



Revealing the transversal continuum of natural landscapes in coastal zones - Case of the Turkish Mediterranean coast



Artan Hysa^{a,*}, Fatma Ayçim Türer Başkaya^b

^a Graduate School of Science, Engineering, and Technology, Istanbul Technical University, Ayazaga Campus, 34496 Maslak/Istanbul, Turkey

^b Department of Landscape Architecture, Istanbul Technical University, Harbiye Mahallesi, Taşkışla Cad., 34437 Şişli/Istanbul, Turkey

ARTICLE INFO

Keywords:

Coastal landscapes conservation
Bands of coastal landscapes
CORINE
ICZM
Model Builder

ABSTRACT

The study presents an analytical framework for examining the transversal structure, rather than the longitudinal pattern of the landscape in coastal zones. Our methodology introduces the concept of the ‘band’ as an alternative to the ‘buffer zone’. The Band is a dynamic notion which is rooted in the organic structure of landscape patterns and which relies on the order of adjacency/connectivity between land cover patches and the coastline. The study utilizes CORINE Land Cover data to produce 10 bands that stretch along the Turkish Mediterranean coast. By introducing two extra attributes: ‘band level’ and ‘transversal continuum depth’, this method is useful for the identification of; (i) transversally connected coastal natural landscape mosaics, (ii) endangered natural landscape patches to be conserved, and (iii) potential artificial surfaces to be restored. The workflow is formalized via Model Builder (ArcGIS), and is applicable to any coastal context in support of diverse decision making processes such as those of Integrated Coastal Zone Management (ICZM).

1. Introduction

Mediterranean coasts have been extensively studied and investigated due to their unique and complex social, economic, and, particularly environmental systems (Di Castri and Mooney, 1973; Blondel and Aronson, 1999). Historically, they have acted as a common pool resource (CPR) for numbers of communities, resulting in a diversity of cultural and natural landscape patterns within its surrounding areas (Duarte et al., 1999; Ostrom, 2008). Closer to our purpose, there have been several studies which have assessed the landscape structure of the Mediterranean region, both in terms of their spatial distribution and their time-dependent alterations of the land cover (Hepcan, 2012). With reference to the literature, the land surface properties of Mediterranean coasts generally are studied according to their longitudinal structure (Ivanov et al., 2013; Pons and Rullan, 2014), and with a focus on the linear configuration of the landscape running along the coastline. This is mainly related to the perception of the coastline as a boundary edge more than a transitional zone between the marine and terrestrial environments (van der Weide, 1993).

The motivation for thinking about coastal zones in a more comprehensive manner is not new. One of the main principles put forward by Kelleher and Kenchington (1991) is a *holistic approach*, which highlights a wider framework for the *connection between the marine and terrestrial elements of coastal zones*. The importance of a holistic

approach is also strongly targeted in Agenda 21, which advocates that a wider view of the coastal zone is necessary since 75% of global population is expected to settle within 60 km of a shoreline by 2020 (UN, 1992). In particular, the chapter 17 of Agenda 21 is generally accepted as having paved the way for the delineation of significant areas of critical habitat to be protected (Barcena, 1992). A broad, holistic approach for coastal zone management is also highlighted as one of the seven principles of Integrated Coastal Zone Management (ICZM), which stresses on the inclusion of the offshore and upland environments, such as land-sea interlinks, as a part of the broader geographical context (Ballinger et al., 2010).

Our study aims to contribute to analysis methods of the transversal structure of landscapes in the coastal zone, rather than their longitudinal patterns. Specifically, the research focuses on the coastal-inland transition spatial gradient of natural landscapes. The core focus is the cross section rather than the front line of the coastal area. Indeed, the idea of the transversal gradient of landscape structure in coastal regions has been highlighted in previous ecological studies (Crossland et al., 2005; Newton and Icely, 2007). The common objective of these studies has been to measure the permeability of coastal areas in terms of species accessibility from continental lands to the coastal front line (Nord and Forslund, 2015) and vice-versa. This approach is proposed as a crucial condition for preserving the richness of the coastal habitat (Theobald et al., 2012). In this context, the proposed method presented

* Corresponding author.

E-mail addresses: artanh@gmail.com (A. Hysa), turerfat@itu.edu.tr (F.A.T. Başkaya).

in this article can be claimed to contribute to the spatial mapping of wildlife permeability across the coastal-inland gradient.

The issue of permeability or the physical accessibility is dependent upon the uninterrupted condition of the habitat, and this guides the discussion towards the concept of “*landscape continuum*”. At the same time, depicted as *landscape connectivity*, it is crucial in providing a habitat for wildlife (*landscape patches*) and allowing movement (*ecological corridors*) throughout a territory comprised of an uninterrupted ecological network (*matrix*) (Forman, 1991). Landscape dis-connectivity or fragmentation is a highly sensitive condition which is a crucial assessment goal in sustainable planning practices (EEA, 2011). Consequently, the transversal natural landscape continuum along the coastal-inland gradient is of great importance to investigate.

The coarser study area of this research consists of the zones along the Turkish Mediterranean coast. The study excludes the islands, since the de-naturalizing process occurring in these areas is considered to be much more modest when it is compared to that of the continental coastal zones (Pons and Rullan, 2014). Moreover, due to their size, the Turkish Mediterranean islands lack the required transversal depth within of coastal-inland gradient, and are therefore irrelevant to the proposed method. Excluding the islands, the 4181 km of the Turkish Mediterranean coast is one of the longest national coastlines bordering the Mediterranean Sea (Gunay, 1987). This geography has been the motivation for several studies which focus on regional (Berberoglu, 2003) as well as local scales (Esbah et al., 2010; Cinar, 2015).

The Turkish Mediterranean coast is considered to have an important and unique geography due to its eco-environmental features. The eastern part of the Turkish Mediterranean coast, in particular, has an exceptionally rich biodiversity (Yilmaz, 1999). According to the German Federal Agency for Nature Conservation, and based on IUCN statistics, the Turkish Mediterranean coast is home to 9383 species, 2682 of which are endemic. This fact makes the region the richest habitat in the Mediterranean area (GFANC, 2012). Additionally, it serves as a transitory habitat for several species of migrating bird as stop-over or breeding sites (van der Have and van den Berk, 1988). This is a factor of great interest, as it is essential to consider the transversal continuity of natural areas in coastal zones when studying the flight corridors and the route selection criteria of migrating birds.

On the other hand, the Turkish Mediterranean coast has been caught between touristic development agendas and natural conservation goals. Touristic services and their associated infrastructures have resulted in significant changes in the natural and cultural landscapes of the Mediterranean area with a dominant effect in the frontal line of the coastal zone (Antrop, 1993). The spatial spread of this concentration from the coastline towards the inland areas is advocated as a sustainable development strategy for tourism (Markovic et al., 2009) being highlighted within ICZM protocol as well (UNEP/MAP/PAP, 2008). While, this attempt diversifies and enriches coastal tourism by easing the pressure on the coast itself, it may cause extensive landscape fragmentation among natural areas further inland. Therefore, it is important to develop an analytical framework to assess the existing transversal continuum of natural landscapes in the coastal zone.

In response to these pressures, the buffer concept is one of the most effective environmental protection strategies in landscape planning practices for both coastal zones and watercourse areas (Fischer et al., 2000). The most important debate regarding the buffer concept is related to the width of the buffer strip. Although there is no universally accepted standard of coastal zone boundaries, certain sets can be derived from the case-based management issues that arise (Clark, 1997). In the literature, there are two main approaches towards this issue; which differ in having a fixed or varying width for the buffer strip. Being single parameter dependent, fixed-width buffer strips are easier to define and manage, but they are often insufficient when attempting to explain several ecological functions (Castelle et al., 1994). On the other hand, buffer strips with variable widths are based on a range of functions. They are typically dependent on context-specific

circumstances including contiguous land use, and stream and site conditions such as; vegetation, topography, and hydrology (Castelle et al., 1994). This approach has been applied in previous studies (Başkaya and Tekeli, 2016).

This article is intended to challenge the *buffer zoning* approach widely theorized and practiced in landscape research (Fischer et al., 2000), by introducing the concept of the *band*. In this study, the *band* is defined as the level of spatial relationship that a specific landscape patch has with the coastline. This approach is dependent on the unique properties of a given landscape pattern, rather than the artificial (man-made) zoning found within the concept of buffer zones. It utilizes the land surface structure as derived from Land Cover/Land Use (LULC) maps. Thus, the findings of the proposed model are dependent upon the properties of the LULC map being used, as this is the fundamental input to the analytical process.

The raw material and the main analytical parameter of this study is the CORINE Land Cover (CLC) data of 2012, which is available as an open source via the European Environment Agency (EEA). Initially, it is used to generate the coastline feature to be utilized as the second parameter of the analysis. Both variables are introduced to a structured/designed process of spatial analysis utilizing GIS technologies. The analytical process is then developed into a model by using the Model Builder utility of ArcGIS, thereby making it applicable for other coastal areas. Using the model and two sets of input data from any coastal zone, it is possible to perform the analysis in a very short period of time. The time efficiency of the analysis provided via the proposed model makes it a useful tool for rapid connectivity analysis of a given landscape at a coarse scale, during the decision making processes of ICZM.

Through four workflow stages, the study produces several results and findings. First, by introducing two extra attributes to landscape patches indicating the *level of band* and the *transversal continuum depth* (TCD) value, the study reveals the *transversally connected natural landscape mosaics* along the Turkish Mediterranean coastal zone. Further analyzing the highlighted agglomerations of interconnected natural lands allows the identification of a set of *endangered* landscape patches to be preserved. In other words, if the landscape units belonging to the ‘red list’ of coastal natural land surfaces are de-naturalized, this may lead to extensive transversal fragmentation of natural lands in coastal zones. Similarly, it is determined that a set of artificial land surfaces are located in the front line of the coast to act as a barrier between the coastline and existing transversally connected natural landscape mosaics. In other words, if these *potential* patches were recovered/restored, they would enhance the transversal continuum of the natural landscapes in coastal zones.

As a conclusion, the article presents a framework for analyzing the landscape pattern in coastal zones. The main goal is to reveal the existing and potential transversal continuum of the natural landscapes within them. The formalized model is applicable to other cases which have similar contexts. It is intended to be a supporting tool in diverse decision making processes of coastal management and planning. The study of the transversal structure of natural landscapes in coastal zones can offer a comprehensive response to both ecological concern and sustainable tourism planning. In particular, the delineation of areas which are remarkable due to the existence of critical habitats they contain, is a crucial contribution to the objectives of Agenda 21 (Forst, 2009). Overall, the multifaceted implications of the presented framework brings it closer to the goals and objectives of ICZM agendas.

2. Materials and methods

2.1. Analytical approach; the concept of bands

Preceding studies have shown that coastal zones generally are studied according to fixed-width buffer strips of 1-10-50 km (Ivanov et al., 2013) or 1-2-10 km (Pons and Rullan, 2014). In these works, the buffer

Download English Version:

<https://daneshyari.com/en/article/8060689>

Download Persian Version:

<https://daneshyari.com/article/8060689>

[Daneshyari.com](https://daneshyari.com)