

# METHODOLOGY FOR ASSESSING ENVIRONMENTAL QUALITY IN THE ROMANIAN COASTAL AREA USING GIS

Alexandru-Ionuț PETRIȘOR

PhD (Ecology), PhD (Geography), Scientific Director, NRDI URBAN-INCERC, Bucharest, Romania, e-mail: alexandru.petrisor@incd.ro

**Abstract.** This brief research report attempts to introduce a special methodology developed for the environmental analysis of the Black Sea coastal area, part of the spatial plan of the region. The methodology employed GIS to look at biodiversity and threats against it (reflected by biogeographical regions, land cover and use and their changes) and its conservation through natural protected sites.

**Key words:** biodiversity, conservation, planning, natural protected sites, transitional dynamics

## 1. Introduction

The strategic importance for the conservation of biodiversity in the environmental policies of the European Union (EU) and pressures exercised by urban sprawl over coastal areas is mainly due to their ecological fragility and vulnerability (Antrop, 2004; Cicin-Sain and Belfiore, 2005; EEA, 2006; McDonald *et al.*, 2008).

The main pressure are due to tourism (Coccosis *et al.*, 1996; Gormsen, 1997; Tsartas, 2003) and climate changes (Nicholls and Hoozemans, 1996). Consequences include the decline of agriculture and adverse social phenomena (Tsartas, 2009), rise of sea level (Nicholls and Hoozemans, 1996), cultural and environmental issues (Gormsen, 1997), which can be mitigated or tackled by planning (Coccosis *et al.*, 1996; Nicholls and Hoozemans, 1996).

The study "*Methodology for the elaboration and framework content of spatial plans for*

*coastal areas. Spatial plan of the zonal territory «Black Sea Coast»", elaborated by NIRD URBAN-INCERC aims, among others, to develop a methodology for analyzing the Romanian coastal area under a planning framework, revealing its current status, dysfunctions and proposing, based on the results of these analyses, strategies for its development.*

In terms of planning, the method developed under the framework of this study for identifying the current status of environmental quality and potential threats attempts to fill in the current gap due to the lack of legally approved instruments in line with the progress of ecology, reflecting the newest theoretical developments in this field (Petrișor, 2013).

## 2. Methodology

The method consisted of GIS spatial analyses carried out using ArcView 3.X and its extensions and datasets related to biogeographical regions, land cover and

use and their changes (freely available from the European Environment Agency), and Romanian natural protected sites of national importance, freely available from the Romanian Ministry of the Environment. All these datasets were clipped for the coastal region, defined by the plan as summing part of adjacent counties, and areas were computed in each case by categories (of land cover and use, change by transitional dynamic – as in Petrișor *et al.*, 2010, or type of protected site).

### 3. Results and discussion

According to the European Environment Agency, there are 11 biogeographical regions in the EU. The Romanian coastal area covers the Black Sea (Pontic) biogeographical region and parts of the Steppic one. The Black Sea region covers the Black Sea shore, shared by seven countries: Romania, Bulgaria, Moldova, Georgia, Russia, Ukraine and Turkey. Only two of them are members of the EU: Romania and Bulgaria. Even though Romania has only 340,981.72 ha of this region (2.40% of its total area), with respect to the EU countries this share increase to 32.35% (Fig. 1 and 2). The Steppic region covers a very little part of Bulgaria (less than 0.01% of the total area of the region), Romania has 3,681,541.36 ha (2.91% of its total area), while the largest majority is situated in former Soviet countries (Fig. 1 and 2). Therefore, out of the EU share, Romania has 99.99%. These figures suggest that the richness of the natural capital, consisting of the presence of 5 of the 11 EU regions in Romania, is part of the national assets. Moreover, the large EU share implies an increased responsibility in relation to it (Schmeller *et al.*, 2008; Ianoș *et al.*, 2009).

Given the spatial scale recommended by the ecologists in relationship to the NUTS

classification of territorial units, the analysis of regional ecological complexes based on CORINE land cover and use data allows for pinpointing changes occurred during 1990-2000 and 2000-2006 (Pienkowski *et al.*, 1996; Bowker, 2000; Palmer, 1999; Petrișor, 2008, 2009; Petrișor *et al.*, 2010). For the first period, the results obtained using the method developed by Petrișor (2008), land cover changes total some 1,527 ha (mainly due to urbanization - 64% and agricultural abandonment - 18%), while areas affected by land use changes sum up to 6,385 ha. Changes of agricultural areas covered by vineyards and orchards suffered changes due to their abandonment - 61%. For the second period, all changes of land cover are due to urbanization (523.8 ha). Out of the areas affected by land use changes (973.13 ha), 64.4% were also affected by urbanization. Other causes include deforestations, agricultural abandonment and development.

Last but not least, the analysis revealed that an important issue related to conservation through protected sites is their overlap, totaling 88% for all categories (Table 1), due to the managerial implications of belonging to a certain type and lack of custodians. Therefore, it is important to identify the appropriate actions for each category, and specific features of individual areas (Chape *et al.*, 2005; Ioja *et al.*, 2010; Evans, 2012).

### 4. Conclusion

The methodology developed in this special case is applicable especially for analyzing vulnerable areas and conservation priorities in an international context. The main limitation relate to the availability of data, while its advantages result from the theoretical substantiation, in line with the progress of systemic ecology.

Table 1. Overlap of natural protected areas by category

Category	% overlapping
NATURA 200 sites (SCIs and SPAs)	87.82%
NATURA 2000 sites, protected landscapes and national parks	87.81%
NATURA 2000 sites, protected landscapes and national parks, natural reserves > 5 ha, natural monuments > 5 ha	87.79%

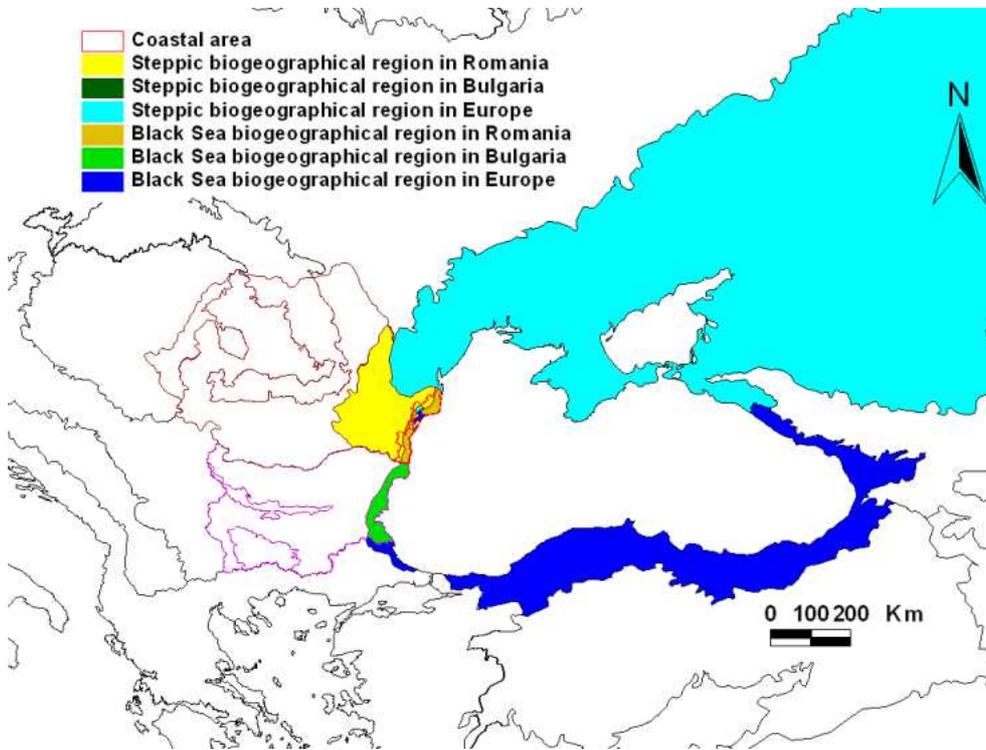


Fig. 1. Steppic and Biogeographical regions in Europe.

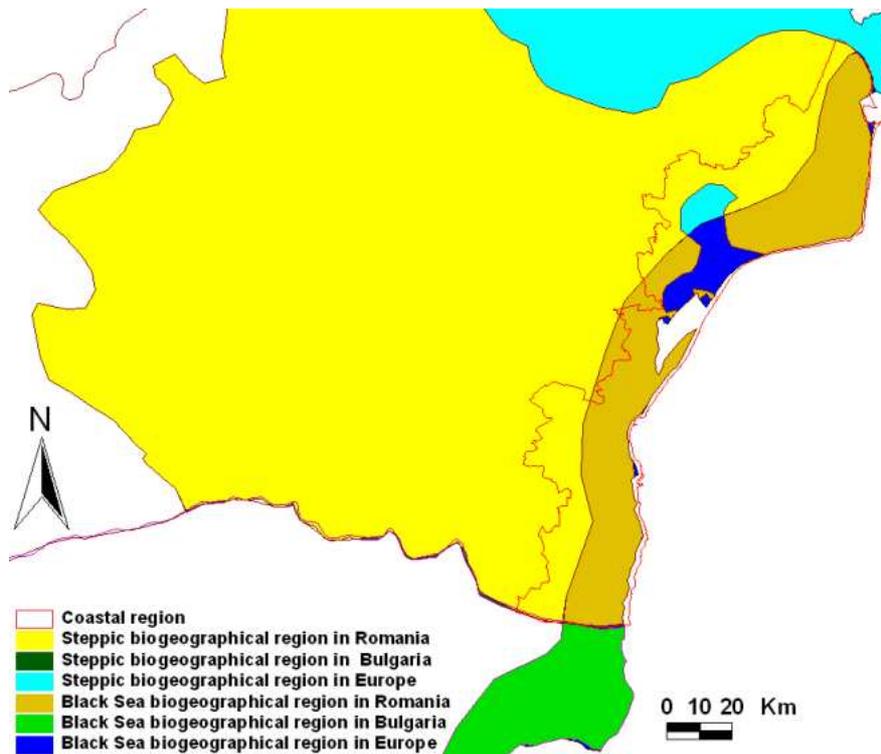


Fig. 2. Steppic and Biogeographical regions in Romania.

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## REFERENCES

- Antrop M. (2004), *Landscape change and the urbanization process in Europe*, Landscape and Urban Planning **67(1-4)**:9-26.
- Bowker G. C. (2000), *Mapping biodiversity*, International Journal of Geographical Information Science **14(8)**:739-754.
- Chape S., Harrison J., Spalding M., Lysenko I. (2004), *Measuring the extent and effectiveness of protected areas as an indicator for meeting global biodiversity targets*, Philosophical Transactions of the Royal Society B: Biological Sciences **360(1454)**:443-455.
- Cicin-Sain B., Belfiore S. (2005), *Linking marine protected areas to integrated coastal and ocean management: A review of theory and practice*, Ocean & Coastal Management **48(11-12)**:847-868.
- Coccosis H., Parpairis A., Priestley G. K. (1996), *Tourism and carrying capacity in coastal areas: Mykonos, Greece*, in: Priestley G. K., Edwards J. A., Coccosis H. (Eds.), *Sustainable tourism? European experiences*, CAB International, Wallingford, UK, 212 pp., ISBN 0-85199-100-9, pp. 153-175.
- European Environment Agency - EEA (2006), *Urban sprawl in Europe. The ignored challenge*, Office for Official Publications of the European Communities, Luxembourg, ISBN 92-9167-887-2, 56 pp.
- Evans D. (2012), *Building the European Union's Natura 2000 network*, Nature Conservation **1**:11-26.
- Gormsen E. (1997), *The impact of tourism on coastal areas*, GeoJournal **42(1)**:39-54.
- Ianoș I., Peptenatu D., Zamfir D. (2009), *Respect for environment and sustainable development*, Carpathian Journal of Earth and Environmental Sciences **4(1)**:81-93.
- Iojă C. I., Pătroescu M., Rozyłowicz L., Popescu V. D., Vergheleț M., Zotta M. I., Felciuc M. (2010), *The efficacy of Romania's protected areas network in conserving biodiversity*, Biological Conservation **143(11)**:2468-2476.
- McDonald R. I., Kareiva P., Formana R. T. T. (2008), *The implications of current and future urbanization for global protected areas and biodiversity conservation*, Biological Conservation **141(6)**:1695-1703.
- Nicholls R. J., Hoozemans F. M. J. (1996), *The Mediterranean: vulnerability to coastal implications of climate change*, Ocean & Coastal Management **31(2-3)**:105-132.
- Palmer M. A. (1999), *The application of biogeographical zonation and biodiversity assessment to the conservation of freshwater habitats in Great Britain*, Aquatic Conservation: Marine and Freshwater Ecosystems **9**:179-208.
- Petrișor A.-I. (2008), *Levels of biological diversity: a spatial approach to assessment methods*, Romanian Review of Regional Studies **4(1)**:41-62.
- Petrișor A.-I. (2009), *Spatial approach to the assessment of anthropogenic impact on biodiversity based on the Nomenclature of Territorial Units for Statistics (NUTS) applicable to Romania, Oltenia*. Studii și comunicări. Științele Naturii **25**:305-308.
- Petrișor A.-I. (2013), *New approach for elaborating environmental studies as part of territorial plans*, Urbanism. Arhitectură. Construcții **4(3)**:33-38.
- Petrișor A.-I. Ianoș I., Tălângă C. (2010), *Land cover and use changes focused on the urbanization processes in Romania*, Environmental Engineering and Management Journal **9(6)**:765-771.
- Pienkowski M. W., Bignal E. M., Galbraith C. A., McCracken D. I., Stillman R. A., Boobyer M. G., Curtis D. J. (1996), *A simplified classification of land-type zones to assist the integration of biodiversity objectives in land-use policies*, Biological Conservation **75(1)**:11-25.
- Schmeller D. S., Gruber B., Budrys E., Framsted E., Lengyel S., Henle K. (2008), *National Responsibilities in European Species Conservation: a Methodological Review*, Conservation Biology **22**:593-601.
- Tsartas P. (2003), *Tourism Development in Greek Insular and Coastal Areas: Sociocultural Changes and Crucial Policy Issues*, Journal of Sustainable Tourism **11(2-3)**:116-132.

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