Proceedings of the World Congress on New Technologies (NewTech 2015)
Barcelona, Spain – July 15 - 17, 2015
Paper No. 156

Dynamics of Land Use and Land Cover Change in Kiskatinaw River Watershed, Canada: A Remote Sensing Analysis and Markov Chain Modelling Approach

Siddhartho Shekhar Paul, Jianbing Li
Environmental Engineering Program, University of Northern British Columbia,
3333 University Way, Prince George, British Columbia, Canada V2N 4Z9
Siddhartho.Paul@alumni.unbc.ca; Jianbing.Li@unbc.ca

Extended Abstract

Kiskatinaw River Watershed (KRW) in north-eastern British Columbia of Canada serves as a crucial water resource for the Peace River Regional District. Over decades, the dominant land use activity in this densely forested watershed has been forestry and agriculture, but rapid and intensive natural gas development in recent years has greatly affected its land use and land cover (LULC) change dynamics. However, few information on LULC change in KRW during the past years has been available. The objective of this study is then to capture and predict the LULC change dynamics in KRW through a combination of remote sensing analysis, GIS and Markov Chain modelling approach. Landsat TM and ETM+ satellite images of the years 1984, 1999 and 2010 were analyzed using object oriented image classification technique to produce LULC maps and detect the associated changes, with 11 LULC categories investigated. It was observed that KRW was covered (80% in 1984, 85.60% in 1999 and 86.28% in 2010) by different types of forest, with wetland coverage of 16.02% in 1984, 7.79% in 1999, and 6.45% in 2010. In particular, a total of 270.78 km^2 of wetlands have disappeared from 1984 to 2010. Other LULC features such as cropland, cut block, pasture, water, and built-up area were also examined for their changes. The areal gain and loss for all LULC types as well as their contribution to the net change were quantified for the period of 1984 -1999 and 1999 - 2010. LULC changes were also examined at sub-watershed scale. Based on the analysis of LULC change from 1984 to 2010, a modelling approach was applied to forecast the future (until 2020) LULC dynamics. Multi-layer perception (MLP) neural network was used to model the LULC transition probability while Markov Chain (MC) model was used to generate future LULC scenarios. Two types of output were produced, with soft prediction maps showing the overall vulnerability of LULC change, and hard prediction generating LULC maps for 2015 and 2020. It was expected that the forest cover will remain almost the same with a predicted increase of 45 km^2, while the wetland depletion will be continuing with another 67.89 km^2 of depletion. An increase of 11.57 km^2 of built-up area and 7.74 km^2 of cut block area was predicted due to ongoing industrial activity such as shale gas development. As an important ecological component, wetland depletion in KRW warrants further examination to identify its probable cause. In summary, this study produced a comprehensive LULC inventory of KRW which will benefit the land use planners to formulate and implement an efficient water resources management strategy.