



Assessment of Enhanced Vegetation Index (EVI) derived agro-climatic zonation map of Ireland based on various partitioning cluster algorithms

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Agriculture is critically dependent on weather and climate for its production and performance. To compare farm system performance at national scale, it is necessary to group farms of similar biophysical characteristics. With the advancement of remote sensing technology, it is easy to monitor farm's vegetation at required spectral, spatial and temporal resolutions. The variations in the red and near infra-red band's reflectance value of a satellite image provide us with a lot of valuable information regarding the quantity of biomass and the percentage cover of vegetation. The objective of this paper was to derive an agro-climatic zonation cluster map of Ireland from the Enhanced Vegetation Index (EVI) of Moderate Resolution Imaging Spectroradiometer (MODIS- 1km) sensor time series data (2002-2014) using various partition-based clustering techniques such as K-Means, Partitioning Around Medoids (PAM) and Clustering Large Application (CLARA). The EVI data for all farm locations in Ireland were used. The monthly, seasonal and cumulative annual EVI, latitude and longitude, and elevation of all farms were analysed using the clustering algorithms. As all the clustering methods depend on pre-defining the number of clusters, we determined the optimal number of clusters with the direct methods of Elbow and Silhouette, which are based on the principle of minimising the intra-cluster variation and measuring the quality of clustering. The resulting point cluster information was populated into a 1km* 1km grid to compare the clusters between methods and to determine the constancy of farm to cluster association between methods. When correlating clusters with farm system characteristics derived from the Agricultural Census at electoral division level, the clusters identified using CLARA were more reflective of the farm system than clusters found by the K-Means and PAM methods. The tillage areas were distinguished most effectively from other farm systems. Even in the absence of climate variables in the study, the EVI effectively identifies the combined effect of agriculture management, soils and climate on the system. The derived agro-climatic zonation data can be fed as an input to Agro-Meteorological models to determine the impact of weather on crop yields and farm performance, while accounting for the variation due to farm system and climatic zone.