

LAND USE/COVER CHARACTERIZATION WITH MODIS TIME SERIES DATA WITH HYBRID CLASSIFICATION METHOD OVER AUSTRALIA FOR 2001 AND 2003

Kaishan Song¹, Mingming Jia¹, Mohsin Hafeez², Zongming Wang¹, Dongmei Lu³, Lihong Zeng¹, Dianwei Liu¹, Bai Zhang¹, Fang Li¹, Jia Du¹, Qingfeng Liu¹.

¹Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences
Changchun, Jilin Province, China, 130012;

²International Water Centre, Charles Sturt University, Wagga Wagga, 2678, NSW, Australia;

³Computer Science and Engineering College, Jilin Architectural and Civil Engineering Institute, Hongqi
Street 1129, Changchun 130000, Jilin Province, PR China.

Tel: 86-431-85542364; Fax: 86-431-85542298; songks@neigae.ac.cn

Abstract—Improved and up-to-date land use/land cover (LULC) data sets that classify land use practices are needed over the whole country of Australia to support science and policy applications focused on understanding the role and response of the LULC to environmental change, especially the climate change issues. The Moderate Resolution Imaging Spectroradiometer (MODIS) holds considerable promise for detailed, large-area crop-related LULC mapping in this region given its global coverage, unique combination of spatial, spectral, and temporal resolutions, and the cost-free status of its data. However, the specific spectral–temporal information contained in these data has yet to be thoroughly explored. The main goal of this study was to map LULC in Australia using MODIS 250 m Normalized Difference Vegetation Index (NDVI), Land Surface Vegetation Index (LSWI, which derived from MODIS reflectance data product) time series data of 2000 and 2003 (2000 represent a climatically normal year, while 2003 represent a severely drought year). NDVI time-series were filtered by the Savitzky–Golay algorithm in the present study to smooth out noise. A combination of unsupervised ISODATA and a hierarchical decision tree classification were performed on 2 years 12-month time-series of MODIS NDVI data over the whole country. Also, land use data derived from Landsat TM, and Australian Vegetation Map and other land use data set were used as labeling reference during the classification process. The MODIS land cover products were evaluated using existing land use/cover data derived from Landsat TM as reference data (AUS-2000). MODIS 250 m NDVI datasets were found to have sufficient spatial, spectral, and temporal resolutions to detect unique multi-temporal signatures for major crop types (non-irrigated crop, spring wheat, and paddy rice), forest, wetland, grazing grassland, sandy and salinity affected land, water body, and large residential area. Regional intra-class NDVI signature variations were found for some crops across the study region that reflected the climate change and planting time differences. The multi-temporal NDVI data tracked similar seasonal responses for all crops and were highly correlated across the growing season. The results of the MODIS-based classification were compared with AUS-2000 and statistical data in the study area. The overall classification accuracy was 86.4%. A spatial consistency index was constructed to evaluate the classification result with GLC2000, MODIS Land cover result with AUS-2000 result. It turned out that our result is more accurate than the current global land cover data set because the relative high resolution of MODIS data and more prior knowledge were used. In conclusion, this method has been used successively for MODIS time series data in 2000 and 2003 to develop land use/land cover classifications and products for land use/cover change in the study area. Australia is a country whose agricultural practice severely influenced by climate change, an up to date land use/cover data set is urgently needed by the government or other agencies to assess the climate change effect on agricultural product. With MODIS data product, it is possible to update land cover/use data set very efficiently. These results also will be used for water use efficiency and climate change impact on regional agricultural management analysis.

Key words: Australia, MODIS NDVI, LULC, Savitzky–Golay filter, LSWI.