Received: 22 March 2023 | Revised: 31 March 2023 | Accepted: 4 April 2023

DOI: 10.1002/esp.5597

STATE OF SCIENCE

ESPL WILEY

Contemporary research in coastal dunes and aeolian processes

Eugene J. Farrell[1] | Irene Delgado Fernandez[2] | Thomas Smyth[3] | Bailiang Li[4] | Christy Swann[5]

[1]Geography and Ryan Institute, University of Galway, Galway, Ireland

[2]Earth Sciences, Universidad de Cádiz, Cádiz, Spain

[3]Department of Biological and Geographical Sciences, University of Huddersfield, Huddersfield, UK

[4]Department of Environmental Science, Xi'an Jiaotong-Liverpool University, Suzhou, China

[5]U.S. Naval Research Laboratory, Washington, District of Columbia, USA

Correspondence
Eugene J. Farrell, Geography and Ryan Institute, University of Galway, Galway, Ireland.
Email: eugene.farrell@universityofgalway.ie

Present address
Christy Swann, RCOAST, New Orleans, Louisiana, USA.

Abstract

Coastal dunes are found along the sandy coasts of oceans, seas, and large lakes all around the world. They are dynamic landforms that evolve along complex morphological and biological continua in response to a range on controls linked to climate, sea level, sediment movement, vegetation cover, and land use. By collating research across the full spectrum of processes shaping different types and sizes of dunes and smaller aeolian bedforms, special issues can aid researchers to identify new research directions and methods emerging from the discipline. This editorial summarizes the 25 contributions to the special issue *Coastal dunes: links between aeolian processes and landform dynamics*. We grouped the contributions into four broad themes: (1) long-term dune evolution, (2) short-term aeolian transport, (3) research methods, and (4) coastal dune management. Contributions to the special issue demonstrate that research interest in coastal dunes, and particularly the impacts of human interventions on dunes, continues to grow. It also shows how aeolian research on coastal dunes covers a range of temporal and spatial scales, from ripple dynamics and instantaneous airflow-transport processes to dune field evolution with rising sea levels and large-scale dune stage shifts. We highlight potential avenues for future research including vegetation roughness characteristics and their effect on wind flow and sediment transport, the challenges of upscaling short- and small-scale results to larger and longer spatiotemporal scales, and the study of both natural and managed dune landscapes.

KEYWORDS
aeolian processes, coastal dunes, dune evolution, dune management, wind blown sand

1 | INTRODUCTION

The special issue *Coastal dunes: links between aeolian processes and landform dynamics* contains 25 manuscripts providing a unique snapshot into the state-of-knowledge of coastal dunes. In total, 131 authors from 56 universities and research centres contributed to the special issue (Figure 1). These manuscripts describe research conducted across 53 different study sites, from 47°S to 53°N, with one site close to the equator (3°S), 22 sites close to the tropics (within 26°S and N), and 28 sites in temperate areas. By collating research across the full spectrum of geomorphic and ecologic processes shaping different types and sizes of aeolian landforms, this special issue can aid researchers to identify new research directions and methods emerging from the discipline. Previous special issues have documented the state of knowledge in coastal dune and aeolian processes research and provide very useful benchmarks to identify changing trends or knowledge gaps and challenges within the discipline. Some of these previous volumes have coincided with scientific conferences. For example, two special volumes emerged from the *6th International Conference on Aeolian Geomorphology* (ICAR VI) in the University of Guelph (Ontario, Canada). One of these was dedicated specifically to aeolian geomorphic processes (measurement and assessment and interaction with landforms and landscapes) and had 16 manuscripts in *Geomorphology* (Bauer, 2009). A second volume, containing

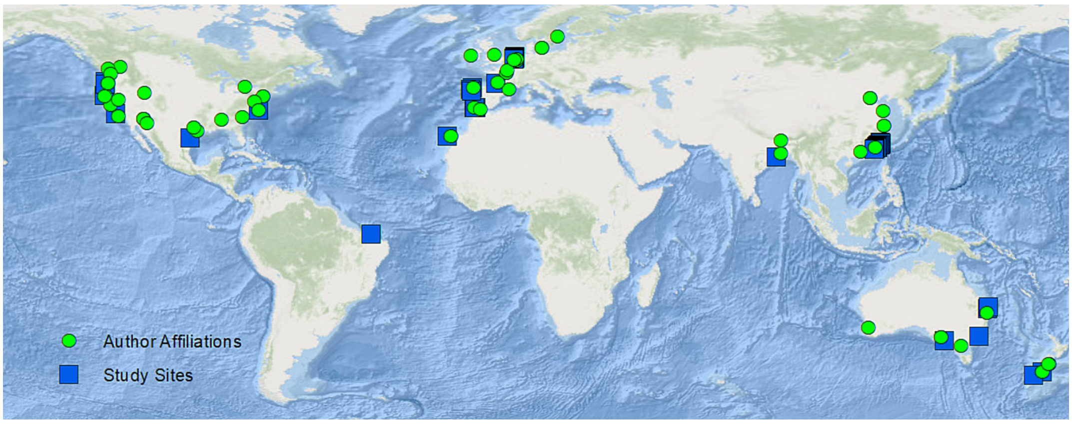

FIGURE 1 The special issue describes research from 53 study sites in total, from 47°S to 53°N, with one site close to the equator (approx. 3°S), 22 sites close to the tropics (within 26°S and N), and 28 sites in temperate areas. A total of 56 research centres and universities are represented through authors affiliations.

14 manuscripts in *Journal of Geophysical Research - Earth Surface* (Lancaster & Marticorena, 2008), was linked explicitly to the major scientific contributions and research of Dale Gillette's career (dust emissions and sediment transport processes). Other standalone special issues were motivated to benchmark the rapidly expanding scientific literature on aeolian processes, sediments, and dunes. Bullard (2008) summarizes the research findings from 16 manuscripts in a special issue of *Earth Surface Processes and Landforms* spanning aeolian sediment transport (relationships between airflow, sediment transport, and sediment moisture or vegetation) and dune dynamics.

Numerous textbooks are available covering all aspects of aeolian processes and landforms aimed at students and nonspecialists. More recently, *Aeolian geomorphology: a new introduction* (Livingstone & Warren, 2019) was revised to update the original publication (Livingstone & Warren, 1996). This textbook encapsulates the advances in observation, measurement, and mathematical modelling of aeolian processes and landforms in coastal, desert, periglacial, and planetary environments. Other textbooks cover aspects of aeolian geomorphology within the context of drylands and dust, for example, *Geomorphology of desert environments* (Parsons & Abrahams, 1994, 2009); *Arid Zone Geomorphology: process, form and change in drylands* (Thomas, 2011); *Arid and Semi-Arid Geomorphology* (Goudie, 2013); and *Aeolian dust and dust deposits* (Pye, 2015). Textbooks focussed on sand dunes include the following: *Aeolian Sand and Sand Dunes* (Pye & Tsoar, 2008), *Geomorphology of Desert Sand Dunes* (Lancaster, 2023), and *Dunes: dynamics, morphology and history* (Warren, 2013). Bagnold's (1941) classic *The Physics of Blown Sand and Desert Dunes* continues to be reprinted with only minor revisions. This is testament to the fact that the founding principles of the discipline first presented by Bagnold remain relevant today. Despite the lack of textbooks with an explicit focus on the geomorphology of coastal dunes, it is important to recognize that two textbooks (Davidson-Arnott et al., 2019, *Introduction to coastal processes and geomorphology* and a revision of the first edition of Davidson-Arnott, 2010, and Masselink et al., 2014, *Introduction to coastal processes and geomorphology*) are very suitable for upper level university students and explore aeolian processes, dune types, vegetation, and dune management. The posthumous *The biology of coastal sand dunes* (Maun, 2009) is primarily focussed on biological processes but does include aspects of the physical features and dynamics of coastal dunes. Cumulatively, these textbooks equip readers with the tools to understand coastal dunes and aeolian processes and capture the essence of the mechanics of aeolian processes and landforms. However, as the volume of peer-reviewed publications continues to grow rapidly, supplemented with publications through other channels (e.g., conferences proceedings, open access reports, and online magazine articles), it is observed that benchmark special issue pieces can quickly become outdated and there is a constant need to reflect on the state of knowledge of our discipline.

2 | THE STATE OF COASTAL DUNE RESEARCH

One distinct trend that emerged in this special issue, compared with previous volumes focussed on aeolian processes and landforms (e.g., Bauer, 2009; Bullard, 2008), is the quantity of research focused on the impacts of human interventions on dunes (Figure 2). The increasing need for dune research on developed coasts was made explicit by Nordstrom (2004) in *Beaches and dunes of developed coasts*, and themes such as the restoration of coastal dunes have been the focus of dedicated textbooks, for example, *Restoration of coastal dunes* (Martínez et al., 2013). Examples of human interventions in coastal dunes in this special issue include the removal of invasive vegetation (Bauer et al., 2022; Hilgendorf et al., 2022; Konlechner & Hilton, 2022), engineered foredune notches (Nguyen et al., 2022), and intensely managed or constructed foredunes (Dickey et al., 2023; He et al., 2022; Sanromualdo-Collado et al., 2022; Walker et al., 2023). Many manuscripts within the special issue that investigated the coastal dynamics of naturally forming dunes also explicitly situated the research in the context of contemporary sea-level rise and climate change (Arce Chamorro et al., 2022; Fisher et al., 2023; Garzon et al., 2022; Hesp et al., 2022; Robin et al., 2022) or hazard mitigation (He et al., 2022). In many cases, dune evolution will depend on human action and management interventions driven by different, sometimes conflicting, values or needs, for example, natural (diversity; complexity; unconstrained; and dynamic) and cultural (stability; accessibility; predictability; and static) optimums (Nordstrom et al., 2000). As coastal dunes are increasingly being targeted as feasible 'Nature-

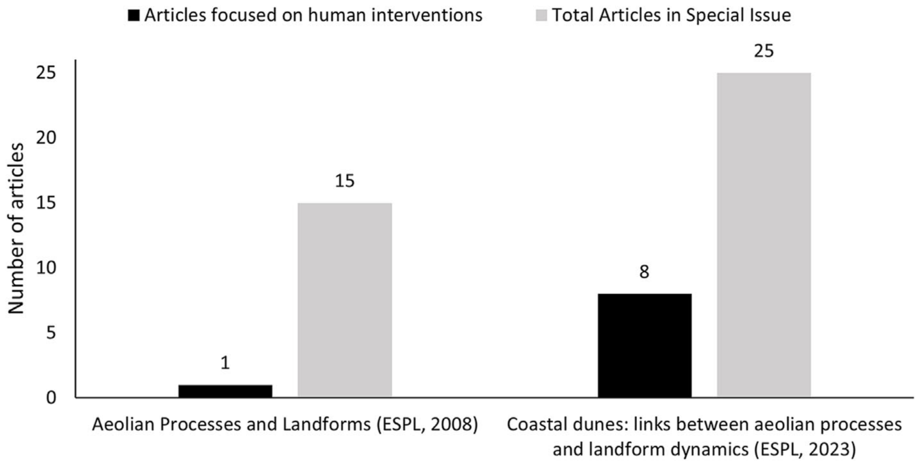

FIGURE 2 Comparison of number of manuscripts with a focus on human intervention between two special issues of Earth Surface Processes and Landforms (ESPL) in 2008 (16 manuscripts; one focussed on human interventions) and 2023 (25 manuscripts; nine focussed on human interventions).

based Solutions' (NbSs) with multiple ecosystems services, as described in Walker et al. (2023) for mitigating air pollution, this trend of coastal dune research increasingly focusing on management along developed coasts will likely continue.

The research within this special issues also reflects the increasingly sophisticated and holistic approach being taken to understanding coastal dune dynamics. For example, a range of research measured or modelled abiotic and biotic factors that impact aeolian systems including waves (Garzon et al., 2022; He et al., 2022; Ruessink et al., 2022), surface moisture (Ruessink et al., 2022), and vegetation (Bauer et al., 2022; Dickey et al., 2023; Konlechner & Hilton, 2022 Kooijman et al., 2022; Li et al., 2022; Sanromualdo-Collado et al., 2022). The data sources were dominated by field experiments and remote sensing, with only five of the 25 articles using data derived from experimental laboratory work or numerical models. The special issue showcases numerous pioneering technologies and methods currently being used in aeolian and coastal geomorphology research, including holographic cameras (Cohn et al., 2022), uncrewed aerial vehicles (Hilgendorf et al., 2022; Walker et al., 2023), sediment sampling devices (van IJzendoorn et al., 2023), medium to long-term evolution models (Ruessink et al., 2022), and camera tracking of sediment tracers (Uphues et al., 2022). The scale of the research was as diverse as the spatial and temporal processes that impact coastal dunes, ranging from instantaneous processes (van IJzendoorn et al., 2023) to geological scales (Patton et al., 2022).

In what follows, we summarize the contributions to the special issue in four thematic sections: (1) long-term dune evolution, (2) short-term aeolian transport, (3) research methods, and (4) coastal dune management.

2.1 | Long-term dune evolution

Coastal dunes go through various evolutionary phases over thousands of years. Along the high-energy Atlantic coast of Galicia (Spain), coastal dunes dated between 35 000 and 14 000 years were formed at the end of the last glaciation when local sea levels were 120 m lower relative to the present day (Arce Chamorro et al., 2022). Strong winds blew sediment exposed on the continental shelf landwards. When sea level rose, this led to flooding of some dune deposits but aeolian processes continued with active formation of new dunes throughout the Holocene. The K'gari and Cooloola Sand Mass areas of Australia host relict and active dune landforms formed during different stages, with ages spanning over 800 000 years (Patton et al., 2022). Monitoring of geomorphic facies changes and topography (Fisher et al., 2023) and new methods based on surface roughness–age models (Patton et al., 2022) are important tools to identify shifts in dune evolution. The innovative technique developed by Patton et al. (2022) permits estimation of relative and absolute dune dates when optically stimulated luminescence (OSL) data are unfeasible due to the size of the dune complex.

Coastal dunes can respond quickly to changes in sea level and variations to sediment budgets at decadal to century timescales. At Padre Island (Texas, USA), a decrease in sediment influx together with a rise in sea level has driven a shift towards dune stabilization over the last 50 years (Fisher et al., 2023). At El Médano (Tenerife, Spain), mining and sand extraction in the 1960s led to a marked decrease in dune volumes (Sanromualdo-Collado et al., 2022) and long-term changes to dune evolution. Despite attempts to restore the foredune following the cessation of mining activities in the 1970s, the reduction of overall sediment budgets limited the capacity of the dune field to grow again, with permanent landscape changes still measurable today.

Changes to dune mobility state can develop relatively fast over a decade or less, both naturally and/or as a result of human activities. Hesp et al. (2022) report on the rapid start of a new transgressive state at the 42 Mile crossing area (Younghusband Peninsula, Australia) with the recently developed sand sheet extending as fast as +100 m in 8 years. Although drivers such as climate change and sea level rise can play a role, wave erosion of the shoreline together with aeolian deflation were primary controls on dune evolutionary phase change. At Doughboy Bay (Aotearoa, New Zealand), the removal of exotic vegetation introduced a shift in aeolian sedimentation and dune mobility over a 15-year period (Konlechner & Hilton, 2022). High mobility levels were recorded following the intervention, with subsequent patterns of sand deposition reflecting alongshore variations in wind characteristics and the presence of dune-building species. The removal of invasive species and replanting of native vegetation have also taken place at Lanphere Dunes (Humboldt Bay National Wildlife Refuge, USA) since the 1980s, where shifts in dune ecogeomorphology affect post-storm dune recovery (Hilgendorf et al., 2022). Although the crest and lee-slope base positions migrated landwards, restored foredunes with native vegetation recovered faster than areas with invasive dune grasses within 2 years.

Once initiated, new dunefield mobility phases can persist for years, depending on the balance between incident wind strength and direction and the response of the vegetation (Konlechner & Hilton, 2022). Locally, blowout activity can be strongly linked with soil characteristics. Working at five different sites along the Dutch coast, Kooijman et al. (2022) observed that high pH soil values reduced the sensitivity to atmospheric N deposition and P availability to vegetation, which favoured the growth of arbuscular mycorrhizal plants. These tend to have lower root biomass and to provide better food for rabbits, hence facilitating soil erosion. The opposite occurred when pH values dropped below 6.5, with an increased probability of blowout stabilization. Zhang, Qui, et al. (2022) reported on the evolution of blowouts in artificial foredunes built using clay structural layers in Changjiang Ao (Pingtan Island, China). Their results illustrate that blowouts transitioned between different stages (notch formation, incipient blowout, fully developed blowout, sediment-transport corridor, and new blowout formation) with dependencies on feedback mechanisms between aeolian processes and blowout morphology, changes in seasonal climate, and the influence of the artificial structure.

Large-scale studies in this special issue are an excellent reminder that coastal dunes are part of wider coastal systems, both spatially and temporally. The erosion of coastal dunes at various sites in Galicia (Spain) exposed older shingle beaches, submerged forest remains, and even megalithic monuments (Arce Chamorro et al., 2022), all expressions of coastline changes over thousands of years. On barrier islands, coastal dunes are a key control on sediment distribution and may be indicative of changes to the entire island at medium timescales (Fisher et al., 2023). The general trend to dune stabilization at Padre Island (Texas, USA) reduced sediment availability to the back-island via a decreased supply of sediment from the fore-island. The authors argue that long-term changes to dune mobility can signal barrier island changing to a different evolutionary state, with lower sand input to back-barrier and tidal flats having implications for barrier island evolution under rising sea levels. Along the western coast of the Taiwan Strait, rivers deliver large quantities of sediment that is dispersed over hundreds of kilometres of coastline environments by longshore currents, until it is pushed to the shore by the waves and to the dunes by the winds (He et al., 2022). At this scale, wave power, followed by aeolian sand drift potential, correlates with foredune height, with high-energy wave climates delivering significant volumes of sand to dissipative beaches backed by larger coastal dunes.

Finally, and though it seems obvious, coastal dunes are inheritably linked with the beach in front of them. Various articles in this special issue demonstrate the role that beach characteristics play on both dune erosion by storm waves and coastal dune growth. Garzon et al. (2022) analysed coastal dune response to storminess over a 60-km stretch in the Algarve (Portugal). The strong variability in dune erosion (from negligible to 40-m retreat) was primarily controlled by the amount of sediment stored on the sub-aerial beach, followed by wave power, with vegetation cover contributing to dune protection an order of magnitude less than backshore sand volumes. Ruessink et al. (2022) developed a quantitative model for predicting coastal dune growth primarily based on adequate parameterization of beach characteristics, such as fetch controls and surface moisture dynamics. The inclusion of supply-limiting factors allowed them to calculate sand supply to coastal dunes over months and years, at orders of magnitude that were consistent with observations.

Robin et al. (2022) investigated the evolutionary paths (stabilization; destabilization; and remobilization) of a 2-km-long modern coastal transgressive dunefield located in southwest France from 1945 to 2020. Using an integrated, holistic research approach (ground penetrating radar [GPR] profiles, aerial photographs, and LiDAR), they found that the dunefield transitioned through distinct stages identified using dune migration rates (0–23 m year^{-1}). Interestingly, they found no correlation between any large-scale climate pattern of atmospheric variability (e.g., the statistically significant increase in storminess and incident winter wave energy over the last decade in the northeast Atlantic) and dunefield behaviour. Instead, they hypothesized that the changes in dunefield morphology and migration rates reflected changes in nearshore processes (massive shoal welding influencing longshore drift), human interventions (vegetation emplacement leading to stabilization), or chronic and natural beach and dune erosion. Their work highlights the importance of combining cross-shore and longshore transport processes in beach-dune evolution models and is in line with findings by Garzon et al. (2022) and others (Crapoulet et al., 2017; Houser et al., 2018; Masselink et al., 2016; Olivier & Garland, 2003). There can be high variability in alongshore shoreline response to regional-scale forcing but, equally, high variability within coastal sites, reflecting the importance of internal and external factors.

2.2 | Short-term aeolian sediment transport

Historically, aeolian sediment transport models have either underperformed or been inconsistent in predicting the flux of wind-blown sand over vegetated surfaces. Some of the challenges stem from our inability to measure or to parameterize flow retardation and resulting shear velocity reduction within near surface canopies (Webb et al., 2020). However, the past two decades have seen major improvements in observations and models of aeolian transport in the presence of vegetation (Hesp et al., 2013; Kuriyama et al., 2005; Li et al., 2013; Okin, 2008; Webb et al., 2020). In this special issue, Bauer et al. (2022) measured the structure of wind flow and sediment transport across a beach-foredune system with two adjacent vegetation types. The invasive *Ammophila arenaria* was taller (~1 m) with denser coverage than the neighbouring *Elymus mollis* canopy (~0.65 m), which consisted of a variety of interspersed native plants. Bauer et al. (2022) showed that the degree of topographically forced and vegetation-enhanced wind flow steering was substantial. *Ammophila* strongly shifted the highly oblique incident wind to shore-perpendicular, an effect that was not as pronounced for the *Elymus* canopy. In both cases, continuous sediment transport rates observed on the beach dropped to essentially zero once the vegetation canopy was encountered on the stoss slope of the dune.

Dickey et al. (2023) found that the depositional lag length increased with decreasing vegetation canopy density. Their results highlight that the standard of practice (Raupach stress partition) used in aeolian models to parameterize shear stress reduction from vegetation cover should be used with caution for dunes with sparse vegetation canopies. The aim of Dickey et al. (2023) was to develop a method for incorporating vegetation into Aeolis, a process-based model of aeolian transport developed by Hoonhout and de Vries (2016, 2019), so that the model can be applied to typical coastal environments that have both bare and vegetated surfaces.

Li et al. (2022) introduced a new generalized aeolian transport model for both bare and vegetated surfaces based on wind tunnel tests. The new equation is a modification of the original and revised wind erosion equations (Fryrear et al., 1998; Woodruff & Siddoway, 1965) based upon reparameterizing the ratio of the transport rate on a vegetated surface to the equivalent transport over bare sand. The authors noted that the equation needed to be tested in field conditions, echoing ongoing challenges associated with wind tunnel studies (section 3.3).

Articles in this special issue have made substantial advances in monitoring instantaneous saltation characteristics and ripple dynamics in field environments (Cohn et al., 2022; Ellis & Sherman, 2023; Uphues et al., 2022). Ellis and Sherman (2023) resolved the temporal dynamics of wind-saltation events in two field sites using a cross-wavelet analysis of co-located wind and saltation sensors. It is important to recognize that there is still a dearth of studies applying spectral analysis to high-resolution datasets from field experiments. Ellis and Sherman (2023) found that in high transport scenarios, wind-sand events averaged between 1.9 and 12.2 s and low transport events occur in 2.1 and 10.8 s. The results emphasize the criticality of tightly controlled field experiments to measure coincident wind and saltation fluctuations and the influence of saltation events on sediment transport models.

Uphues et al.'s (2022) study advanced our understanding of what influences aeolian ripple formation and migration and how these small, yet ubiquitous, bedforms influence flux predictions from sediment transport models. Their new Active Bed Surface Layer conceptual model provides a framework to better quantify aeolian sediment transport by focusing on the most important processes in the Active Bed Surface Layer for different transport regimes and can be incorporated into future numerical model schematizations.

In addition to papers focused on aeolian transport through vegetation and on beaches, Zhang, Sherman, et al. (2022) introduced a classification system to characterize the understudied sediment transport process of avalanching on the lee sides of large barchan dunes. The study provides the first detailed measurements of grainflow morphometry based on terrestrial laser scanning and image analysis of 2852 grainflows on dunes. Although the study does not account for causes of grainflows among other processes, their classification is an important first step towards understanding the nature of potential controls on grainflows, such as fluid shear stress, critical angle variations, relationships between grainfall pattern and bulge geometry, and sediment variability.

Saha and Sinha (2023) used multiproxy techniques, including grain size parameters and the microtexture of quartz grains, to investigate and to discriminate different cross-shore depositional processes in the tropical coastal area of Chandipur, India. Changes in the surficial microtextural properties of quartz grains were analysed suggesting that diverse granulometric parameters translate different sedimentary environments such as tidal flats, beaches, and dunes.

2.3 | Research methods

Contributions to this special issue describe diverse research methodologies including field observation, wind tunnel experimentation, and numerical simulation. It is interesting to note that 20 of the 25 studies in this special issue are based wholly on field observations or experiments. There is only one wind tunnel experiment and four numerical studies, of which three required additional fieldwork for model validation. The extraordinarily small number of wind tunnel papers is most likely linked to the topic of this special issues: coastal dunes. As previously described, it is recognized that there are limits on the ability of wind tunnel experiments to replicate prototype conditions. There is overwhelming evidence that over the past century, wind tunnel studies have greatly enhanced our knowledge of aeolian processes but they do have inherent and critical constraints trying to replicate the physical processes driving aeolian transport and subsequent dune landform response (Sherman, 2020; Sherman & Farrell, 2008). Therefore, it is not surprising that the only wind tunnel work in the special issue (Li et al., 2022) focusses on the sand transport over a flat, vegetated surface.

It is important to highlight novel methods that appeared in this special issue. Cohn et al. (2022) introduced a holographic camera system to reconstruct the three-dimensional images of saltation clouds and output sand particle location, size, and shape information. This novel approach provides a technique to measure saltation clouds at much higher spatiotemporal resolution than is otherwise available. Van IJzendoom et al. (2022) described a newly designed scraper sampler used to investigate the spatial and temporal variations in grain size at millimetre-scale vertical resolution that was previously not attainable. Using this sampler, they were able to show that the grain size characteristics of the upper layer in the intertidal zone can deviate from the median grain size due to the effect of marine and aeolian processes. This work highlights the need to carefully critique any sediment sampling strategy embedded within aeolian sediment transport experiments. Uphues et al. (2022) successfully used still and video captures from cameras to track the dispersal of sediment tracers to explore sediment sorting processes and their influence on the magnitude and mode of aeolian transport. A pixel colour recognition algorithm was used to count the tracers within post-processed images stitched together using a digital microscope. This analytical method overcomes the tedious, time-consuming, and error-prone parts of conventional sediment tracer studies that rely on manual visual counts of tracer grains within samples.

Many of the research methods used in the special issue have been pioneered in aeolian geomorphology over the past two decades and are now considered standard for aeolian experimentation to detect high-frequency fluctuations in wind speed and saltation intensity. These include ultrasonic anemometers for two- or three-dimensional wind velocity (Nguyen et al., 2022; Uphues et al., 2022; Zhang, Sherman, et al., 2022) and acoustic (e.g., miniphones in Ellis & Sherman, 2023), piezoelectric (e.g., sensits in Cohn et al., 2022), and optical (e.g., wenglors in Dickey et al., 2023) sensors to measure saltation. All these sensors are now reasonably inexpensive but are critical to collect high-resolution datasets to test the reliability of numerical wind flow and transport models, for example, computational fluid dynamics (CFD) models in Bauer and Wakes (2022) and Nguyen et al. (2022). Sand transport was also measured using pot traps in Nguyen et al. (2022) which illustrates that not all equipment needs to rely on new(er), highly technical or costly technologies to be effective. The morphology, size, and dates of sand grains were measured using scanning electron microscopy, laser granulometers, and optically stimulated luminescence (Arce Chamorro et al., 2022; Patton et al., 2022; Saha & Sinha, 2023). Satellite images and aerial photos are still the standard for estimating land cover (Fisher et al., 2023; Garzon et al., 2022; Hesp et al., 2022; Konlechner & Hilton, 2022; Robin et al., 2022). Similarly, the research community is using LiDAR (Fisher et al., 2023; Garzon et al., 2022; Robin et al., 2022; Sanromualdo-Collado et al., 2022; Zhang, Sherman, et al., 2022) and differential global navigation satellite systems (GNSS) (He et al., 2022; Nguyen et al., 2022; Zhang, Qui, et al., 2022) to measure topography. It is interesting to note that Uncrewed Aerial Systems (UAS) are now emerging as a feasible survey technique within the coastal dune community. Two studies are reported using UASs to obtain accurate topographic maps (Hesp et al., 2022; Walker et al., 2023). It is reasonable to assume that the use of cost-effective, off-the-shelf UAS platforms in coastal studies will increase exponentially the next years as the technology continues to rapidly advance (sensors; software; and hardware) allowing researchers to effectively bridge the gap between accurate, high-resolution field data and larger scale remotely sensed data to detect morphological and ecological change.

2.4 | Coastal dune management

The aim of this special issue is to showcase research that contributes to understanding the short- and long-term behaviour of coastal dune systems in order to learn and develop sustainable and attainable management strategies that reduce coastal risks. Coastal dune ecosystems have inherent functioning traits or resilience and can regenerate rapidly after sustained periods of chronic degradation or shorter term disturbances (extreme storm events and human interventions) to maintain the delivery of critical ecosystem goods and services. The optimum condition for maintaining species diversity in dunes must embrace dunes as dynamic landforms that comprise different sections evolving at different rates or stages with many different degrees of sediment movement, vegetation cover, and land use. Some of the principal ways in which dunes can be affected by human activities are mining, construction, pedestrian trampling and vehicle use, reshaping, and artificial changes to dune mobility levels among other impacts (Nordstrom, 2014). Coastal dunes can be affected by beach management (e.g., mechanical clearing of beach debris), large-scale coastal management (e.g., changes to dune budgets because of the creation of coastal infrastructure interfering with littoral drifts), and human activities in rivers and estuaries (e.g., installation of dams) (Davidson-Arnott et al., 2019).

Additional to ongoing studies on human activities, the last couple of decades have seen an increase of articles focusing on direct management interventions on coastal dunes, ranging from non-intervention or minimal intervention through to intensive single species management and habitat recreation (Rhind & Jones, 2009). It is interesting to observe conflicting management practices that can equally perceive bare sand as good and/or bad; migrating dunes as good and/or bad; and fully vegetated, stable dunes as good and/or bad (e.g., Cooper & Jackson, 2021; Creer et al., 2020; Delgado-Fernandez et al., 2019; Pye & Blott, 2020).

In areas where bare sand is a hazard (e.g., sand deposition; air quality; and increased dune mobility), the response has been to stabilize coastal dunes using planting, fencing, controlled access and walkovers, or temporary dune stabilizers. Walker et al. (2023) demonstrated the positive impact of coastal dunes as an NbS in Oceano Dunes (California, USA). Their study site is situated within a large transgressive dune system that hosts a state park that has been managed for off-highway vehicle recreation the past four decades. The high volume of traffic within the vehicle use areas obliterated the dunes and created bare sand sheets that are highly emissive of dust-sized particles, causing frequent exceedances of state air quality standards. In response, an NbS restoration plan was implemented over a 20-ha site using five different planting and/or seed treatments to initiate the development of new vegetated foredunes. The results observed over a 2-year period showed that the NbSs had a positive sediment budget; enhanced the development of sizable nebkha dunes (an important stage in foredune development in this region); and some increased plant cover and species richness.

Hilgendorf et al. (2022) provide evidence of how dynamic dune restoration focusing on the removal of invasive species in the Lanphere Dunes in northern California (USA) can reinstate the natural ecomorphodynamic function to an invasively vegetated and stabilized foredune. In some cases, dune restoration focussed on invasive plant removal is not enough as soil microbial legacy effects can derail efforts to re-establish functioning, intact, and resilient native dune ecosystems (Parsons et al., 2020). Sanromualdo-Collado et al. (2022) list management interventions to both vegetate (by planting) and mobilize (by machinery) bare sand environments created as a consequence of sustained periods of aggregate extraction in Tenerife, Spain. Garzon et al. (2022) highlight the importance of dune vegetation in promoting dune stability and growth, as well as fixing dune position to mitigate storm erosion in Portugal.

Conversely, Kooijman et al. (2022) note that bare sand in blowouts adds to the geodiversity of dune environments and can mitigate the negative effects of acidification on the topsoil that is more prevalent in industrialized countries where dune plant communities are threatened by high atmospheric nitrogen deposition and associated acidification. In areas where bare sand dune habitats have been created by mechanically removing the vegetation, it is usually in response to ecologic preferences (e.g., the Dynamic Dunescapes project in England and Wales) or as the natural consequence of removing invasive species from dunes (Darke et al., 2013, 2016). The rapid decline of plant and animal species requiring bare sand or early successional dune conditions is well documented in NW Europe (Brunbjerg et al., 2015; Howe et al., 2010), with some authors arguing that without ecological management interventions to provide niche habitat conditions, these species are at risk of extinction (Creer et al., 2020). Removing dune vegetation may temporarily enhance biodiversity but interventions can be short-lived and hence unsustainable (e.g., Arens et al., 2013; Rodgers et al., 2019), and they can increase beach erosion and the risk of coastal flooding (Lindell et al., 2017). In many locations, removing dune vegetation goes against evolutionary coastal dune vegetation cover trends (Jackson et al., 2019; Rodgers et al., 2019). Whether species-driven approaches to dune restoration are too 'interventionist' (Delgado-Fernandez et al., 2019) or akin to 'dune gardening' without regard for active geomorphic processes (Cooper & Jackson, 2021) is an ongoing contentious debate in the discipline (Arens & Geelen, 2006; Hilgendorf et al., 2022; Laporte-Fauret et al., 2021). No matter the motivation driving a preferred option, it is clear that that no 'one-size fits-all approach' to sand dune management exists. Pye and Blott (2020) argue that a range of ecosystem services needs to be taken into account when developing dune management plans—which sometimes benefits specific plants and animals or, ceteris paribus, geomorphic processes (Pye et al., 2007). In the context of building coastal resilience to rising sea levels, climate change, and increasing human stresses in the environment, there is a need to understand the long-term impact that interventions such as remobilization and other human activities have on the evolution of coastal dunes.

3 | CONCLUSIONS

The 25 research articles included in this Special Issue on *Coastal dunes: links between aeolian processes and landform dynamics* are testament to the growing interest on the evolution and functioning of coastal dunes. Studies cover all temporal and spatial scales from ripple dynamics and instantaneous airflow-transport processes to dune field evolution with rising sea levels and large-scale dune stage shifts. By continuing to refine both short-term and medium to long-term transport models, the coastal-aeolian community provides future researchers with opportunities to fill knowledge gaps. Some of these include our understanding of vegetation roughness characteristics and their effect on wind flow and sediment transport, the challenges of upscaling short- and small-scale results to larger and longer spatiotemporal scales, and the study of both natural and managed dune landscapes, among many others. Novel methodological advances such as the ones included in this special issue may instigate new research programmes that can contribute to resolving many of these current gaps, with important impacts on our ability to predict coastal dune system response and beach-dune interactions at scales that are relevant for management. Other important future studies might include the role of human activities on dune evolution and conservation (e.g., vegetation trampling and the effect of hard and soft engineering), links to community-driven coastal restoration programmes, and the effects of anthropogenic climate change human-induced and rising sea levels.

ACKNOWLEDGEMENTS

The team would like to thank the 131 contributing authors whose research and ideas define this special issue. The coastal dune community greatly appreciates and values your ongoing work. We would like to acknowledge the large number of individuals who provided expert reviews, many times repeatedly (for the same manuscript or for different manuscripts), of the published work: Bas Arens, John Armstrong-Altrin, Andreas Baas, Bernard Bauer, Joanna Bullard, Pedro Costa, Susana Costas, Sierd de Vries, Maciej Dłużewski, Alexandra Evans, Jack Gillies, Evan Goldstein, Francisco Javier Gracia, Patrick Hesp, Paul Hesse, Michael Hilton, Ning Huang, Hiromi Itamiya, Edyta Kalińska, Madeline Kelley, Brian Lees, Debora Lithgow, Kevin Lynch, Néstor Marrero-Rodríguez, Ana Matias, Steven Namikas, Sam Provoost, Ken Pye, Michel Riksen, Ana Luísa Rodrigues, Maciej Dłużewski, Joanna Rotnicka-Dłużewska, Peter Ruggiero, Yoshiki Saito, Douglas Sherman, John van Boxel, Meagan Wengrove, Phillipe Wernette, and Na Yan. Finally, we are indebted to the leadership and mentoring of Stuart Lane in ESPL. This special issue could not have transpired with your editing support and guidance. Open access funding provided by IReL.

CONFLICTS OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

ORCID

Eugene J. Farrell https://orcid.org/0000-0001-7877-4629
Thomas Smyth https://orcid.org/0000-0002-1740-762X
Bailiang Li https://orcid.org/0000-0001-5178-0156

REFERENCES

Arce Chamorro, C., Vidal Romaní, J.R., Grandal d'Anglade, A. & Sanjurjo Sánchez, J. (2022) Aeolization on the Atlantic coast of Galicia (NW Spain) from the end of the last glacial period to the present day: chronology, origin and evolution of coastal dunes linked to sea-level oscillations. *Earth Surface Processes and Landforms*, 48(1), 198–214.

Arens, S.M. & Geelen, L.H.W.T. (2006) Dune landscape rejuvenation by intended destabilisation in the Amsterdam water supply dunes. *Journal of Coastal Research*, 22(5), 1094–1107. Available from: https://doi.org/10.2112/04-0238.1

Arens, S.M., Mulder, J.P., Slings, Q.L., Geelen, L.H. & Damsma, P. (2013) Dynamic dune management, integrating objectives of nature development and coastal safety: examples from the Netherlands. *Geomorphology*, 199, 205–213. Available from: https://doi.org/10.1016/j.geomorph.2012.10.034

Bagnold, R.A. (1941) *The physics of blown sand and desert dunes*. New York: Methuen.

Bauer, B.O. (2009) Contemporary research in aeolian geomorphology. *Geomorphology*, 105(1–2), 1–5. Available from: https://doi.org/10.1016/j.geomorph.2008.02.014

Bauer, B.O., Hesp, P.A., Smyth, T.A., Walker, I.J., Davidson-Arnott, R.G., Pickart, A. et al. (2022) Air flow and sediment transport dynamics on a foredune with contrasting vegetation cover. *Earth Surface Processes and Landforms*, 47(11), 2811–2829. Available from: https://doi.org/10.1002/esp.5425

Bauer, B.O. & Wakes, S.J. (2022) CFD simulations of wind flow across scarped foredunes: implications for sediment pathways and beach–dune recovery after storms. *Earth Surface Processes and Landforms*, 47(12), 2989–3015. Available from: https://doi.org/10.1002/esp.5439

Bullard, J.E. (2008) Synthesis of recent ESPL research: aeolian processes and landforms. *Earth Surface Processes and Landforms*, 33(13), n/a. Available from: https://doi.org/10.1002/esp.1757

Brunbjerg, A.K., Jørgensen, G.P., Nielsen, K.M., Pedersen, M.L., Svenning, J.C. & Ejrnæs, R. (2015) Disturbance in dry coastal dunes in Denmark promotes diversity of plants and arthropods. *Biological Conservation*, 182, 243–253.

Cohn, N., Dickhudt, P. & Marshall, J. (2022) In-situ measurement of grain size characteristics within the aeolian saltation layer on a coastal beach. *Earth Surface Processes and Landforms*, 47(9), 2230–2244. Available from: https://doi.org/10.1002/esp.5373

Cooper, A. & Jackson, D. (2021) Dune gardening? A critical view of the contemporary coastal dune management paradigm. *Area*, 53(2), 345–352. Available from: https://doi.org/10.1111/area.12692

Crapoulet, A., Héquette, A., Marin, D., Levoy, F. & Bretel, P. (2017) Variations in the response of the dune coast of northern France to major storms as a function of available beach sediment volume. *Earth Surface Processes and Landforms*, 42(11), 1603–1622.

Creer, J., Litt, E., Ratcliffe, J., Rees, S., Thomas, N. & Smith, P. (2020) A comment on some of the conclusions made by Delgado-Fernandez et al. (2019)."Is 're-mobilisation' nature conservation or nature destruction? A commentary". *Journal of Coastal Conservation*, 24, 1–4.

Darke, I.B., Eamer, J.B., Beaugrand, H.E. & Walker, I.J. (2013) Monitoring considerations for a dynamic dune restoration project: Pacific Rim National Park Reserve, British Columbia, Canada. *Earth Surface Processes and Landforms*, 38(9), 983–993. Available from: https://doi.org/10.1002/esp.3380

Darke, I.B., Walker, I.J. & Hesp, P.A. (2016) Beach–dune sediment budgets and dune morphodynamics following coastal dune restoration, Wickaninnish Dunes, Canada. *Earth Surface Processes and Landforms*, 41(10), 1370–1385. Available from: https://doi.org/10.1002/esp.3910

Davidson-Arnott, R. (2010) *Introduction to coastal processes and geomorphology*. Cambridge, UK: Cambridge University Press.

Davidson-Arnott, R., Bauer, B. & Houser, C. (2019) *Introduction to coastal processes and geomorphology*. Cambridge, UK: Cambridge University Press, https://doi.org/10.1017/9781108546126

Delgado-Fernandez, I., Davidson-Arnott, R.G. & Hesp, P.A. (2019) Is 're-mobilisation' nature restoration or nature destruction? A commentary. *Journal of Coastal Conservation*, 23, 1093–1103.

Dickey, J., Wengrove, M., Cohn, N., Ruggiero, P. & Hacker, S. (2023) Observations and modeling of shear stress reduction and sediment flux within sparse dune grass canopies on managed coastal dunes. *Earth Surface Processes and Landforms*, 1–16. Available from: https://doi.org/10.1002/esp.5526

Ellis, J.T. & Sherman, D.J. (2023) Cross-wavelet analysis of coherent wind and saltation events. *Earth Surface Processes and Landforms*, 48(2), 406–414. Available from: https://doi.org/10.1002/esp.5493

Fisher, K.R., Ewing, R.C. & Duran Vinent, O. (2023) Decadal and seasonal changes in landcover at Padre Island: implications for the role of the back-barrier in signaling island state change. *Earth Surface Processes and Landforms*, 48(1), 163–178. Available from: https://doi.org/10.1002/esp.5479

Fryrear, D.W., Saleh, A. & Bilbro, J.D. (1998) A single event wind erosion model. *Transactions of the ASAE*, 41(5), 1369–1374. Available from: https://doi.org/10.13031/2013.17310

Garzon, J.L., Costas, S. & Ferreira, O. (2022) Biotic and abiotic factors governing dune response to storm events. *Earth Surface Processes and Landforms*, 47(4), 1013–1031. Available from: https://doi.org/10.1002/esp.5300

Goudie, A.S. (2013) *Arid and semi-arid geomorphology*. Cambridge, UK: Cambridge University Press. Available from: https://doi.org/10.1017/CBO9780511794261

He, Y., Cai, F., Liu, J., Qi, H., Li, B., Zhao, S. et al. (2022) Foredune height variations along the western coast of Taiwan Strait. *Earth Surface Processes and Landforms*, 47(11), 2765–2778. Available from: https://doi.org/10.1002/esp.5422

Hesp, P.A., DaSilva, M., Miot da Silva, G., Bruce, D. & Keane, R. (2022) Review and direct evidence of transgressive aeolian sand sheet and dunefield initiation. *Earth Surface Processes and Landforms*, 47(11), 2660–2675. Available from: https://doi.org/10.1002/esp.5400

Hesp, P.A., Walker, I.J., Chapman, C., Davidson-Arnott, R. & Bauer, B.O. (2013) Aeolian dynamics over a coastal foredune, Prince Edward Island, Canada. *Earth Surface Processes and Landforms*, 38(13), 1566–1575. Available from: https://doi.org/10.1002/esp.3444

Hilgendorf, Z., Walker, I.J., Pickart, A.J. & Turner, C.M. (2022) Dynamic restoration and the impact of native versus invasive vegetation on coastal foredune morphodynamics, Lanphere Dunes, California, USA. *Earth Surface Processes and Landforms*, 47(13), 3083–3099. Available from: https://doi.org/10.1002/esp.5445

Hoonhout, B. & de Vries, S. (2019) Simulating spatiotemporal aeolian sediment supply at a mega nourishment. *Coastal Engineering*, 145, 21–35. Available from: https://doi.org/10.1016/j.coastaleng.2018.12.007

Hoonhout, B.M. & de Vries, S. (2016) A process-based model for aeolian sediment transport and spatiotemporal varying sediment availability. *Journal of Geophysical Research: Earth Surface*, 121(8), 1555–1575. Available from: https://doi.org/10.1002/2015JF003692

Houser, C., Wernette, P. & Weymer, B.A. (2018) Scale-dependent behavior of the foredune: implications for barrier island response to storms and sea-level rise. *Geomorphology*, 303, 362–374.

Howe, M.A., Knight, G.T. & Clee, C. (2010) The importance of coastal sand dunes for terrestrial invertebrates in Wales and the UK, with particular reference to aculeate Hymenoptera (bees, wasps & ants). *Journal of Coastal Conservation*, 14, 91–102.

Jackson, D.W., Costas, S., González-Villanueva, R. & Cooper, A. (2019) A global 'greening' of coastal dunes: an integrated consequence of climate change? *Global and Planetary Change*, 182, 103026. Available from: https://doi.org/10.1016/j.gloplacha.2019.103026

Konlechner, T.M. & Hilton, M.J. (2022) Post-disturbance evolution of a prograded foredune barrier during a sustained dynamic restoration project—the role of wind speed, wind direction and vegetation. *Earth Surface Processes and Landforms*, 47(15), 3435–3452. Available from: https://doi.org/10.1002/esp.5466

Kooijman, A., Schouten, M., Postema, A., Cammeraat, E. & Arens, B. (2022) Blowout dynamics in lime-rich and lime-poor coastal dunes in the Netherlands. *Earth Surface Processes and Landforms*, 47(11), 2695–2708. Available from: https://doi.org/10.1002/esp.5402

Kuriyama, Y., Mochizuki, N. & Nakashima, T. (2005) Influence of vegetation on aeolian sand transport rate from a backshore to a foredune at Hasaki, Japan. *Sedimentology*, 52(5), 1123–1132. Available from: https://doi.org/10.1111/j.1365-3091.2005.00734.x

Lancaster, N. (2023) *Geomorphology of desert dunes* (2nd ed.). Cambridge, UK: Cambridge University Press. Available from: https://doi.org/10.1017/9781108355568

Lancaster, N. & Marticorena, B. (2008) Introduction to special section on aeolian processes: field observations and modeling. *Journal of Geophysical Research: Earth Surface*, 113(F2), 1–2. Available from: https://doi.org/10.1029/2008JF001056

Laporte-Fauret, Q., Castelle, B., Michalet, R., Marieu, V., Bujan, S. & Rosebery, D. (2021) Morphological and ecological responses of a managed coastal sand dune to experimental notches. *Science of the Total Environment*, 782, 146813. Available from: https://doi.org/10.1016/j.scitotenv.2021.146813

Li, H., Liu, C., Cheng, H., Zou, X., Zhang, C., Liu, B. et al. (2022) A general model for predicting aeolian transport rate over sand surfaces with vegetation cover. *Earth Surface Processes and Landforms*, 47(10), 2471–2482.

Li, J., Okin, G.S., Herrick, J.E., Belnap, J., Miller, M.E., Vest, K. et al. (2013) Evaluation of a new model of aeolian transport in the presence of vegetation. *Journal of Geophysical Research: Earth Surface*, 118(1), 288–306. Available from: https://doi.org/10.1002/jgrf.20040

Lindell, J., Fredriksson, C. & Hanson, H. (2017) Impact of dune vegetation on wave and wind erosion: a case study at Ängelholm Beach, South Sweden. *Vatten: Tidskrift för vattenvård/Journal of Water Management and Research*, 73(1–2), 39–48.

Livingstone, I. & Warren, A. (1996) *Aeolian geomorphology: an introduction*. Harlow, UK: Addison Wesley Longman Ltd.

Livingstone, I. & Warren, A. (2019) *Aeolian geomorphology: a new introduction*. Chichester, UK: John Wiley & Sons Ltd. Available from: https://doi.org/10.1002/9781118945650

Martínez, M.L., Hesp, P.A. & Gallego-Fernández, J.B. (2013) Coastal dunes: human impact and need for restoration. In: Martínez, M., Gallego-Fernández, J. & Hesp, P. (Eds.) *Restoration of coastal dunes. Springer Series on Environmental Management*. Berlin, Heidelberg: Springer. Available from: https://doi.org/10.1007/978-3-642-33445-0_1

Masselink, G., Hughes, M. & Knight, J. (2014) *Introduction to coastal processes and geomorphology*. Oxfordshire, UK: Routledge.

Masselink, G., Scott, T., Poate, T., Russell, P., Davidson, M. & Conley, D. (2016) The extreme 2013/2014 winter storms: hydrodynamic forcing and coastal response along the southwest coast of England. *Earth Surface Processes and Landforms*, 41(3), 378–391.

Maun, M.A. (2009) *The biology of coastal sand dunes*. Oxford, UK: Oxford University Press. Available from: https://doi.org/10.1093/oso/9780198570356.001.0001

Nguyen, D., Hilton, M. & Wakes, S. (2022) Wind flow dynamics and sand deposition behind excavated foredune notches on developed coasts. *Earth Surface Processes and Landforms*, 47(7), 1698–1719. Available from: https://doi.org/10.1002/esp.5341

Nordstrom, K.F. (2004) *Beaches and dunes of developed coasts*. Cambridge, UK: Cambridge University Press.

Nordstrom, K.F. (2014) Coastal dunes. In: Masselink, G. & Gehrels, R. (Eds.) *Coastal environments and global change*. Chichester, UK: John Wiley & Sons, pp. 178–193.

Nordstrom, K.F., Lampe, R. & Vandemark, L.M. (2000) Reestablishing naturally functioning dunes on developed coasts. *Environmental Management*, 25(1), 37–51. Available from: https://doi.org/10.1007/s002679910004

Okin, G.S. (2008) A new model of wind erosion in the presence of vegetation. *Journal of Geophysical Research: Earth Surface*, 113(F2), 1–11. Available from: https://doi.org/10.1029/2007JF000758

Olivier, M.J. & Garland, G.G. (2003) Short-term monitoring of foredune formation on the east coast of South Africa. *Earth Surface Processes and Landforms: The Journal of the British Geomorphological Research Group*, 28(10), 1143–1155.

Parsons, A.J. & Abrahams, A.D. (1994) *Geomorphology of desert environments*. Netherlands, Springer, pp. 3–12. Available from: https://doi.org/10.1007/978-94-015-8254-4_1

Parsons, A.J. & Abrahams, A.D. (2009) *Geomorphology of desert environments*. Netherlands, Springer, pp. 3–7. Available from: https://doi.org/10.1007/978-1-4020-5719-9_1

Parsons, L.S., Sayre, J., Ender, C., Rodrigues, J.L. & Barberán, A. (2020) Soil microbial communities in restored and unrestored coastal dune ecosystems in California. *Restoration Ecology*, 28, S311–S321.

Patton, N.R., Shulmeister, J., Rittenour, T.M., Almond, P., Ellerton, D. & Santini, T. (2022) Using calibrated surface roughness dating to estimate coastal dune ages at K'gari (Fraser Island) and the Cooloola Sand Mass, Australia. *Earth Surface Processes and Landforms*, 47(10), 2455–2470. Available from: https://doi.org/10.1002/esp.5387

Pye, K. (2015) *Aeolian dust and dust deposits*. London, UK: Academic Press.

Pye, K., Saye, S. & Blott, S. (2007) Sand dune processes and management for flood and coastal defence. Part 2: sand dune processes and morphology. DEFRA R&D Technical Report FD1392/TR, 70pp.

Pye, K. & Blott, S.J. (2020) Is 're-mobilisation' nature restoration or nature destruction? A commentary. Discussion. *Journal of Coastal Conservation*, 24(1), 10.

Pye, K. & Tsoar, H. (2008) *Aeolian sand and sand dunes*. Berlin, Germany: Springer-Verlag.

Rhind, P. & Jones, R. (2009) A framework for the management of sand dune systems in Wales. *Journal of Coastal Conservation*, 13, 15–23.

Robin, N., Billy, J., Nicolae Lerma, A., Castelle, B., Hesp, P.A., Rosebery, D. et al. (2022) Natural remobilization and historical evolution of a modern coastal transgressive dunefield. *Earth Surface Processes and Landforms*, 1–20. Available from: https://doi.org/10.1002/esp.5535

Rodgers, S., O'Keeffe, N. & Delgado-Fernandez, I. (2019) Factors affecting dune mobility in Newborough, Wales. In: Durán, R., Guillén, J. & Simarro, G. (Eds.) *Proceedings of the X Jornadas de Geomorfología Litoral*. Castelldefels 4–6 September, Spain, pp. 129–132.

Ruessink, G., Sterk, G., Smit, Y., De Winter, W., Hage, P., Donker, J.J. et al. (2022) Predicting monthly to multi-annual foredune growth at a narrow beach. *Earth Surface Processes and Landforms*, 47(7), 1845–1859. Available from: https://doi.org/10.1002/esp.5350

Saha, K. & Sinha, S. (2023) Distinguishing depositional environments in the beach-dune system of Chandipur, India, based on sediment texture and quartz grain surface features. *Earth Surface Processes and Landforms*, 1–16. Available from: https://doi.org/10.1002/esp.5546

Sanromualdo-Collado, A., Marrero-Rodríguez, N., García-Romero, L., Delgado-Fernández, I., Viera-Pérez, M., Domínguez-Brito, A.C. et al. (2022) Foredune responses to the impact of aggregate extraction in an arid aeolian sedimentary system. *Earth Surface Processes and Landforms*, 47(11), 2709–2725. Available from: https://doi.org/10.1002/esp.5419

Sherman, D.J. (2020) Understanding wind-blown sand: six vexations. *Geomorphology*, 366, 107193. Available from: https://doi.org/10.1016/j.geomorph.2020.107193

Sherman, D.J. & Farrell, E.J. (2008) Aerodynamic roughness lengths over movable beds: comparison of wind tunnel and field data. *Journal of Geophysical Research: Earth Surface*, 113(F2), 1–10.

Thomas, D.S. (2011) *Arid zone geomorphology: process, form and change in drylands*. Chichester, UK: John Wiley & Sons. Available from: https://doi.org/10.1002/9780470710777

Uphues, C.F., van IJzendoorn, C.O., Hallin, C., Pearson, S.G., van Prooijen, B.C., Miot da Silva, G. et al. (2022) Coastal aeolian sediment transport in an active bed surface layer: tracer study and conceptual model. *Earth Surface Processes and Landforms*, 47(13), 3147–3162. Available from: https://doi.org/10.1002/esp.5449

van IJzendoorn, C.O., Hallin, C., Cohn, N., Reniers, A.J. & De Vries, S. (2023) Novel sediment sampling method provides new insights into vertical grain size variability due to marine and aeolian beach processes. *Earth Surface Processes and Landforms*, 48(4), 782–800.

Walker, I.J., Hilgendorf, Z., Gillies, J.A., Turner, C.M., Furtak-Cole, E. & Nikolich, G. (2023) Assessing performance of a "nature-based" foredune restoration project, Oceano Dunes, California, USA. *Earth Surface Processes and Landforms*, 48(1), 143–162. Available from: https://doi.org/10.1002/esp.5478

Warren, A. (2013) *Dunes: dynamics, morphology, history*. Chichester, UK: John Wiley & Sons. Available from: https://doi.org/10.1002/9781118295786

Webb, N.P., Chappell, A., LeGrand, S.L., Ziegler, N.P. & Edwards, B.L. (2020) A note on the use of drag partition in aeolian transport models. *Aeolian Research*, 42, 100560. Available from: https://doi.org/10.1016/j.aeolia.2019.100560

Woodruff, N.P. & Siddoway, F.H. (1965) A wind erosion equation. *Soil Science Society of America Journal*, 29(5), 602–608. Available from: https://doi.org/10.2136/sssaj1965.03615995002900050035x

Zhang, S., Qiu, X., Fu, S., Fu, J., Chen, S., Tian, W. et al. (2022) Evolution of blowouts in artificial foredunes on Pingtan Island, China. *Earth Surface Processes and Landforms*, 47(10), 2597–2611. Available from: https://doi.org/10.1002/esp.5397

Zhang, P., Sherman, D.J., Pelletier, J.D., Ellis, J.T., Farrell, E.J. & Li, B. (2022) Quantification and classification of grainflow morphology on natural dunes. *Earth Surface Processes and Landforms*, 47(7), 1808–1819. Available from: https://doi.org/10.1002/esp.5348

How to cite this article: Farrell, E.J., Delgado Fernandez, I., Smyth, T., Li, B. & Swann, C. (2023) Contemporary research in coastal dunes and aeolian processes. *Earth Surface Processes and Landforms*, 1–9. Available from: https://doi.org/10.1002/esp.5597