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Methodological proposal to classify and delineate natural protected areas. Study case: Region of Extremadura, Spain

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ABSTRACT

A significant change to Natural Protected Areas (NPAs) has been occurring worldwide. This change could cause concurrently potential damages related with NPA characteristics. Particularly, many regions of Spain face strong pressure due to their geographical, demographic and economic handicaps. This study presents a methodological proposal for properly classifying and delineating NPA, highlighted in a case region of Extremadura, being NATURA 2000 site of local heritage and one of less developed regions in European Union (EU). With Geographic Information System (GIS), the case region was firstly analyzed and then presented the real geo-socio-economic impact and environmental protection implementation, which urgently need to adopt a new methodological proposal with the complex and diverse legislations. Knowing the problems from the case region analyzed, the methodological proposal as the objective of this research describes how to define proper criteria, how to propose land use plan, and how to analyze socio-economic development with professional and public participation for NPA, and, therefore, to revitalize the problematic area. Thus, this methodological proposal as new valuable approach, which filling a niche of current outdated NPA, can be used and reapplied to other destinations with similar geographical characteristics for analyzing its current situations and predicting its future improvements.

1. Introduction

In worldwide, a significant threat has been occurring in Natural Protected Areas (NPAs) or in NATURA 2000 sites of local heritage over the decades (European Commission, 2017). These areas can be characterized as both hotspots of relevant habitats with regard to the Birds Directive 2009/147/EC and Habitat Directive 92/43/EEC(European Commission, 2016a, b), and cultural landscapes that were extracted from the millennial interaction and iteration between humanity and the environment (Semeraro et al., 2016; Moreira et al., 2011). With the establishment of the first national parks in the beginning of 20th century, conservation has been timelier nuance that can define less interaction and much more protection to these changes since the late 1980s, with the appearance of the Brundtland report (Brundtland Commission, 1987). In the beginning of 1990s, with the Rio Summit (de Río de Janeiro, 1994), the changes of NPA have been obvious. Here, all the costs for acting on specific areas have moved towards the interactions between man and nature and the relations between flora and fauna and its surroundings (Cuff and Rayment, 1997; Marcer et al., 2010). Thus, these changes, in the context of international regulations, have been consolidated through high standard legislative documents. However, the integration of environmental protection with rural development plans and public participation is still not developed yet(Sunyer and Manteiga, 1998).International conventions or agreements, European directives, national legislations or regional regulations should determine the proper way to follow. The heterogeneity of legislative framework makes the applicability thereof often complicated, contradictory, and improvised at the time of the definition of NPA and the implementation of management plans (Mallard and Francois, 2013; Mikkonen, 2013).

Regarding with public participation, all the regulations refer and highlight its necessity for helping conservation and management tasks for NPA. However, it raises some problems when the election of Areas of Special Conservation (ASC) forms the depart of NATURA 2000 Network of local heritage. This election is systematically taking into account the scientific considerations and not the needs of local

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communities that have contributed to its maintenance (Apostolopoulou et al., 2012). Although there are some exceptions, this scenario is found by residents in these rural areas where they have already declared the definition of these areas. It is not surprising, therefore, the hostility that these communities are made to NPA (Martínez and Romero, 2003). Undoubtedly, it is very important that with public participation we need to properly follow recent legislation, delimitation of NPA and to define territorial incidence and methodology of gradual indicators of permissiveness of activities and land use in NPA.

It is clear that there are many positive implications of some NPAs implementation in rural economy: socio-economic improvement (Ervin et al., 2010; Nyaupane and Poudel, 2011) subsidies or direct aids to farmers and ranchers (Romero Calcerrada et al., 2000) diversification of the economic-tourism (Lindberg et al., 1998; Nyaupane and Poudel, 2011; Whitelaw et al., 2014) impact on the policies of rural development through acting LEADER ("Liaison Entre Actions de Développement de l'ÉconomieRurale", meaning of "Links between the rural economy and development actions") (Jeong et al., 2016). However, there are also negative implications. Among the negative aspects of the NPA declaration, many researchers would quote: the low acceptance of local population (Ojeda, 2000); the limitation of uses or activities (Troitiño, 1995); the conditions established to build new infrastructures and implement new activities; or lack of legislation uniformity to protect or manage similar areas (Hoyos et al., 2012). With respect to international literatures, some case studies tend to be more recent and numerous. They seem also to be a more marked theme in the case studies regarding one of the aspects that insists mostly in the European and national legislation, that is, public participation, which appearing their negative perception (Hiedanpää, 2002; Dimitrakopoulos et al., 2010; Pietrzyk-Kaszyńska et al., 2012) or positive perception on it (Jones et al., 2012). Other case studies also explore the importance of local communities in the conservation, maintenance and management of these areas (Getzner and Jungmeier, 2002; Visser et al., 2007; Söderman, 2009; Louette et al., 2011; Young et al., 2013; Jeong et al., 2016). Besides these aspects, another important group of research work is analyzing exclusively the conflict generated by the community of environmentaldirectives in the development of new activities, equipment or infrastructures that allow further growth of the local communities (Palerm, 2006; Beunen et al., 2013) or the actual application thereof in relation to national legislation (Morris, 2011; Jones-Walters and Čivić, 2013). Finally, it is also relevant to highlight the most conservationists' visions or links to environmental concepts of ecological corridors, ecological networks, networks of habitats, ecological relations, interactions of hybrid species, habitats, biodiversity, etc. (Jongman, 1995; Velázquez et al., 2010; Jackson, 2011; Bryan, 2012). For this reason, many studies have presented and delivered indicators on the coverage, land cover trends, pressures, performance, and management efficiency of NPAs (Joppa et al., 2008; Nelson and Chomitz, 2011; Joppa and Pfaff, 2011; Geldmann et al., 2013; Nole et al., 2013; Bunce et al., 2013; Borrass, 2014; Coetzee et al., 2014; Marino et al., 2015; Gray et al., 2016; Saura et al., 2017), which also have an outstanding relevance in the European conservation area of the natural heritage and the delimitation of these areas.

This research presents a new methodological proposal to correctly classify and delineate NPAs and its aspects with highlighting a case study region of Extremadura, Spain. Specifically, the methodology suggested as the research objective is guiding to define concrete and specific criteria of determinations and limitations with professionals' participation. It is also to propose land use plan with public participation process and can analysis socio-economic development with public participation for NPAs of local heritage. With the support of Geographic Information System (GIS) tools, the analyzed maps of the case study region present the real geo-socio-economic impact and environmental protection implementation, which urgently need to adapt the methodology proposed with the complex and diverse environmental legislations. Therefore, this methodology as new valuable approach, which filling a niche of current outdated NPA, can be used and can be reapplied to other destinations and countries with similar geographical characteristics and aspects for analyzing its current situations and predicting its future improvements. The suggested approach isorganized first explaining a description of a case study region of Extremadura. Then, the "Proposed methodology" section presents to classify and delineate NPAs and its aspects. In the last section, the "Discussion and conclusion", discuss the results from the method application, summaries considerations found from this work, and describes suggestions for future research.

2. Theoretical and territorial basis. Extremadura as an example of region in which applies methodology

Extremadura is one of the Regions in which the methodology can be used. Taking into account different aspects such as the knowledge we have about the Region such as the environment, demography or socioeconomic level, how these aspects evolve and develop as well as the surface of protected open spaces and all what this involves, we believe that the methodology we propose can be clearly put into practice in Extremadura as well as in some other regions with similar characteristics. Apart from that, in order to put the methodology into practice, we have also taken into account aspects like such a reduced population density, territorial and societal deficiencies as well as population abandonment.

Extremadura is a region with two major provinces, Badajoz and Cáceres, bordered Castilla y León to the north, Andalucia to the south, Castilla y La Mancha to the east and Portugal to the west. Its location within Spain coordinates 39 °N 6 °W as depicted Fig. 1. The region has a total area of 41,634 km^2 (8.2% of Spain).

According to the Corine Project 2012 (see Fig. 2), the agricultural area of Extremadura including the agroforestry system had 58% of the region comparing to the rest of Spain, having 50% of the land. The area mostly consists of the irrigated crops, arable land and permanent crops. In the forest area, its biggest part is the natural grasslands reaching 15% and its next part is the sclerophyllous vegetation reaching 10% is in Extremadura. These two forest areas are considered as the most important areas done by the National Forest Inventory of the Ministry of Environment. The water area is very small of the whole area (1.65%), but is very important from ecological and sustainable point of view. This water area is three times bigger than the wetlands area although that is mostly man-made reservoirs and exceeds more than 1% of the total area along with Murcia and Cantabria region. Regarding with the artificial area, due to geographical reasons, its occupation level is very low (0.7%), having a weak urban system in relation to its territorial extension and very low population density also.

As shown in Fig. 3, two maps represent the difference of land cover and land use changes in Extremadura between 1990–2000 and 2006–2012. In Fig. 3A (1990–2000), the agricultural area has been slightly decreased, but the forest area including the agroforestry system has been increased. Particularly, the agriculture industry has an import role in Extremadura economy as seeing its relevance and coverage changes occurred in this period. Thus, the dynamics of rangeland have been occurred in the areas between the agricultural and forestry area. These areas have resulted a net increase of the forest area and have represented an extensive management of the marginal or border area. When considering the artificial area, the expansion of water area has been noticed due to new reservoirs' construction that was higher than the general artificial area growth. However, reflecting the initial coverage of water area that was very low, it was considerable that the increase was relatively high (30.7%). Precisely, the regulation of water resources and irrigations considered as important element has been oriented due to energy production. The construction of dams and water infrastructures has caused a clear detectable effect to the territory. All these aspects are positive since we have water supplies for human consumption and agricultural exploitation for irrigated land which is