LAND USE/COVER CHANGE DETECTION IN THE AMUR RIVER BASIN USING MODIS TIME SERIES DATA WITH HYBRID CLASSIFICATION METHOD

Kaishan Song[1], Zongming Wang[1], Qingfeng Liu[1], Dongmei Lu[2], Jin Cui1, Lihong Zeng[1], Dianwei Liu[1], Bai Zhang1, Jia Du[1]

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

[2] Computer Science and Engineering College, Jilin Architectural and Civil Egineering 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 intensively land use/cover changing area in the Amur River Basin (AMB) to support science and policy applications focused on understanding the role and response of the LULC to environmental change issues. The AMB is very large, trans-boundary mega ecosystem that includes portions of Northeast China, Russia, Mongolia and North Korea, which locates between lat. 42 to 55 N and long.108 to 141 E, with an area of 2,095,000 km^2. Its elevation is between 110 and 2760m. AMB is characterized by diverse natural ecosystems and abundant natural resources. Land cover types, ranging from temperate to boreal evergreen conifer-deciduous broad leaf mixed forests, deciduous broad leaf forests, woodlands, and shrublands in the Mountain Ranges to typical steppes and desert steppes in the west parts of the basin where Mongolia and inner Mongolia jointed, with agricultural lands (e.g., the Liao River Plain, the Songnen Plain, Khanka Lake plain, Zeya river Plain and the Middle Plain where Ussuri river joint with Amur river), wetland meadow extensively locate in these alluvial flood plains, meadow and typical steppes was in the mid part of AMB. The study area is characterized by a temperate continental monsoon climate. Temporal and spatial climatic variability, especially annual precipitation as well as substantial interannual fluctuations and innerannual changes, is one of the most notable features of the region. Temporal climatic patterns, the interannual and innerannual variability, are also high and this temporal variability is highest in the driest and coldest portions of the region. The frost-free period of the study area is 110-165 days 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 and their applicability for large area LULC classification is relatively unknown. The main goal of this study was to map LULC change in the Amur River Basin using MODIS 250 m Normalized Difference Vegetation Index (NDVI), Land Surface Vegetation Index (LSWI) time series data in 2001 and 2007. 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 from the study region. A task-oriented classification system according to the regional land use/cover situation adopted from IGBP and GLC2000 were applied in this study. The MODIS land cover result of Northeast China was evaluated using existing land use/cover data derived from Landsat TM data, the part belongs to Russia were evaluated by land use data provided by Pacific Geography Institute Far East Branch of Russia Academy of Science. MODIS 250 m NDVI datasets were found to have sufficient spatial, spectral, and temporal resolutions to detect unique multi-temporal signatures for the region's major cropland, 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 land cover and were highly correlated across the growing season. The results of the MODIS-based classification were compared with both the Landsat-based classification for the 2-year period and statistical data in the study area. The overall classification accuracy was 84%. In conclusion, this method has been used successively for land use/cover change monitoring in the year 2001 and 2007 in the study area. It also turned out that MODIS 250 NDVI time series data have great potential for large basin land use/cover monitoring and information updating for basin environmental research, also it can provide relatively accurate land use/cover data set for hydrological and climate modeling. These results also will be used for water use efficiency and climate change impact on regional agricultural management analysis.

Key words: Amur Basin, 250m NDVI, LULC, Savitzky–Golay filters, LSWI.