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Method Article

A GIS-based method for revealing the transversal continuum of natural landscapes in the coastal zone

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A B S T R A C T

The method presented in this article is helpful for analyzing the landscape properties and unfolding the transversal continuity of natural landscapes in the coastal zone. The novel conceptual approach to analyze the landscape structure in the transversal direction with reference to coastline is different from others focusing on the longitudinal analysis of landscape properties in the coastal areas. The procedure is relying on the fundamental questioning of the spatial relation of each landscape patch with the coastline. The raw material is Land-Use/ Land-Cover (LULC) data. At this stage the method is tested successfully utilizing CORINE Land Cover (CLC) data. The method is structured in four sequential stages, and formalized via ModelBuilder/ ArcGIS software into a model applicable to any coastal zone. The output of each phase is used as the raw material of the following stage. The presented method is useful in identifying a set of endangered natural landscape patches located as a hinge in between two transversally connected natural landscape mosaics (TCNLM). A second set is highlighted as potential artificial surfaces located as barriers between the coastline and TCNLM. The presented method is useful in the analysis stages of Integrated Coastal Zone Management (ICZM) and Sustainable Coastal Tourism (SCT).

- *The presented procedure focuses on the transversal landscape structure in the coastal zone rather that the classical longitudinal analysis of coastal landscapes.*
- *The procedure brings a new way of CORINE Land Cover data utilization beyond its basic monitoring objective, useful for a variety of decision making and management processes such as; Integrated Coastal Zone Management (ICZM), Sustainable Coastal Tourism (SCT), Environmental protection, Landscape connectivity, etc.*
- *The method builds a novel tool set customized via ModelBuilder in ArcGIS, being applicable to any coastal zone.*

A R T I C L E I N F O

Method name: ModelBuilder, Transversal Continuity Depth (TCD)
Keywords: ModelBuilder, ArcGIS, CORINE Land Cover, ICZM, Sustainable Coastal Tourism
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Specifications Table

Subject area	• *Earth and Planetary Sciences*
More specific subject area	*Coastal Zone Management, Environmental Protection, Landscape Connectivity*
Method name	*ModelBuilder, Transversal Continuity Depth (TCD)*
Name and reference of original method	*Hysa, A., & Türer Başkaya, F. A. (2018). Revealing the Transversal Continuum of Natural Landscapes in Coastal Zones- Case of the Turkish Mediterranean Coast. Ocean & Coastal Management, 158, 103-115.*
Resource availability	*CLC data source:* http://rod.eionet.europa.eu/obligations/572/deliveries *ModelBuilder Diagrams are shared with this article.*

Method details

Conceptual approach: the concept of band

The method presented in this article originates from an unusual conceptual approach to the analysis of landscapes in the coastal zone (Fig. 1a) as developed in our previous research [1]. Generally, the coastal landscapes are investigated in their longitudinal structure along the coastline, leading to the widely used approach of fixed buffer strips (Fig. 1b) [2]. In contrast, our approach is focusing on the transversal formation of landscapes along the coastal zone. Investigating the landscape structure from the coastline further inland, leads to the novel *concept of bands* (Fig. 1c). More precisely the band level refers to the adjacency order a certain landscape patch has with the coastline considering the later as the initial spatial reference. This new approach is profoundly settled on the organic structure of landscape patches in the territory (Fig. 1c), much different from the fixed buffer strips being an inorganic zoning (Fig. 1b).

The procedure is formalized into a model/ toolset via ModelBuilder in ArcGIS 10.2.2 software. ModelBuilder is accepted as a visual programming language useful in constructing reprocessing workflows in the form of models. The formalized models consist of stringed sequences of geo-processing tools by providing the output of the previous operation as the input of the next one [3]. The usage purposes of Model Builder is of a very wide range but in this experiment it can be considered to help in developing a model as a customized tool unique to the goals of the study [4].

The workflow consists of one preparatory and four analytical stages (Fig. 2). First, the input parameters of the process, being the land cover data and the coastline feature, are derived from Corine Land Cover (hereafter CLC) geospatial data as the raw material of this study. Both inputs are introduced into the process of the Stage 1 generating the set of 10 bands (Fig. 2). The output of the Stage 1 is the main input of the Stage 2 which results in the set of *transversally connected natural landscape mosaics* (hereafter TCNLM). The main goal of the Stage 3 is the reclassification of each landscape patch of TCNLM by the maximum band level they provide transversal connectivity for, by assigning the *transversal continuity depth* (hereafter TCD) value. Last, at the Stage 4 there are defined a set of endangered natural landscape patches and a further set of potential artificial land cover surfaces.

The endangered natural landscapes set consists of patches which are located as singular hinges in-between two TCNLM. Generally, these patches belong to middle bands such as, the band 5, the band 6, or the band 7. Their endangered status relies on the assumption that if such unique natural landscape patches were artificialized, they would cause landscape fragmentation to TCNLM in the coastal zone. Similarly, the set of potential artificial landscape units includes artificial patches belonging to the band 1 (located in the waterfront), which act as barriers between the coastline (sea/ ocean) and the TCNLM. These artificial patches are labeled as potential based on the assumption that if they were recovered/ restored close to their natural state, they would provide extensive connectivity between the coastline and TCNLM.

Stage 1 in detail

The Stage 1 of the procedure is preceded by a preliminary stage (Stage 0 in Figs. 2 and 3) aiming the derivation of the geospatial polyline feature of the coastline. First, CLC data in the coastal zone is