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Machine learning classification of soil drainage status using multispectral

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Intensification of the Irish dairy and beef sectors will require increased productivity on soils where dry matter yields are currently sub-optimal. Large parts of the Border, Midlands and Western region (BMW) of Ireland constitutes an area of natural constraint where excessive soil moisture (from variable meteorology, geomorphology, management practices and land cover) limit farm operations through reduced growth and utilisation. Available soil maps of the region provide a general overview of soil drainage class (poor, well, moderate etc.); however there is no detailed understanding of the distribution or extent to which specific parcels within the poorly drained class are poorly drained and which have been improved by artificial drainage. Mapping the distribution of the drained/ wet soils is the first step in understanding grassland production at a national level, and provides a platform for determining areas at risk from environmental degradation, for example from soil compaction and erosion, poaching, flooding and surface water pollution.

This paper presents the results of a supervised classification of soil drainage status using random forest and support vector machine classifiers. Persistently wet soils are slower to heat up, which may delay the onset of grass growth in spring. Prolonged saturation, in spring and over the growing season, creates stress which delays and depresses growth in plants. This effect can be identified in satellite images as relative increases/decreases in reflectance across several bands, but notably in red/ near infrared. Only dry grassland on fine textured mineral soils were considered for the classification. Reflectance data was 30 m spatial resolution Landsat 8 OLI data from spring 2014-2016. A normalised difference vegetation index (NDVI) was used as a surrogate for vegetation productivity; and used to assess the influence of topography on vegetation growth across different scales. Topographic (e.g. elevation, slope etc.) and meteorological (rainfall, global radiation) factors which were demonstrated an effect on NDVI values were included in the classification.