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19. Mapping Potential Environmental Conflicts in the Danube Delta Biosphere Reserve

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Abstract: A broad literature deals with the environmental conflicts. One of the frameworks for analyzing them is provided by the concept of "opportunity cost"; when the same resource can be used in multiple ways, the potential uses can generate conflicts among the users. Among the resources, land has one of the highest potential for generating conflicts worldwide. Environmental conflicts determined by land use are amplified in protected areas, where the protection status is potentially conflicting with all economic uses. Previous analyses in the Danube Delta Biosphere Reserve underlined the fact that the protection status determined over the time social problems through the restrictions imposed on local activities, but also through the pressure of tourism. The present study was aimed at pinpointing the areas with a high potential for conflict using spatial data. Data was freely provided by the Romanian Ministry of the Environment for the reserve limits and for the spatial distribution of birds, other species and habitats representing a priority in conservation, and from the European Union Copernicus Program for the land cover and use. The analyses consisted of spatially overlaying the areas where human activities occur naturally (artificial and agricultural areas) and the spatial distributions of species and habitats important for conservation. The results indicate that the areas where conflicts may appear are situated mostly in the northern part of the reserve and cover almost 450 km^2 (8% of the total area of the reserve). Proper planning can provide solutions for harmonizing societal needs and environmental issues.
Keywords: conservation, geospatial data, geo-statistical methods, protected species, protected habitats

INTRODUCTION

Brought forward as a concept supporting decision making related to management of natural resources, the cost of opportunity measures the impact of assigning a certain resource to a specific economic activity, in order to select the most cost-effective planned use (Norton-Griffiths and Southey, 1995; Pearce and Markandya, 1987). In natural protected areas, where the potential uses of most natural resources are limited by the conservation status, finding the optimal cost of opportunity by evaluating the impact of assigning these resources to a certain use becomes even more important (Chomitz et al., 2005).

The benefits or disservices of utilizing resources in a specific way over another can also be analyzed through an ecosystem services framework (*****, 2005), considering supporting, provisioning, regulating and cultural services provided by nature (Costanza et al., 1997). The valuation of trade-offs between ecosystem services provided in different decision scenarios can be further supported by specific tools. Such tools are integrated models analyzing the ecological and socio-economic processes that occur and interact in complex relationships in coupled human and natural systems (Armatas et al., 2018; Liu et al., 2015, Turner et al., 2016, Xu et al., 2018).

As the controversial debate between nature conservation and its effects on humans carries on (Adams and Hutton, 2007; Andam et al., 2010; Busch and Grantham, 2013; James et al., 2001; Kothari, 2006; Kušová et al., 2005), the conflicts between the need for preserving natural resources and local communities' need for economic development bear significant social and environmental consequences (Agrawal et al., 2008; Cernea and Schmidt-Soltau, 2003). Such negative outcomes are even more so prominent in vulnerable areas like the Danube Delta, which is almost entirely rural, sparsely populated, with communities that struggle with depopulation and aging.

Among the resources, land has one of the highest potential for generating conflicts worldwide. Environmental conflicts determined by land use are amplified in protected areas, where the protection status is possibly conflicting with all economic uses.

Generally, economic activities have been identified as the main causes for conflicts, with agriculture weighing most heavily in this respect (Frys and Nienaber, 2011). Most of the times, conflicts emerge because of restricting access to resources (Adams and Hutton, 2007; Ferraro et al., 2011; Iojă et al., 2010); decreasing the rights derived from ownership (Adams and Hutton, 2007; Wilkie et al.,2006); not taking into account the particularities of local cultures (Singh, 2012) or from a distribution of revenues perceived as unfair (Kothari, 2006; Ohl et al.,2008).

Moreover, human-conservation conflicts are oftentimes expressions of underlying human–human conflicts, such as between authorities and local people, or between people of different backgrounds. Consequently, social factors are an important component to be considered within the complexities of conflict (Dickman, 2010). An approach that is gaining popularity in development planning, especially in vulnerable communities is the use of lay knowledge in informing decision making through participatory processes (Herman et al., 2018). Therefore, in environmental policy-making, it has become increasingly important to incorporate, besides the rational arguments of environment experts, the opinions of the local communities, rooted in their sense of place. In this way, divergent concepts of sustainability may be reconciled, as many cases of environmental dispute stems from local people's responses to environmental policies that do not match their social-ecological practices and views. (Moran and Rau, 2014).

Provided that deltas are complex territories where the coexistence of natural environment, urban dynamics and climate changes take place, there is a stringent need to support spatial planners and decision makers by assessing the spatial implications of different socio-economic variables and to promote adaptation strategies based on the development of future scenarios (Zagare, 2012).

The Danube Delta, displaying an unique landscape comprised of endless successions of water and land, is an area with a multiple protection status due to its impressive biodiversity: UNESCO world heritage site for its natural patrimony, Ramsar site – wetland of international importance, as well as being a part of the Natura 2000 European network of protected areas (Gâştescu and Ştiucă, 2008; Geacu et al., 2012).

This particular status and multiple layers of environmental protection, combined with the fact that the delta is inhabited by local communities that have molded their own habitat in rural settlements, poses important challenges in planning for sustainable development in the area.

In accordance with its Biosphere Reserve stature, the Danube Delta is expected to be governed by policies converging towards an integrated economic, societal, cultural and environmental sustainability (Petrişor et al., 2016).

The conservation management policies for the unique pattern of closely tied habitats and ecosystems in the Danube Delta have often led to tensions between the management authorities and the local populations. As underlined by Bell et al. (2009), disagreement persists in matters such as the regulation of fishing, hunting and other economic activities, taxation and transport policies or the establishment of restricted areas within the Delta. While past anthropic activities in the Danube Delta led to important impacts on the natural environment (Ianoş et al., 2009; Stănică and Panin, 2009), there are also economic activities which can be optimized in order to become sustainable on the long term, such as ecotourism, reed harvesting and processing, small-scale businesses based on traditional activities (Nichersu et al., 2016; Văidianu et al., 2015a).

Because of almost non-existent participatory governance of the area, the Danube Delta Biosphere Reserve Authority is often negatively perceived by locals as an entity with many rights (planning, zoning, management) but little responsibility for locals' livelihoods, leaving many local people feeling abandoned or as low-priority in management authorities' agenda (van Assche et al., 2017). The large number of stakeholder institutions and confusion surrounding their conflicting or overlapping roles further aggravates hostility towards the institutionalized management of the delta and its resources (Bell et al., 2001).

As some authors who have analyzed the legal and institutional framework in the Danube Delta Biosphere Reserve point out, sustainable development requires better integration of various sectors and improved cooperation between the government bodies, the local communities and stakeholders, as well as enhanced decisional transparency (Văidianu et al., 2015b, Văidianu et al., 2014). Furthermore, additional actions in order to promote participatory planning and education of the local population and visitors regarding activities that affect the environment (natural or built), as well as developing training tools for professionals are essential for the effective management of a protected area (Golumbeanu et al.,2012, Văidianu et al., 2014).

The present study aims at mapping potential land-use conflicts in the Danube Delta Biosphere Reserve, thus identifying vulnerability hotspots that require particular attention and need to be prioritized for specific, long-term conflict resolution action included in mitigation and adaptation strategies.

MATERIALS AND METHODS

The research used a methodology employing the geo-statistical analysis of geospatial data. The most recent data on land cover and use reflect the situation on 2012 and are freely offered by the European Union Copernicus Land Monitoring Service (http://land.copernicus.eu/pan-european/corine-land-cover/lcc-2006-2012/view) in a shapefile format; the projection is ETRS 1989 Lambert Azimuthal Equal Area L52 M10. In order to use the data with ArcView GIS to perform spatial analyses, the data needed to be re-projected unto the Romanian national projection system, i.e. Stereo 1970. Other data sets were freely provided by the Romanian Ministry of the Environment on their website dedicated to the geospatial data on environmental issues (http://mmediu.ro/categorie/date-gis/205); the datasets used in the analyses included the limits of Danube Delta Biosphere Reserve, the spatial distribution of birds, other species and habitats representing a priority in conservation. Their spatial projection is Stereo 1970.

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 computations of areas.

RESULTS AND DISCUSSION

Fig. 1 displays an "overall picture" of the spatial distribution of land used by humans (built up or agricultural land) and the ranges of birds, other protected species and habitats within the administrative limits of Danube Delta Biosphere Reserve. As can be seen, the areas dedicated to human activities overlap with at least one category of areas requiring protection.

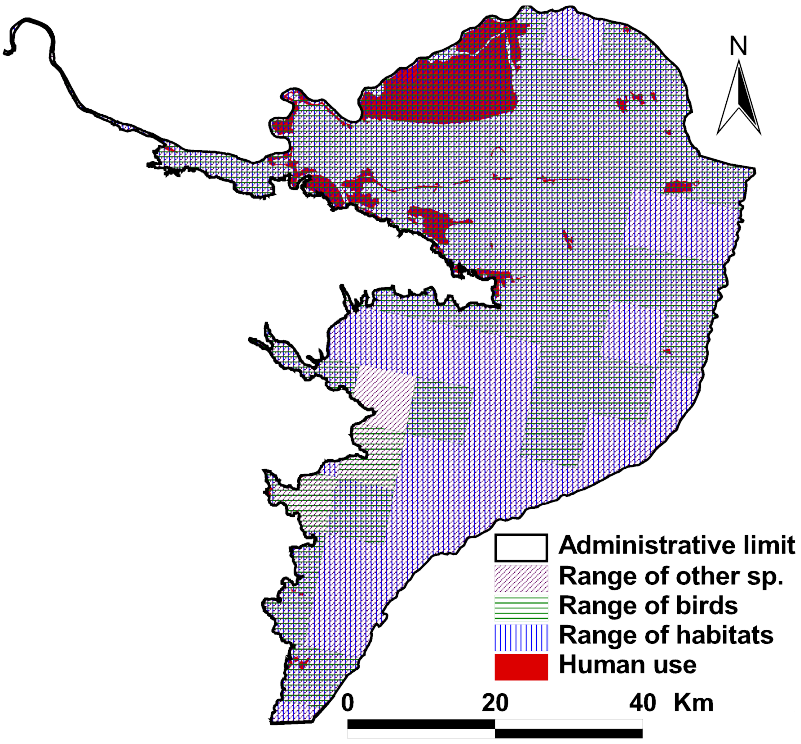

Figure 1. Overlapped distribution of the land used by humans (built up or agriculture) and the ranges of birds, other protected species and habitats within the administrative limits of Danube Delta Biosphere Reserve. Source: map created by the authors using data from Copernicus Land Monitoring Service and the Romanian Ministry of the Environment.

This finding is even more evident in Fig. 2, displaying the areas of potential conflicts. The image shows that conflicts are possible over almost the entire area dedicated to human activities, similar to the findings of Meiţă et al., 2014 and Petrişor et al., 2016. According to the figures obtained using the X-Tools extension of ArcView, the areas with potential conflicts between human activities and all conservation targets (birds, other species and habitats) cover 450 km^2 (8% of the total area of the reserve).

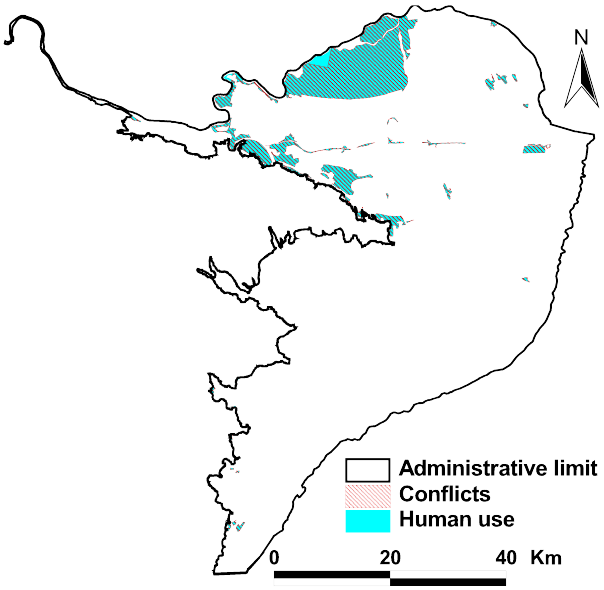

Figure 2. Spatial distribution of the areas of potential conflict between the human activities and species or habitats requiring protection within the administrative limits of Danube Delta Biosphere Reserve. Source: map created by the authors using data from Copernicus Land Monitoring Service and the Romanian Ministry of the Environment.

In general, these conflicts can take several forms: landlessness, joblessness, homelessness, marginalization, food insecurity, increased morbidity and mortality, loss of access to common property and social disarticulation (Cernea and Schmidt-Soltau, 2003), or different reactions: moving away, opposing/protesting, ignoring the protection status by poaching and harvesting the natural resources (Fiallo and Jacobson, 1995; Ferreira, 2002; Laurance, 2004; Campbell, 2005; Agrawal et al., 2008; Iojă et al., 2010; Grodzinska-Jurczak and Cent, 2011; Torri, 2011).

In order to reconcile man and nature, proper planning can offer solutions, especially for the natural protected areas (Meiţă et al., 2014; Petrişor, 2016; Petrişor et al., 2016), by the involvement of local communities in drafting the future of the human landscape in harmony with nature. However, tailored solutions, such as the planning methodology for wetlands (Petrişor and Meiţă, 2017), must be considered first, instead of applying the general planning methods.

The main limitation of the study relates to the fact that the planning system of Romania did not enter the digital era completely. The plans are not necessarily up-to-date, and, even more important, provided in a GIS format allowing for the integration of planning provisions with other spatial data. Due to this, the study was unable to overlap the planning provisions over the results of the spatial analyses, in order to identify the places where specific constraints are set over the built-up areas and over agricultural or other human activities, such that the resources are used in a way that can allow for a reconciliation of nature and humans.

CONCLUSION

The Danube Delta Biosphere Reserve is a place where conflicts between the human activities and the conservation of species and habitats can start at any point within the areas used for human activities.

Although the question of harmonizing society and the environment remains open, proper planning may offer solutions to their reconciliation. Finding innovative ways of valorizing local resources, including cultural assets and ecosystem services, building on the beneficial effects derived from a strong human-nature relationship in planning for resilience as well as empowering local communities to engage in bottom-up and collaborative action seem to be prerequisites for a sustainable development strategy in such particular areas.

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