SCIENCE FOR ENVIRONMENT POLICY

Measuring biodiversity loss in threatened Mediterranean coastal sand-dune habitats, Italy

16th August 2021
Issue 566

Subscribe to free bi-weekly News Alert.

Source:
Sperandii, M., Barták, V., Carboni, M. and Acosta, A. (2020). Getting the measure of the biodiversity crisis in Mediterranean coastal habitats. *Journal of Ecology,* 109(3): 1224–1235.

Contact:
Marta Gaia Sperandii,
martagaia.sperandii@uniroma3.it

Threatened Mediterranean coastal sand-dune habitats have outstanding conservation value — home to rare flora, rich in fauna and offering protection against storms. Yet there is a lack of recent comprehensive studies that survey long-term changes in these habitats. This re-surveying study quantifies functional and taxonomic changes over the last 10–15 years in a 75-kilometre (km) stretch of Italian coastal dunes. The researchers find that approximately 23% of threatened sand-dune habitats have disappeared from the surveyed area.

Coastal dune habitats are dynamic ecosystems, hosting highly specialised, often rare plant communities. However, they are currently listed amongst the most endangered ecosystems worldwide. The Mediterranean dunes have been classified as 'threatened' in the European Red List of Habitats[1], with coastal erosion, urbanisation and population growth potentially contributing to the deterioration of coastal landscapes.

Despite concerns regarding these important habitats, there is no comprehensive analysis of recent changes in community structure (an interacting group of various species in the same location) and functional changes — including multiple diversity measures. This resurveying study compared 10 to 15-year-old data of an area of Central Italian sand-dune habitats, with contemporary data, to observe whether observed changes at the community and species level are of particular concern.

Historical surveys of a narrow strip of sand dune habitats, along the Tyrrhenian and Adriatic coasts of Central Italy, took place between 2002–2007. The resurveying of 334 of these plots of herbaceous habitats, listed in the European Habitats Directive (92/43/EEC), took place in April to May 2017–2018.

The habitat types surveyed for functional and taxonomic changes across multiple biodiversity features were: upper beach, embryo dunes, shifting dunes, fixed dunes, and dune grasslands. Observed biodiversity changes were compared at community and species level across habitats (loss of generalised biodiversity), and across ecological functions — such as the loss of one or more plant species whose ecological role (or functional trait) is to stabilise sand dunes.

Environment

European Commission

SCIENCE FOR ENVIRONMENT POLICY

Measuring biodiversity loss in threatened Mediterranean coastal sand-dune habitats, Italy (continued)

The team used a 'Random Extinction Colonisation' model to estimate random simulated habitat changes (such as colonisations) — for comparison with historical data. Functional trait data related to plant height, specific leaf area and plant lifespan, were extracted from 'Trait Dunes', a database of plant traits of coastal dune species in the study area. A community shift in these functional traits has habitat-specific implications — for example, a shift to small annual species with high specific leaf area indicates habitat degradation[2], whereas, an increase to tall perennial species (which can help bind sand together) suggests habitat improvement.

The resurveying findings revealed severe shifts in the taxonomic profile of the sand dune communities due to non-random species loss, with some loss in key functions — implying large changes in both community structure and ecological strategies of these endangered habitats. More specifically, taxonomic loss was clearly extraordinary in upper beach areas at 34.44%, with embryo dunes and dune grasslands also significantly affected. Deviation from the expected change in plots over time was particularly prevalent in 13.33% of the not-classified (NC) plots — which contained invasive/alien species, so could not be allocated an EU habitat class.

The analysis highlighted changes in the dominant plant traits of shifting dunes, with a reduction in plant height, and an increase in specific leaf area; there was also a significant increase in specific leaf area in embryo dunes. Perennial species decreased in shifting dunes, and increased in the upper beach plots. All habitats showed changes in species abundance over time, but this was particularly prevalent in upper beach and shifting sand dunes. The historical dominant species (the European sea rocket (*Cakile maritima*) and marram grass (*Ammophila arenaria* subsp. *Australis*), an important sand-binding species), were replaced by sand couch-grass (*Elymus farctus*), indicative of embryo dunes. Overall the study found substantial changes in composition and spatial distribution of species in the communities.

Approximately 23% of the historical plots had disappeared — either under the sea, or with no vegetation present on resurveying. Coupled with substantial losses in those species studied, the researchers suggest this shows intense degradation processes are occurring in coastal dune habitats, particularly on the upper beach and on shifting dunes.

This study provides evidence of large, non-random taxonomic and functional losses and habitat degradation of threatened Mediterranean coastal dune plant communities, over a very short time span. To assist policymakers and conservation managers, the researchers highlight the sand-dune habitats most at risk of being lost completely. They suggest that research is needed to precisely pinpoint the potential drivers of these changes.

Read more about:
Biodiversity, Climate change and energy, Environment and health, Land use, Marine and Coastal, Risk assessment

To cite this article/service:
"Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

1. European Commission (2016). *European Red List of Habitats: Part 2. Terrestrial and freshwater habitats.* Publications Office. ISBN 978-92-79-61588-7, doi: 10.2779/091137

2. High specific leaf area (SLA) is generally characteristic of fast-growing, acquisitive species, while low SLA is more typical of 'conservative' species that grow slower, have longer cycles and tend to store more nutrients. Shifting dunes are normally characterised by tall, perennial species with relatively low SLA. Because they are tall, slow-growing and perennial (and some of them have rooting systems that are stimulated by sand accumulation), they trap sand, grow, and build dunes, which provide ecosystem services (i.e. coastal defence and protection from storms).