THE USE OF REMOTE SENSING TECHNIQUES AND GEOGRAPHICAL INFORMATION SYSTEM FOR MONITORING CULTIVATED AREA AND PRODUCTIVITY OF SOME FIELD CROPS

By

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M.Sc. Agric. Sc. (Agronomy), Ain Shams University, 2012

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ABSTRACT

Abdelraouf Massoud Ali: The Use of Remote Sensing Techniques and Geographical Information System for Monitoring Cultivated Area and Productivity of some Field Crops. Unpublished Ph.D. Thesis, Arid Land Agricultural Graduated Studies and Research Institute, Agriculture in Desert and Salt Affected Areas, Faculty of Agriculture, Ain Shams University, 2015.

One of the main challenges in determining crop growth vigor or biomass from remotely-sensed images is the alignment of the acquisition date of the image with the optimal crop growth period. As discussed to increasing the temporal frequency of image acquisition addresses this problem but can be costly ،especially, in the case of fine resolution (i.e. high spatial resolution) platforms .

However, with landsat being available at a relatively small cost (usually free ،(composite 16-day NDVI LANDSAT data (~30 m x 30 m pixel size) throughout the entire crop growth period was used for this research. This ensured a continuous vegetation index profile, which captured land use patterns (e.g. fallow, cropping (before and during the growing period of winter crops. The measured 16-day aggregated NDVI LANDSAT was used as temporal input for quantifying and understanding the crop growth trajectory at each pixel. Standard and advanced image processing techniques were applied to the multi-date NDVI imagery . These methods included geometric corrections, image enhancement and transformation, re-projection, supervised classification, and classification accuracy assessment. Temporal classification methodology and multi-temporal algorithms were adapted, developed and tested at the shire level in order to determine crop area planted for different crop types

(e.g. wheat, sugar beets, Alfa Alfa, Potato and onion) at the end of the crop growing season as well as for early-season estimates.

the second objective of this research is to use remote sensing satellite data imagery to generate remotely-sensed empirical pre-harvest wheat and rice yield prediction models. The main input parameters of these models are spectral data either in form of spectral reflectance data that are released from the different land sat bands (, red, and near infra-red) or in forms of spectral vegetation indices that are algebraic ratios generated from the spectral reflectance values. The other type of the input factors is Leaf Area Index (LAI) that is a biophysical parameter closely related to crop canopy spectral characteristics and was measured by LAI Plant Canopy Analyzer (PCA). The five vegetation indices that are calculated through different forms that mastered the band of near infra-red with the bands of red to produce Difference Vegetation Index (DVI), Infrared Percentage Vegetation Index (IPVI), Ratio Vegetation Index (RVI), Normalized Difference Vegetation Index (NDVI) and Soil Adjusted Vegetation Index (SAVI). The above mentioned factors were individually used as input factors for either simple regression modeling or for multi-regression modeling associated with the Leaf Area Index (LAI) in each model of yield prediction for wheat crop in each of their season of cultivation. All generated models are site specific limited to the area and the surrounding environment and could be applicable under similar conditions using the extra pollination approach. The study was carried out in Salheia project using the dataset from two wheat seasons 2012/2013, 2013/2014, The total wheat area was cultivated by Misr1. Molding and validation process were carried out for crop for each season independently.The generated models were validated through main step. the correlation coefficient that is released from the generated models, while the second one is the validation through testing the yield that is calculated through the generated models (modeled yield) against the yield that is reported from field.Testing modeled yield versus reported yield was carried out through common statistical test. the correlation coefficient for a direct regression analysis between modeled and predicted yield for each generated model. The correlation coefficient (r) of the generated models indicated that spectral bands (red and near infra-red bands) showed high accuracy and sufficiency to predict the yield. This relationship was proved through correlation coefficient of the generated models and through the generated models with the wheat for the two seasons. It is clear that using LAI with other spectral factor increased the accuracy of the generated models as shown from the validation process for all models. The models are applicable after 90 days from sowing date for similar cultivation management under the same environmental conditions.

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