

# Deciphering Coastal Vulnerability Index (CVI) for the coastal areas of Rhodes Island and the possible impact on tourism

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## Abstract

Rhodes Island, located in the southeastern Aegean Archipelagos. Coastal areas, extended sandy beaches, people's hospitality, and adequate infrastructure are principal factors that have increased the touristic value of the island. The estimation of the Coastal Vulnerability Index is important, since coastal environments play an important role for the tourist decision. Coastal systems are the most sensitive in environmental changes. In this study CVI is used, in order to indicate the most vulnerable areas, through the interpretation and the calculation of various parameters. The data for the calculation of the CVI were mainly geomorphological, as long as fieldwork and laboratory analysis. The data were interpreted through GIS platform. GIS environment contributes to the simultaneous processing of all these data, the representation of the spatial distribution of these parameters, and finally to depict of the most vulnerable areas. Thus, these results will contribute to the most suitable, sustainable solutions for the decision making authorities.

**Keywords:** CVI, Coastal environments and tourism, Sustainable development, South Aegean Prefecture.

## 1. Introduction

Sea level rise is currently one of the most important climate change pressures on the European coasts

(Alexandrakis et al., 2010). According to the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4) sea level is projected to rise till the end of the 21st century. In addition, shoreline change is considered one of the most dynamic processes in coastal areas (Alexandrakis et al., 2010).

The purpose of this study is the assessment of coastal vulnerability of Rhodes Island, which is located in the southeastern part of the Aegean Archipelagos (fig. 1).

## 2. Methods

The Coastal Vulnerability Index (CVI) which was used proposed by Thieler & Hammar-Klose, (1999). It has six variables (Coastal slope, Geomorphology, Relative Sea Level change, Shoreline displacement, Tide gauge, Significant wave height) and it is calculated as the square root of the product of the six variables, ranked from 1 to 5 according to table (1) by the equation:

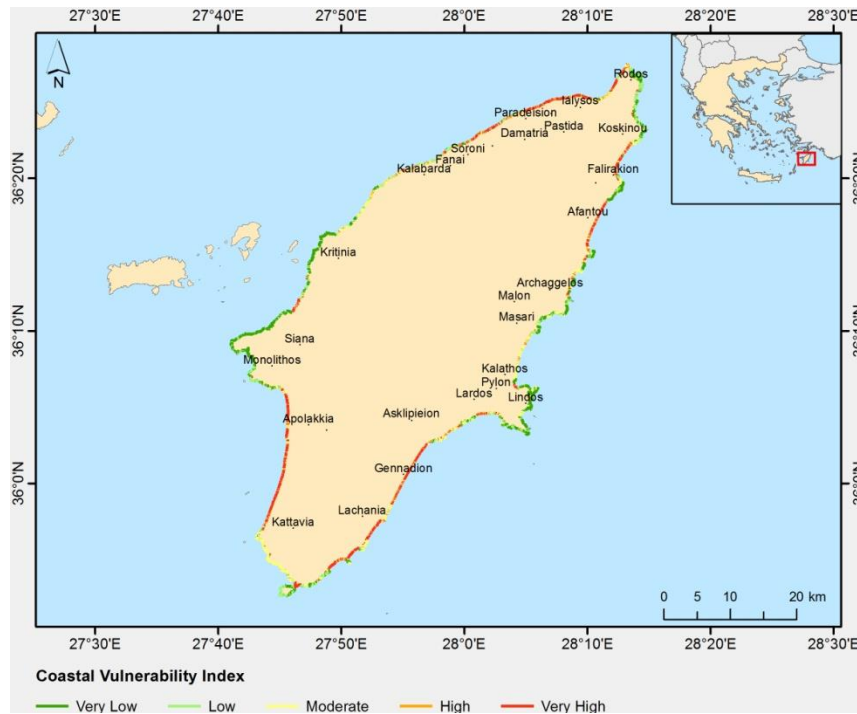
$$CVI = \sqrt{\frac{(a * b * c * d * e * f)}{6}}$$

a: Geomorphology, b: Coastal slope (%), c: Shoreline accretion/erosion (m/y), d: Relative Sea Level change (mm/y), e: Mean Tide range (m), f: Maximum Significant Wave Height.

Finally, a database was established through GIS in order to interpret all the information simultaneously.

**Table 1.** Variables and Limits modified for this study, based on Thieler & Hammar-Klose, (1999)

CVI	Very Low	Low	Moderate	High	Very high
Variables	1	2	3	4	5
Geomorphology	Rocky cliffed	Medium cliffs	Low cliffs, alluvial plains	Cobble beaches, lagoons	Sandy beaches, deltas
Coastal Slope (%)	>20	7 - 20	4 - 7	2.5 - 4	<2.5
Shoreline accretion/erosion (m/y)	>2	1 - 2	-1 - +1	-1 - -2	< -2
Rate of Sea Level Change (mm/y)	<1.8	1.8 - 2.5	2.5 - 3	3 - 3.2	>3.2
Mean Tide Range (m)	>6	4.4 - 6	2 - 4	1 - 1.9	<1
Max Wave Height (m)	<0.55	0.55 - 0.85	0.85 - 1.05	1.05 - 1.25	>1.25



**Figure 1.** CVI map for the Island of Rhodes

### 3. Results

The main touristic beaches are showing High and Very High vulnerability such as, the city of Rhodes (western part), Ialyisos, Paradeision, Soroni, Kalabarda. In the eastern part of the city of Rhodes shows Low and Very Low vulnerability (fig. 1). Faliraki bay presents Very High vulnerability and that's important as Faliraki bay along with Afantou, which also presents Very High vulnerability, are the most visited beaches on the island of Rhodes (fig. 1). Also Archaggelos, Gennadion, Lachania and Prassonissi (beach) present Very High vulnerability. In the Southwestern side of the island the beaches of Kattavia and Apollakia present Very High vulnerability (fig. 1). From Appolakia till Kalabarda the vulnerability is presented to be Low and Very Low. Also Low and Very Low vulnerability is observed in the eastern part of the island mainly between Archaggelos till Lindos.

### 4. Discussion-Conclusion

The most vulnerable areas are the coastal areas presenting low inclination, unconsolidated sediments, situated mainly in the NW part, the NE part, the SE part and SW part. These areas are also the most significant tourist areas of the island of Rhodes (Kyriakou et al., 2017; Vandarakis et al., 2018). Since tourism the most significant pillar of greek economy (Vandarakis et al., 2018), CVI contributes to the estimation of the coastal vulnerability, in order to make a holistic assessment.

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