Chapter 12

Integrating Spatial Planning of Protected Areas and Transportation Infrastructures

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ABSTRACT

Our study focuses on the position of protected areas in relation to the transport infrastructure planning and their specific requirements (fragmentation, artificial edge effects, buffer zones, etc.). The presence of transport infrastructure in protected areas is discouraged by the European Union legislation and although their avoidance should be easy, there are numerous cases in which knowledge of the protected areas lacked from the transport infrastructure planning. Our chapter presents the theoretical aspects of integrating protected areas with transportation infrastructures and the main software and methodologies which can be used in the planning process exemplified with case studies. The multitude of challenges found in transportation and conservation planning requires complex decision support systems (DSS), such are the tools based on Geographical Information Systems (GIS) we showcased in this chapter.

1. INTRODUCTION

The environment of our planet is dramatically changing under an ever increasing pressure on the natural resources by the large human population and its wide range of needs. One of the most visible and important direction of change is the destruction of natural habitats, affecting the very functionality that entire ecosystems rely on (Primack, Pătroescu, Rozyłowicz, & Iojă, 2008). There are immediate and long term consequences, not only on the natural balance, but also on the human communities (M.R. Niță,

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As an example, clearing the forests for resource exploitation, agricultural uses or to accommodate expanding cities, sets in motion a chain of events including loss of habitats and biodiversity, increased erosion and loss of soil, increased water runoff and floods, climate change and desertification (Acevedo et al., 2008). To remove the natural habitats, which at the present seems entirely possible and the direction the human population is choosing, would imply the loss of ecosystem services and resources with catastrophic consequences (MEA, 2005).

Protected areas emerged as an important tool to oppose this process and safeguard natural elements vital for our present life and future existence, and are one of the most common land conservation policies worldwide. For the International Union for Conservation of Nature (IUCN) a protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means (Chape, Blyth, Fish, Fox, & Spalding, 2003), to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley, 2008). Considering this widely known definition, protected areas ensure not only the preservation of the natural aspects, but also of the coexistent cultural values (Antrop, 2005), acknowledging in this way on one hand the juxtaposition of human presence on the same space as the natural one and on the other hand the necessary public positive involvement (Primack et al., 2008). The needs of the population living in the protected areas and of the general population, including relevant stakeholders, are to be taken into consideration and adjusted with the conservation requirements if long-term sustainability is to be achieved (Ontario Ministry of Natural Resources, 2009).

Successful protected areas should be established on principles such as the precise identification of values (species, habitats, biomes, ecosystems etc.) and pressures (del Saz-Salazar & Rausell-Köster, 2008), adequate legislation (including management plans) and objectives (Lichtenberg, Tra, & Hardie, 2007), appropriate zoning (M. E. Watts et al., 2009), balanced management of uses (prohibited and permitted activities), permanent public consultation and involvement, creative awareness and education programs (Sevenant & Antrop, 2010), sustainable financing, intelligent administration or effective monitoring and response, easy access to relevant information about the present situation and the possible effects of proposed policy changes (Audenaert, De Cleyn, & Vankerckhove, 2008; Handy & Mokhtarian, 1995).

In order to provide the much needed system equilibrium at regional and global scale, one of the most important principles when establishing protected areas is to ensure not only that they maintain the conservation of their components but also are covering in a network distribution all the key ecosystems. The European Union’s Nature 2000 network of protected areas ensures the long-term survival of Europe’s most valuable and threatened species and habitats (Ioja, Rozylowicz, Patroescu, Nita, & Onose, 2011). Worldwide, in the 2003 UN list of protected areas there were 100,000 protected areas in 227 countries or territories, occupying 11.5% of the planet’s land surface area (Chape et al., 2003).

The activities that exist inside and outside with potentially negative side-effects needs to be carefully administrated. Every activity has an ecological footprint (M.R. Niță, 2008; Pătroescu, Niță, Iojă, & Vânău, 2009), from the most destructive ones, such as urban development, forest exploitation/deforestation, farming and mining to the traditional, less intensive ones. Not always activities that produce environmental externalities are addressed by legislative measures or incentives for reducing their impact. An element that is always there, no matter what activity is taken into consideration, is the transport infrastructure. The maintenance of ecosystem functions and structures increases in difficulty as they have to coexist with the transportation infrastructure (Zhu & Dale, 2000).

Transportation infrastructure is an essential component of our present way of life. It sustains the mobility of people and it is vital to the production and distribution of goods (Hensher & Button, 2003). The development of modern fast ways of transport, including aviation, rail, road, and ship transport led