ABSTRACT

MONITORING AND DETECTION OF INTERANNUAL CROP LAND USE CHANGES IN CENTRAL LUZON USING NOVEL SATELLITE-BASED CLASSIFICATION TECHNIQUE

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The extent of agricultural land has been mapped and surveyed in the Philippines periodically, however, given the dynamic nature of agricultural land and yearly changes in land cover on a regional scale, more frequent mapping of cropland is necessary for effective monitoring. Remote sensing provides a complementary source of data. Previous efforts made use of single-date imagery which does not reflect phenological stages and patterns and are hampered by clouds and infrequent data acquisition. The Moderate Resolution Imaging Spectroradiometer (MODIS) has a data record that observes daily since February 2000. Seasonal growth of vegetation and long data record can be used to compensate for the limitations of other optical satellite sensors to produce regular maps. This study aimed to map out single-cropping, double-cropping and perennial crop areas in addition to forests and built-up areas in the Central Luzon region in the Philippines using time-series images of normalized difference vegetation index (NDVI) maps derived from the 8- day MODIS surface reflectance product for 14 years, from 2001-2014. A smoothened and filtered time-series was produced using a modified Harmonic Analysis for Time Series algorithm. An artificial neural network was designed using a scaled conjugate gradient activation and was trained using ground data. The overall accuracy of the 2014 map was 62.05% and a kappa of 0.45. From 2001 to 2014, a 155.56% increase in single-cropping systems was observed while double cropping systems decreased by 14.83%. Perennials increased by 76.21% while built-up areas decreased by 12.22%. There are various error sources including mixed-pixels as well as scale problems. Field validation and comparison of MODIS NDVI derived from 3-day composites with NDVI values obtained from field spectrometer measurements yielded an R2 of 0.80, signifying good reliability of the satellite-derived information with . An analysis of an event of dry spells associated with El Nino events have also led to the switching of areas from double cropping systems to single cropping systems or other land uses temporarily as the event persists. The method developed has promising potential for producing frequent maps to aid in the management of cropland, specifically when this is scaled up to a national-level of mapping and also when forecasts are employed to predict future land use patterns.

Keywords: MODIS, phenology, artificial neural networks, land use change, agriculture, NDVI