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Remote Sensing Based Ecotope Mapping and Transfer of Knowledge in Raised Bogs

Saheba Bhatnagar (1), Bidisha Ghosh (1), Shane Regan (1,2), Owen Naughton (3,4), Paul Johnston (1), and Laurence Gill (1)

(1) University of Dublin, Trinity College Dublin, Dept. of Civil, Structural and Environmental Eng. , Dublin, Ireland (sbhatnag@tcd.ie), (2) National Parks and Wildlife Survey, Ireland, (3) Geological Survey Ireland, (4) IT Carlow, Dept. of the built environment

Due to the inaccessibility of many wetlands, there is a growing recognition that remote sensing techniques can be a viable and cost-effective alternative to field-based ecosystem monitoring. Wetlands encompass a diverse array of habitats, for example, fens, bogs, marshes, and swamps. In this study, we have concentrated on natural raised bogs, found in the Irish midlands. The objective of the study was to investigate the use of multispectral satellite imagery for delineating the extent of raised bogs and then monitoring their ecological composition in order to help with Ireland's obligations under the EU Habitats Directive. This was carried out using open-source Sentinel-2 data. An initial study to delineate the boundary of the bogs using the combination of edge detection techniques was performed. Once the bog boundary was defined, the spectra from the delineated area were studied. Various vegetation indices along with soil moisture information and DEM were used as features to train the classification algorithm. An ensemble classifier Bagged Tree (BT) as a supervised pixel-based learner has been used for mapping the ecotopes. In order to acknowledge the spatial distribution of the ecotopes, we partitioned the bog into ecotope-objects via graph cut segmentation also known as MAP (maximum a posteriori) estimation. The results have been verified for 5 different bog-sites using field-derived ecotope maps which has shown that the addition of spatial knowledge enhances the overall accuracy. The study further extends to investigate the scope whether it is possible to transfer the knowledge contained in the classification algorithm from one bog-wetland to other wetlands. If this is possible it would mean that other bogs could be automatically and remotely mapped. Various bog-indices highlighting special areas in the bogs under consideration were created. For bogs located in close proximity, the knowledge transfer is carried out successfully for the active regions (i.e. the major peat forming areas) using a binary-linear discriminant. The study limits to closely located bogs due to unavoidable changes in environmental conditions which in turn changes the intensity values of ecotopes in far-away locations. Such a methodology that is just being developed may be able to significantly reduce the amount of field work required by ecologists on each wetland using freely available satellite data.