Coastal setback line for the Kyparissiakos Gulf (Ionian Sea, Greece) according to the Mediterranean ICZM protocol

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The present investigation concerns the application of the Article 8-2 of the Mediterranean ICZM protocol in the environmentally sensitive coastal dune field of the central part of the Kyparissiakos Gulf (Ionian Sea, Greece). The Kyparissiakos dune field, comprising a set of coastal ecosystems of exceptional value, needs effective ICZM and, amongst all, has to consider the issue of Sea-Level Rise (SLR).

The dune field consists of "parabolic" type dunes that are stable and subjected locally to human interference. It consists of four shore-parallel dune lines: the outer (and most recently formed) 1st dune line has formed during the last 500 years, the 2nd during the last 1000 years, whilst the 3rd and 4th lines have formed not later than 1600 years BP (Poulos et al., 2012). Moreover, the four dune lines (from the youngest to the oldest) lie at distances of approximately 60 m, 100 m, 200 m and 600 m from the coastline, having maximum heights of 4 m, 6 m, 10 m, and 10-12 m, respectively.

The dune field, in general, is in equilibrium with the current nearshore hydrodynamics as the width of the beach zone is greater than the maximum run-up length (not included storm surge). The maximum wave run-up height (R), relative to the mean sea level, has been calculated by applying Komar's (1998) equation: $R = 0.36 \cdot g^{0.5} \cdot S \cdot H_o^{0.5} \cdot T$ (g: acceleration of gravity; Ho: maximum offshore wave height; T: corresponding maximum wave period; S: tangential beach slope). Thus, the wave run-up due to the highest incoming waves can reach elevations of the order of 1.6m in the case of the NW waves (Ho=6m, T=9 s) and 2m in the case of W and SW waves (Ho=6.4m, T=6.4s). These elevations correspond to 25m and 40 m of tangential distances on the beach surface, which are less than the current beach width (> 60 m). However, if the maximum wave heights coincide with the maximum storm surge (0.5 m) observed in the area, wave action can reach and erode the foot of the 1st dune line. Thus, for the current sea level, the maximum wave excursion would reach the line along the foot of the 1st dune line. The application of the Barcelona 2008 protocol requires a free zone of 100 m, landwards of the maximum wave elevation, in this case reaching the 2nd dune line. If the moderate scenario of sea level rise ca. 0.4 m (IPCC, 2013) is realised, extensive erosion is expected to take place, leading to the destruction of the 1st dune line and the formation of a new shoreline close to the foot of the 2nd dune line, which might be partially destroyed and reshaped by the transgressive landward transfer of dune material. On the basis of the above, for this particular sensitive coastal environment, even the 100 m set-back line might be inadequate, even for the moderate sea level rise scenario for the year 2100.