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Natural versus Urban dunes along the Emilia-Romagna coast, Northern Adriatic (Italy)

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Beach-dune interaction models can be precious tools for land managers and policymakers. However, if the models are inaccurate, land use policies may be designed based on false pretences or assumptions leading to poor land management, long-term erosion and sustainability issues, and increased difficulties in maintaining the dynamic coastal systems. From the literature, it appears that even the most reliable beach-dunes interactions models are not applicable to all coastal systems (Short and Hesp, 1982; Psuty, 1988; Sherman and Bauer, 1993).
The study aims to identify the morphological evolution of the Emilia-Romagna coastal dunes according to its natural and "human" characteristics and to classify groups of dunes with similar evolutionary patterns.
The coastal area consists essentially of 130 km of low sandy coast, interrupted by vast lagoon areas, harbor jetties and numerous hard coastal defense structures that were built during the first half of the 20th century to protect the Emilia-Romagna coast against erosion. Today about 57% of the littoral is protected by hard defenses, which have modified the morphodynamic characteristics of the beach without inverting the negative coastal evolution's trend.
From recent aerial photographs (2011), 62 coastal dunes have been identified and mapped. Furthermore, the dune analysis shows a variability of the "physical characteristics" of coastal-dune systems along the Emilia-Romagna coast. The dune height varies from 1 to 7 meters, the width of the beach and of the active dunes range respectively from 10 to 150 m and from 10 to 65 m.
Three main factors may explain the variability of the "physical characteristics":
1- Firstly the frontal dunes may be of different states according to the classification of Hesp (2002) since they correspond to incipient foredunes, well-developed foredunes, blowouts, residual foredunes as well as reactivated relict foredunes,
2- This could also be related to a different orientation of the coastline and foredune's line to the dominant onshore winds and,
3- Human impacts may also explain this variability since most of the dune-beach systems of Emilia-Romagna are characterized by important anthropogenic features that do not adequately describe beach-foredune interactions.
A factor analysis of the coastal dunes has allowed formulating hypotheses about their evolutionary trends according to the importance and interference of factors, both natural and anthropic, acting on the beach-dune system. Four groups of dunes have been identified corresponding to natural dunes, semi-anthropic dunes with major natural features, semi-anthropic dunes with major anthropic feature and "urban" dunes. Furthermore, while human activities impede the formation and development of new incipient dunes, other human activities favor the conservation and development of the human-altered foredunes.

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