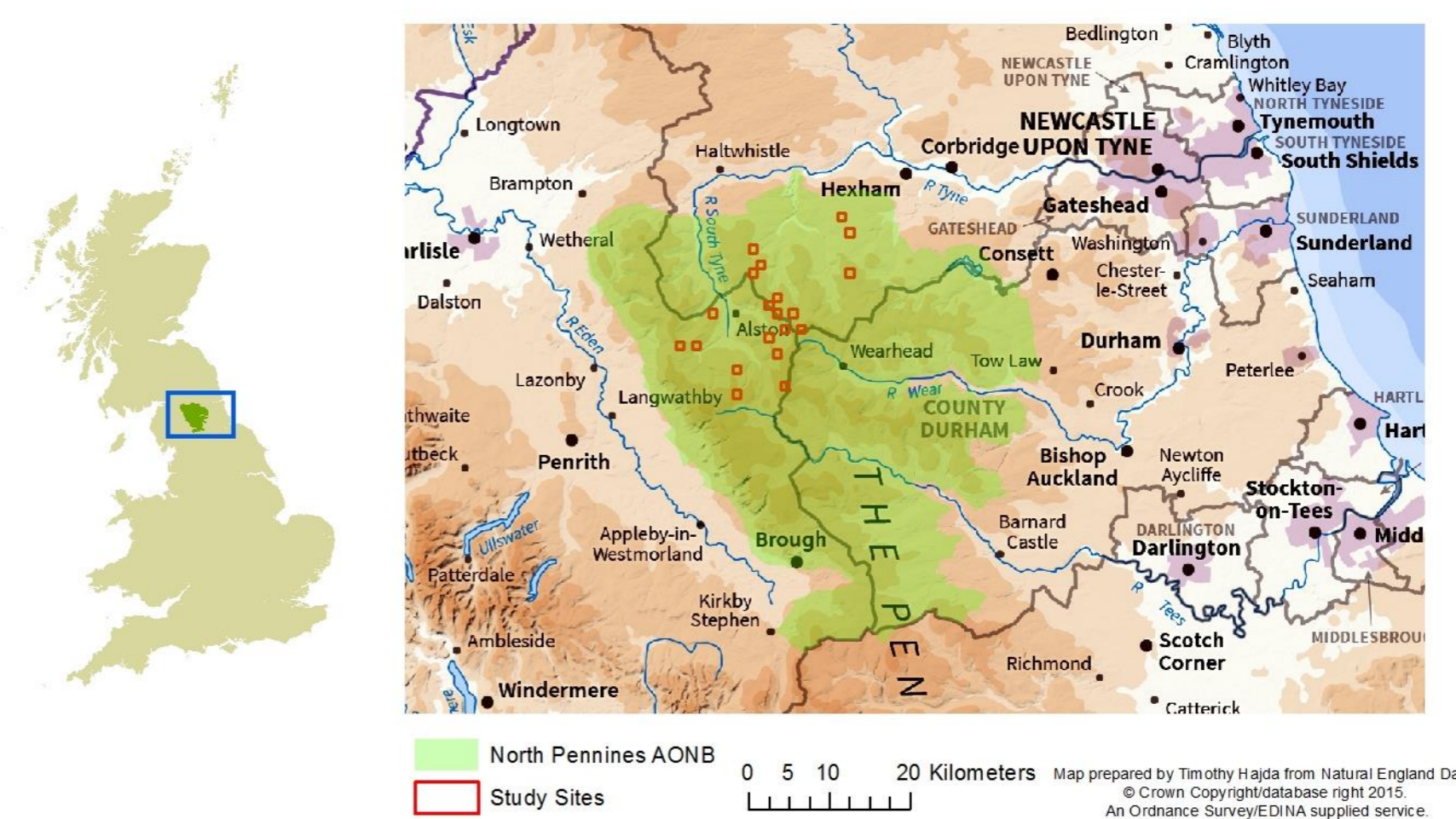

Figure 3 Study sites were selected within the North Pennines AONB, a region of particular importance for breeding waders.

4. Findings

- Due to accessibility issues and time constraints, only six of the twenty blocks could be visited.
- A total of sixty-one individual waders were recorded within the surveyed blocks.
- No statistically significant relationships were found between the hypothesised habitat associations and the presence of breeding waders.
- Weak, but statistically significant, relationships were identified between soil moisture measurements and NDVI and NDWI.
- Whilst no significant relationships were found, this should be interpreted with caution as it was almost certainly limited by the very small data volume.
- A much greater number of blocks would need to be visited in order to accurately assess the usefulness of remote sensing and GIS for determining habitat associations.
- The method used to derive soil moisture from optical imagery indicated that there is a correlation with vegetation indices, but a more robust approach would be needed to obtain more precise estimates from satellite imagery.

5. Acknowledgements and references

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