



Modelling Landcover Change with a CA-Markov Model for the Siliana Hydrological Catchment (Northwestern Tunisia)

Imen EL Ghouli^{a,b,c}, Haykel Sellami^a, Slaheddine Khelifi^b, Marnik Vanclooster^c

^aCentre for Water Research and Technology, Laboratory of georesources (haysellami@yahoo.fr)

^bUR-Gestion Durable des Ressources en Eau et en Sol, Tunisia, Ecole Supérieure des Ingénieurs de MedjezElbab, Université de Jendouba (slaheddinekhelifi@gmail.com, imenelghoul91@gmail.com)

^cUniversité catholique de Louvain, Earth and Life Institute (ELI), Louvain La Neuve, Belgium
(marnik.vanclooster@uclouvain.be)

Abstract: Simulating future land cover change is one of the major challenges for scientists, decision makers, and local authorities in terms of data, methods, and models that should be used to create a sustainable land cover planning process. The study aims to evaluate the past land cover changes from 1990 to 2019 in Siliana catchment in Northwest Tunisia and predict the situation to 2030 and 2050. Satellite images of Landsat 5-thematic mapper for the years 1990, 2000, 2010 and 2019 were used for analyzing and predicting the spatio-temporal distributions of land cover for this study. Based on these past analyses, future land cover maps of the study area were developed using a Cellular Automata (CA)-Markov chain model. The results indicate that the area of cereal cultivation, olive plantation, irrigated land and urban land were expanded by 1%, 112%, 350% and 150% respectively from 1990 to 2019. In contrast, the area of forest and pasture land were reduced by 13% and 58% respectively during the same period. Using the transition matrix, the spatial distribution of land cover was simulated for 2010 and 2019. The kappa coefficient, which measures the agreement between simulated and reference maps, was greater than 0.7 for both maps while the overall accuracy values of the land-use maps were 87.6% and 86.5% respectively. After model validation, future land cover maps were simulated. Results show that the increase of the areas for cereal cultivation, olive tree plantations, irrigated land and urban land and the decrease of forest and pasture land will persist in 2030 and 2050. The results of this research are of great importance for regional authorities and decision makers in strategic land use planning and for the modelling of impacts of land use change on the hydrology of the catchment.

Keywords: landcover change; modelling; Siliana catchment; CA-Markov