

11 ■ Long term wetland-related land cover and use changes in Romania

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Abstract: Starting from the importance of wetlands, assessed through the perspective of the ecosystem services provided, but also from the fact that the chaotic development of Romania, characteristic to transition countries, resulted into important land cover and use changes, this study aims to assess the effect of these transitional dynamics against the wetlands. The study uses geospatial data, analyzed based on computing the area covered by different uses or affected by changes. The findings indicate an alarming trend, consisting of a continuous loss of the wetland areas. While the limitations inherent to using CORINE data do not allow for discerning the intricate mechanisms of change, the overall picture requires immediate action on behalf of the authorities for avoiding further losses.

Keywords: geospatial data, biodiversity, land cover and use, transitional dynamics.

INTRODUCTION

Wetlands are important due to the ecosystem services provided to the human society, as reservoirs of biodiversity (Russel et al., 2002; Tyler Miller and Spoolman, 2009), but also due to the threats and vulnerabilities menacing them (Williams and Dodd, 1979; Sbarcea et al. 2019). The ecosystem services provided by wetlands include supply (Mitsch and Gosselink, 2000; Heint, 2001; McCulloch et al., 2003; St. Louis et al., 2004), regulation (Kuenzer and Renaud, 2012), cultural (Rasleigh et al., 2011), and support (Gibbs, 1993; Meitã and Petrișor, 2015).

In more details, wetlands offer benefits to society, often supporting large populations (Saito, 2005), such as: highly fertile soils for agriculture, transportation of people and goods, water resources, and rich biodiversity and recreational value (Coleman and Wright, 1971; Ibeanu, 2000; White, 2002; Reker et al., 2006; Kuenzer and Renaud, 2012; Buhociu et al., 2013a, b; Renaud et al., 2013), habitats for key and rare species (Wolfe et al., 2002). Wetlands are among the most productive natural systems (Saad, 2003).

Nevertheless, different impacts, including direct interventions (Tyler Miller and Spoolman, 2009), but also other activities such as intensive agriculture, change of water and sediment fluxes, or urbanization and industrialization (Saito, 2005; Syvitski and Saito, 2007; Syvitski, 2008; Meyer and Nijhuis, 2010; Kuenzer and Renaud, 2012; Renaud et al., 2013; Dandekar and Thakkar, 2014; Giosan et al., 2014), make wetlands are disappearing globally at an alarming rate (Heint, 2001).

Romania did not make an exception; the lakes along the shoreline and the Danube Delta were turned into agricultural land during the communist period, and other wetlands, including the Danube Delta, were subject to important human impacts (Meitã, 2010; Meitã et al., 2010). The following period can be characterized by a chaotic development, where some natural ecosystems were lost by their transformation into man dominated-ones, and semi-natural ecosystems appeared when nature colonized abandoned man-dominated system, or even purposefully (Petrișor, 2012)

The present study attempts to assess the long-term dynamics of land cover and use changes in Romania in order to see whether wetlands were affected, and any clear trends can be seen. The essential question concerns the possible loss, given the potential ecological consequences.

MATERIALS AND METHODS

The research used geospatial data on land cover and use, freely available from two sources, i.e., CORINE land cover and use changes data provided by the Copernicus Land Monitoring Services (<http://land.copernicus.eu/pan-european/corine-land-cover/lcc-2006-2012/view>) for 2012 – land cover

and use and 2006-2012 – land cover and use changes and by the European Environment Agency (<http://www.eea.europa.eu/data-and-maps/>) for 2000 and 2006 – land cover and use, and respectively for 1990-2000 and 2000-2006 – land cover and use changes. The software used to analyze the spatial data based on overlying and clipping the different datasets was ArcView 3.X, in conjunction with its X-Tools extension, used for the computation of areas under different categories.

RESULTS AND DISCUSSION

Fig. 1 displays the dynamic of the area covered by wetlands in Romania during 2000-2012, based on land cover and use data; the image indicates a clear decreasing trend ($R^2 = 0.95$), suggesting that wetlands were constantly lost throughout the ten years. However, Fig. 2, based on land cover and use change data, indicates a different situation; during 1990-2000 and 2000-2006 the loss of wetland area (through its transformation in other uses) is relatively equal with its gain (resulting from the transformation of other uses into wetlands), with very small values in the second period. During 2006-2012, almost 55 km² of other uses were transformed into wetlands.

This is, most likely, a temporary effect of the massive flush floods occurred in 2005-2007, but could also reflect the construction of engineering structures used to retain the water as a preventive measure against floods. Furthermore, it has to be stressed out that the spatial resolution of CORINE is a minimum mapping unit of 25 hectares for the land cover and use data, and 5 ha for the land cover and use change data (Hagenauer & Helbich, 2012).

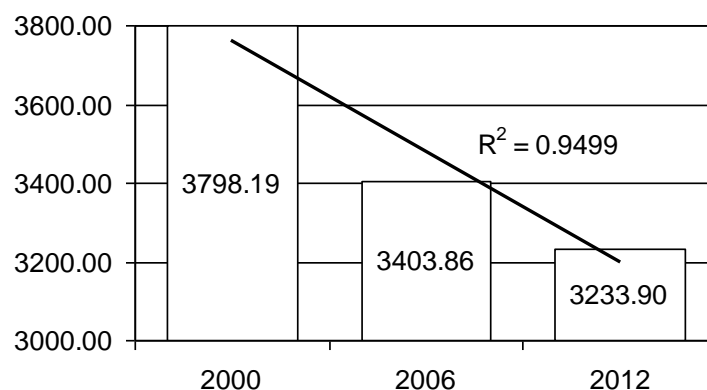


Fig. 1. Dynamic of the area covered by wetlands in Romania during 2000-2012 (values in km²). Source: map created by the authors using free data from Copernicus Land Monitoring Service and the European Environment Agency.

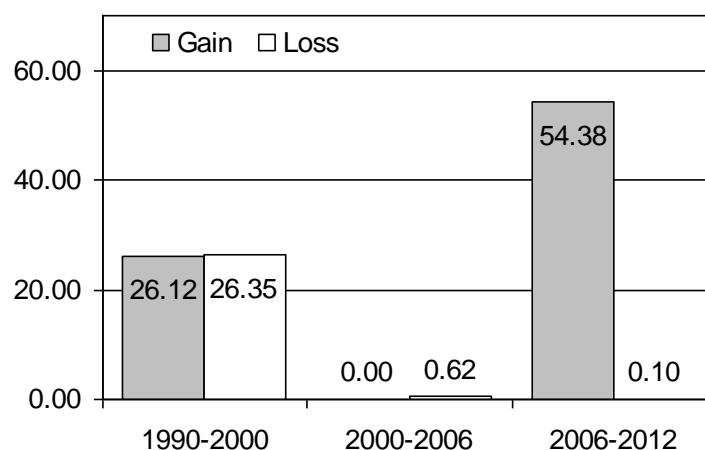


Fig. 2. Dynamic of the land cover and use changes connected to the wetlands in Romania during 1990-2012 (values in km²). Source: map created by the authors using free data from Copernicus Land Monitoring Service and the European Environment Agency.

Similarly, other issues characteristic to CORINE data include misclassification of satellite data and different classification schemes and resolutions from one period to another (Jansen, 2007; Pelorosso *et al.*, 2011; Verburg *et al.*, 2011). Such issues are visible when looking at the type of wetlands: salted marshes in 2000, and salted marshes, inland marshes, and peat bogs in 2006 and 2012. It is virtually impossible for the two new categories to have suddenly emerged starting 2006, but very likely to be the result of a better classification due to the change of the Romanian institution dealing with the actual processing of data. However, these fine-tuning details do not affect the global result, showing a decrease of the total area covered by wetlands.

CONCLUSIONS

The main findings of the study show that, based on the land cover and use data, the overall surface of wetlands diminished consistently. However, the land cover and use change data show inconsistent trends, which do not allow for discerning the detailed mechanisms of change. In a nutshell, the findings suggest the need for action, in order to prevent further loss.

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