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Handling historical information on protected-area systems and coverage. An information system for the Natura 2000 European context

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ABSTRACT

Protected-area coverage is an internationally-recognized surrogate indicator for measuring biodiversity conservation. To measure trends in biodiversity conservation over time, historical records on protected-area boundaries are needed. Protected-area systems represent a challenge in information management for public environmental organizations. Protected areas may be subjected to changes which must follow a mandatory multiple-step administrative process. A wealth of information is generated which needs to be stored in a way that eases the handling process and for future reference. We present an information system which handles both change on protected-area boundaries over time and their related administrative processes. It also provides distributed data maintenance functionality as well as integrated alphanumeric, file and cartographic information handling. We discuss the actual implementation of the system for handling Natura 2000 sites in the Catalan and Spanish contexts. The designed system is applicable to other European Union member states.

1. Introduction

Protected areas are legal instruments specially dedicated to the protection and maintenance of biological diversity (IUCN, 2010). Protected-area coverage is widely used as a surrogate indicator, *proxy*, for estimating trends in the protection of biodiversity (United Nations Environment Programme, 2010, 2006; United Nations Development Programme, 2010; European Environment Agency, 2005; Millenium Ecosystem Assessment, 2005; Chape et al., 2005). Protected-area coverage is calculated by adding the area of each protected area in a given region as defined by their boundaries.

The Convention on Biological Diversity (United Nations, 1992) strongly recommends that signing parties establish a system of protected areas in order to conserve biological diversity. Spatially-enabled databases are needed to perform gap analysis and evaluate nature protection (UNEP–WCMC, 2008; Scott et al., 1993). Such evaluations provide important insight on where new resources should be placed (Brooks et al., 2004; Scott et al., 1993). To analyze trends in nature protection over time historical boundary records are needed.

Nature protection frameworks at the regional, national and international levels conform a series of overlapping cartographic boundaries and regulations which represent not only a major challenge for decision-making but also for information management in public environmental organizations. These organizations need tools for querying and analyzing this intricate and geographically-tied web of legal texts. These tools not only serve the purpose of well-organized, accessible, comprehensive, quality and up-to-date historical repositories of information but can also assist them in dealing with long legal processes with conflicting parties.

Current technological development in information and communication technologies (ICT) offers an unprecedented opportunity to greatly enhance the handling, analysis and public dissemination of environmental information. Governmental organizations are required and recommended by competent bodies to make public such information (The Council of the European Communities, 2003; World Commission on Protected Areas (IUCN), 2005). They are responsible for providing reports and accounts of statistics on protected areas including historical information (European Environment Agency, 2007).

The European Union nature protection policy is based upon Natura 2000, a coherent ecological network of protected areas comprising *Special Areas of Conservation* (SAC) (The Council of the European Communities, 1992) and *Special Protection Areas* (SPA) (The Council of the European Communities, 1979). European Union

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member states are responsible for submitting to the European Union a list of *Sites of Community Importance* (SCI) for approval and declaration as SAC. After this process, protected areas may also still preserve their former protection category. Thus, Natura 2000 represents a further level of legal complexity. In the case of Catalonia, in a single administrative process, 73 new protected areas have been added to the already existing list of other types of protected areas managed by the Catalan government (Generalitat de Catalunya, 2006, 2007).

Protected areas are not static legal entities over time but undergo changes in their regulations which follow the legal and socioeconomic contexts at any given moment. These changes may not only affect the existing set of regulations but also their boundaries; *i.e.* they get extended, reduced, reclassified, amalgamated with neighbouring sites, renamed, etc. (Fish et al., 2005). To be legally valid, each of these changes must undergo a mandatory, strict and predefined administrative process that involves a series of steps starting at the initial proposal by the promoting party, *e.g.* the public administration, and ending with the publication of the approved legal text in the official governmental bulletin. Each of these steps may introduce interim changes in the working set of boundaries; some of them due to claims placed by affected parties, *i.e.* local administrations and the public in general. An accurate handling of all this information is crucial for an effective guidance of the process and for ensuring adequate treatment of this external participation. Historical digital archives, *i.e.* databases, represent a fundamental tool for handling all this information. They also provide the base from which it is possible to understand the historical context of protected-area establishment (UNEP–WCMC, 2008; UNECE, 1998) and evaluating protected-area coverage over time is possible.

1.1. Handling of historical information in reference protected-area databases

To our knowledge, only the World Database on Protected Areas (WDPA) holds information on historical changes in protected areas (UNEP–WCMC, 2009; Chape et al., 2005; Fish et al., 2005). However, the scope and aim of the WDPA is quite different from the information system we present. WDPA is a global compilation of information offered via a web site in a digested way. As of February 2010, Natura 2000 sites are still not available at the WDPA (IUCN–UNEP, 2010; UNEP–WCMC, 2009). We present an information system which handles historical versions of protected-area boundaries and assists in handling the administrative work involved in protected-area declaration, modification and termination.

The Protected Areas Database of the United States of America is a collaborative effort between governmental and non-profit organizations. Its latest downloadable version, released April 2009, does not contain historical information and its plans only include the date of establishment of protected areas for a later date (GreenInfo Network, 2010; Conservation Biology Institute, 2008).

In Australia, the Collaborative Australian Protected Areas Database (CAPAD) is a textual and spatial database compiled from information supplied by the Australian, State, and Territory Governments and other protected-area managers (Australian Department of the Environment, Water, Heritage and the Arts, 2009). CAPAD's GIS layer contains only the latest valid boundaries with only information on the gazettal date of the original proclamation and the date of the most recent gazetted amendment but not a complete historical record of changes (Australian Department of the Environment, Water, Heritage and the Arts, 2009; Australian Department of the Environment and Heritage, 2004).

The European Common Database on Designated Areas (CDDA) offers information on the nationally designated sites for the Natura 2000 ecological network (European Environment Agency, 2009b). The CDDA database holds only information on the gazettal date of original declaration and latest amendment but not its historical track (European Environment Agency, 2009c). There is a recommendation that the structure be redesigned to accommodate historical information (European Environment Agency, 2007).

In Germany, a member state of the European Union, the map service of the Federal Agency for Nature Conservation offers only the latest available official boundaries and the year of the protected-area establishment (German Federal Nature Conservation Agency (BfN), 2010).

In Spain, another member state of the European Union, the Spanish chapter of the Federation of Nature and National Parks of Europe holds the Protected Areas Observatory (Europarc España, 2010) and provides only the latest available boundaries, the year of the protected-area declaration and the latest legal modification.

In this paper, we present an information system, a module of the *Natural Heritage Information System of Catalonia (SIPAN)* of the Catalan government, which can handle change in protected-area boundaries at two nested-levels. At the first level, every single regulatory change is recorded. At the second nested level, every interim change due to the administrative process handling of the first-level regulatory change is also recorded. The first level allows for the tracking of trends in protected-area coverage through time. The second level helps public environmental organizations in driving the process of protected-area change. The system is comprehensive to the whole of the protected-area system in Catalonia. We use Natura 2000 as an example on which to demonstrate it. Information can be fed to reference databases such as WPDA (IUCN, 2004) and CDDA (European Environment Agency, 2009a) as recommended by the Convention of Biological Diversity (United Nations Environmental Programme, 2008).

The complexity of policy frameworks in different environmental domains, in the European Union and elsewhere, makes environmental information systems a necessity for policy makers and for the public. The contribution of this paper in information management on the biodiversity protection domain is in line with other efforts in different environmental domains such as Calder et al. (2008), Tuchyna (2006), Culshaw et al. (2006), Düpmeier and Geiger (2006), Usländer (2005). Furthermore, such a system could feed other environmental systems which use spatio-temporal information on nature protection or land-use for a range of environmental analyses including global change (Schaldach and Alcamo, 2006).

2. Legal context

The Birds and Habitats directives constitute the basic European policy framework for nature conservation (The Council of the European Communities, 1992, 1979, 1997). They declare *Natura 2000* as a *coherent ecological network* composed of *Special Areas of Conservation (SAC)*. SAC represent sites in need of conservation for containing habitats of European value or parts of the distribution areas of species of European value. In the case of Spain, several legal texts transpose these directives and establish the legal framework by which regional governments, *e.g. the government of Catalonia*, are entitled to propose and declare Natura 2000 sites (Gobierno del Estado Español, 1998, 1995, 1989).

The government of Catalonia, coordinated with the rest of regional governments by the Spanish Government, submitted to the European Union the list of Sites of Community Importance (Generalitat de Catalunya, 2006, 2007; Parlament de Catalunya, 2006). All sites proposed as SCI are incorporated into the Catalan protected-area network.