



Impact of coastal management practice on long-term foredune behaviour

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Coastal dunes located in densely populated areas provide various services to man, such as protection against flooding during storm surges, recreation, and nature conservation. As a result, man will interfere with the natural dynamics of coastal dunes if these negatively affect these functions. For example, local storm erosion of the foredune will reduce the safety level of dunes as flooding defence, or the resulting steep dune front can be perceived as a public safety issue (collapse). Usually, the applied management interventions aim at restoring the pre-storm situation. As such they result in an increased recovery rate from an erosional event as compared to post-storm recovery rates occurring without human intervention.

The above raises the question whether the usually localized and intermittent human interventions will actually interfere with the long term evolution of the foredune area. And if so, whether these short term management interventions can turn out to be detrimental to the persistence of these functions in the long run. Especially for the flooding defence functionality this is of importance, as we can expect natural drivers of coastal behaviour, such as storm climatology and mean sea level stand, to change over the next century.

To increase insight in the above issues we performed a case study on the behaviour of managed foredunes along the Holland coast (The Netherlands). Information on the morphologic behaviour was extracted by EOF-analysis from a 40 year data set (1965-2004) of annual, high-resolution elevation surveys of the subaerial part of coastal profile along about 90 km of coastline. Information on the applied dune management during this period was retrieved from documents as well as from interviews with coastal managers with long-term involvement in the actual dune maintenance practice in the studied area.

It appeared that during the studied period the coastal management policy changed from being essentially reactive in nature to being pro-active. Prior to 1990, when storm erosion occurred or blowouts developed in the foredune, recovery of the dune was stimulated by placing sand fences and planting marram grass. In case of dune erosion, the steep erosion front was usually flattened for public safety by ground moving equipment. After 1990, large-scale sand nourishment programs were implemented (beach and nearshore) in order to build erosion buffers, and over time the earlier dune management measures were to a large extent abandoned.

Our study shows that in the reactive approach man only interferes with high order processes that do not fundamentally change the currently present type of foredune, hence will not fundamentally change the morphodynamic functioning of the current foredune system. In the pro-active approach, to the contrary, man interferes at a much more fundamental level by changing the sediment budget of the beach-dune system. Indications appear from the morphological analysis that this approach may lead to changes in the prevailing type of foredune morphology. In that case, the future characteristic foredune morphology and behaviour may deviate considerably from what we see today along this coastline.