Application Of GIS And Remote Sensing For Predicting Land-use Change In The French Jura Mountains With The LCM model: The Impact Of Variables On The Disturbance Model

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Abstract: This research work studies the land-use change for the Ain watershed in the Jura Mountains, Eastern French. Using the satellite images LANDSAT in 1975, 1992, 2000 and 2010, the land-use data for the four corresponding years was first generated and the diachronic land-use analysis from 1975 to 2010 was next carried out. These four satellite images in the study zone are taken in the same season (dry season) in order to limit the errors caused by the effect of seasonal factors on the vegetation changes in the classification process. In order to generate the four land-use maps, the satellite images were classified using the Maximum Likelihood supervised classification, the most popular method used for quantitative analysis of remote sensing data. The land-use map in 2010 is validated based on the observations from ground visits in 2011. The other land-use maps are validated by the data of ground truth which was established from the auxiliary information layers taken in the area.

Also, the land-use in the future is generated regarding the evolution trend of land-use in the past based on the Land Change Modeler (LCM). Then, the multi-temporal analyse of land-use change is carried out and the variables affecting the LCM are evaluated using the Multi-Layer Perceptron and the Markov transition probabilities. Three pairs of maps (1975, 1992), (1992, 2000), and (2000, 2010) are used to generate the predictive maps. This phase helps us first to identify potential relationships between land-use changes and potential variables, and then to validate the predictive model by comparing results with reference maps of 2000 and 2010 issued from remote sensing treatment for the same dates.

Variables considered include the number of explanatory variables of Transition Sub-model, the scale of studied region, the period of observed land-use data and the period which needs to be predicted. By this work, we show the important effect of these variables on the disturbance LCM. Among those variables, the number of explanatory variables and the period needing to be predicted have the most important effect. When the number of explanatory variables increases, the precision of land-use prediction is enhanced. Concerning the period which needs predicting, the prediction precision will be reduced about 3.8% for every 10 years.

Keyword: land-use, remote sensing, GIS, LCM, Markov chain