

Land-use change detection in South East Spain

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INTRODUCTION

Anthropogenic land-use (LU) activities are altering at high rates the natural ecosystems of the southeast of Spain. Land-use change (LUC) models are broadly used for LUC detection but usually they are too complicated for a simple and broad model use. Here, we present the application of a Markovian cellular automata (CA Markov) model to spatially locate land-use changes in the Almeria province to detect natural threaten areas.

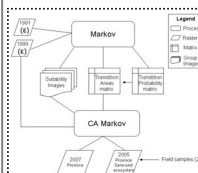
OBJECTIVES

- 1) To test an easy to use model for detecting LU change in Mediterranean ecosystems. This model should be an efficient tool for conservation management and,
- 2) to detect particularly vulnerable ecosystems and natural endangered areas threaten by future LUCs.

METHOD I

Regional Ecosystems zonation (Cabello et al. 2006) and the annual rate of vegetation lost (Puyravaud 2003) were used for detecting areas losing the most vegetation. There, spatial analysis were developed.

The model:



Probabilistic models like Markov are broadly used for LUC detection. But it lacks the spatial dimension of changes.

Thus, a Cellular Automata Markov that spatially locates LUC was selected (Fig. 2).

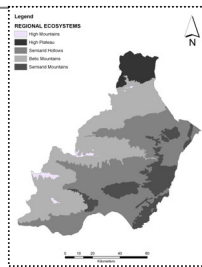


Figure 1. Regional Ecosystem map for Almeria province

METHOD II

•A **LU projection** was done at a provincial and ecosystem level from 1991-1999 to 2007 (Fig 3a).

•**Validation** of the model projection was carried out in 2005 using field data (stratified probability field sampling): confusion matrix and kappa index (Fig 3b).

•The **reliability** of land-use projections was interpolated for the whole province by indicator kriging (Fig.3b).

•**Null model**: comparison of the projected values (2005 and 2007) with the 1999 LU data in order to check the stability of the changes predicted by the model (the disagreement due to quantity and location).

•**Landscape equilibrium** state: Markov characteristic (Fig.6).

CONCLUSIONS

•Although it is a challenge to simulate landscape patterns using transition probability models, the **selected model** has been proved to be a simple but effective approach to model the evolution of LU patterns in areas with intense human activity.

•For the province, the main **LU forces of change** detected were urban, agriculture and greenhouses. Semi-arid Hollows showed the most warning LU changes.

•The provincial LU projection showed **reliable** results for 2005 except for those very dynamic areas (due to the use of a LU suitability map that does not take into account the spatial degree of change).

•When the model was compared to a **Null model** it predicted more stability than change. This can be explained due to the quality of the inputs, the use of cell-to-cell accuracies measures instead of fuzzy ones or can also be regarded as a characteristic of LU change models.

•The **landscape equilibrium state** showed that provincial natural vegetation could be isolated in protected areas by 2034 if current management policies do not change. There is therefore an urgent requirement for conservation planning outside protected areas.

RESULTS

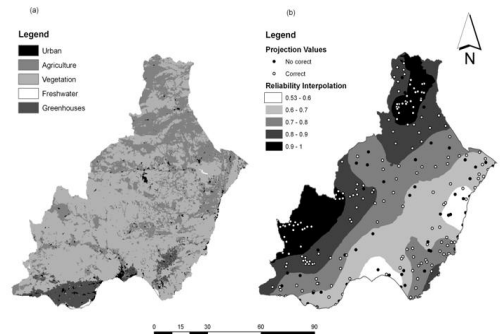


Figure 3. Spatial LU projection to 2005 from 1999 (a) and spatial reliability of the projections (b)

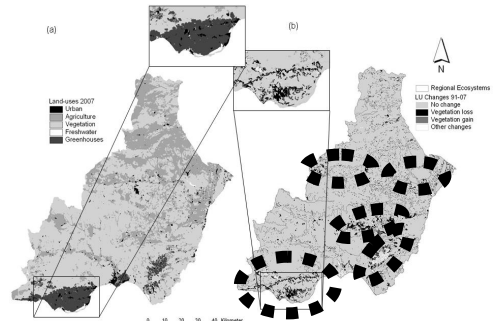


Figure 4. Spatial LU projection to 2007 from 1999 (a) and spatial LUs changes from 1991 to 2007 (b). Detail of one of the biggest greenhouse concentration in the province, Campo de Dalías (El Ejido).

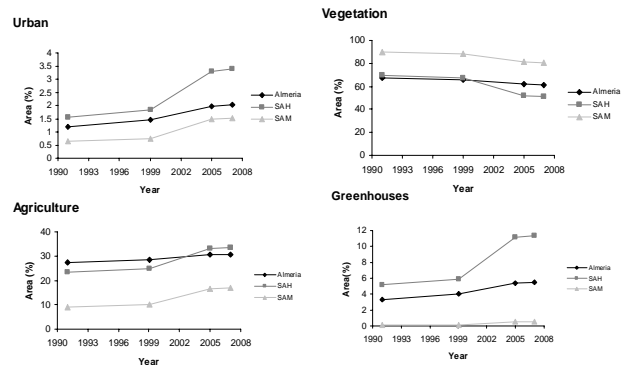


Figure 5. Historic and future LU changes in Almeria province. SAH: Semi-arid Hollows, SAM: Semi-arid Mountains

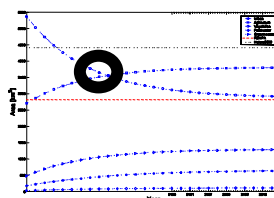


Figure 6. Land-use area for the provincial stable state of the landscape.

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- Puyravaud, J.P. (2003). Standardizing the calculation of the annual rate of deforestation. *Forest Ecology and Management*, 177, p 593-596
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