Hijacking the 3Ss to ground reflective co-management of beach-dune environments

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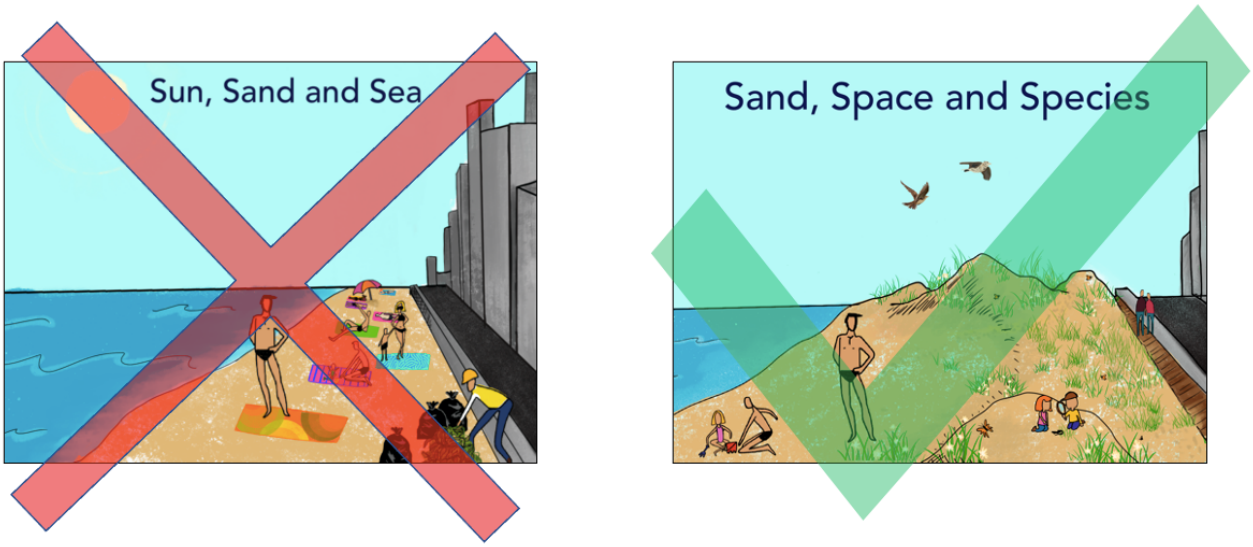
Abstract

The global drive to provide the 3Ss (Sun, Sand and Sea) for the benefit of tourists has been a contributory factor in the parallel deterioration of beach-dune habitats on our coasts. In Europe, this has happened at a time when habitat conservation and integrated coastal zone management have been strongly backed to redress declining habitat condition. This paper proposes that we hijack the 3Ss slogan and use it as one tool in the continuing struggle to effect a transition to genuine sustainable coastal management. In this reappropriation of the slogan, the 3Ss stand for **Sand, Space and Species**. The new 3Ss would facilitate a shared focus on what are the essential components required for long-term, healthy beach-dune systems, using straight-forward language to initiate conversations between very diverse stakeholder groups.

Graphical Abstract



Commentary

At a time when we are seeing publications such as 'The Last Beach' and the latest EU Habitats reporting that >75% of European coastal dunes are in poor to bad condition (EEA, 2020; Pilkey and Cooper, 2014), can we as coastal scientists say our knowledge is having an impact at societal level? Or is it more accurate to say that we have little impact compared to those who sell our natural heritage as a well-packaged product? The success of the tourist driven slogan the 3Ss (Sun, Sand and Sea) has made a significant contribution to the current deleterious status of beach-dune environments (Defeo and Elliott, 2021; Defeo et al., 2009; Garcia-Lozano et al., 2018; Rangel-Buitrago et al., 2015; Schlacher et al., 2007; Soto et al., 2021).

As a selling point for mass tourism in the Mediterranean, the 3Ss idea has spread world-wide to become a more general understanding of what constitutes a quality beach, and by association, coastal dunes. This represents a serious barrier to achieving sustainable management of beach-dune systems located outside of mass tourism destinations. In the *Sun, Sand and Sea* conception a beach is a perfectly clean sand surface, managed to rid it of anything that may be construed as unappealing: for example, seaweed is removed for aesthetic and odour reasons; insects are seen as pests; plants are removed as weeds. While this may be acceptable in certain situations [maybe where the beach is located in a city], it is not an appropriate conceptualisation for semi-natural environments where our best scientific understanding of system dynamics is to let natural processes regulate beach and dune form (Cooper and McKenna, 2008; Delgado-Fernandez et al., 2019; Gonzalez and Holtmann-Ahumada, 2017; Sarda et al., 2015). There is little question that healthy beach-dune systems offer society a huge range of ecosystem services, including a nature-based solution as coastal protection against climate change impacts (Barbier et al., 2011; Drius et al., 2019b; Guisado-Pintado et al., 2016; Pascual et al., 2017; Temmerman et al., 2013).

The evidence - beaches and dunes deteriorating and being lost – suggests our science is failing to make the desired impact that is achievable with the knowledge we presently possess. There are issues around how we communicate science, with our skills, motivations and opportunities varying individually as scientists. There are also problems in our ability to work across disciplinary boundaries, where diverse perspectives bring distinct conceptualisations, values and languages (Bubela et al., 2009; Cooper and

Jackson, 2019; Fischhoff, 2019; Illingworth, 2017). These issues are compounded by shortcomings in contemporary beach management, where decision-making has been shown to: be reactive (as opposed to strategic); favour simple technological fixes that are expensive and short-term; be sector-based and reach-based which both ignore wider knock-on effects; be lacking in evaluations of past failures; be rigid, not allowing for alternatives if the chosen option fails; favour protection over adaptation; be subject to conflicting political and social agendas (e.g., Cooper and Pile, 2014; McKenna et al., 2008; Puente-Rodríguez et al., 2015; Rangel-Buitrago et al., 2018). As we move further along the path towards co-production of knowledge and more integrated forms of decision-making (Birch and Reyes, 2018; Bodin, 2017; Flannery and McAteer, 2020; Glavovic, 2013a; Partelow et al., 2020; Tompkins and Adger, 2004), facilitating a better understanding of the fundamentals of beach-dune dynamics within a broader set of stakeholders is essential to progress (Rangel-Buitrago et al., 2018). Here it is proposed that we hijack the 3Ss for this very purpose: a common shared starting point in simple language, for developing long-term, flexible planning options that involve beach-dune environments. In this reappropriation of the slogan, the 3Ss stand for Sand, Space and Species (Figure 1).

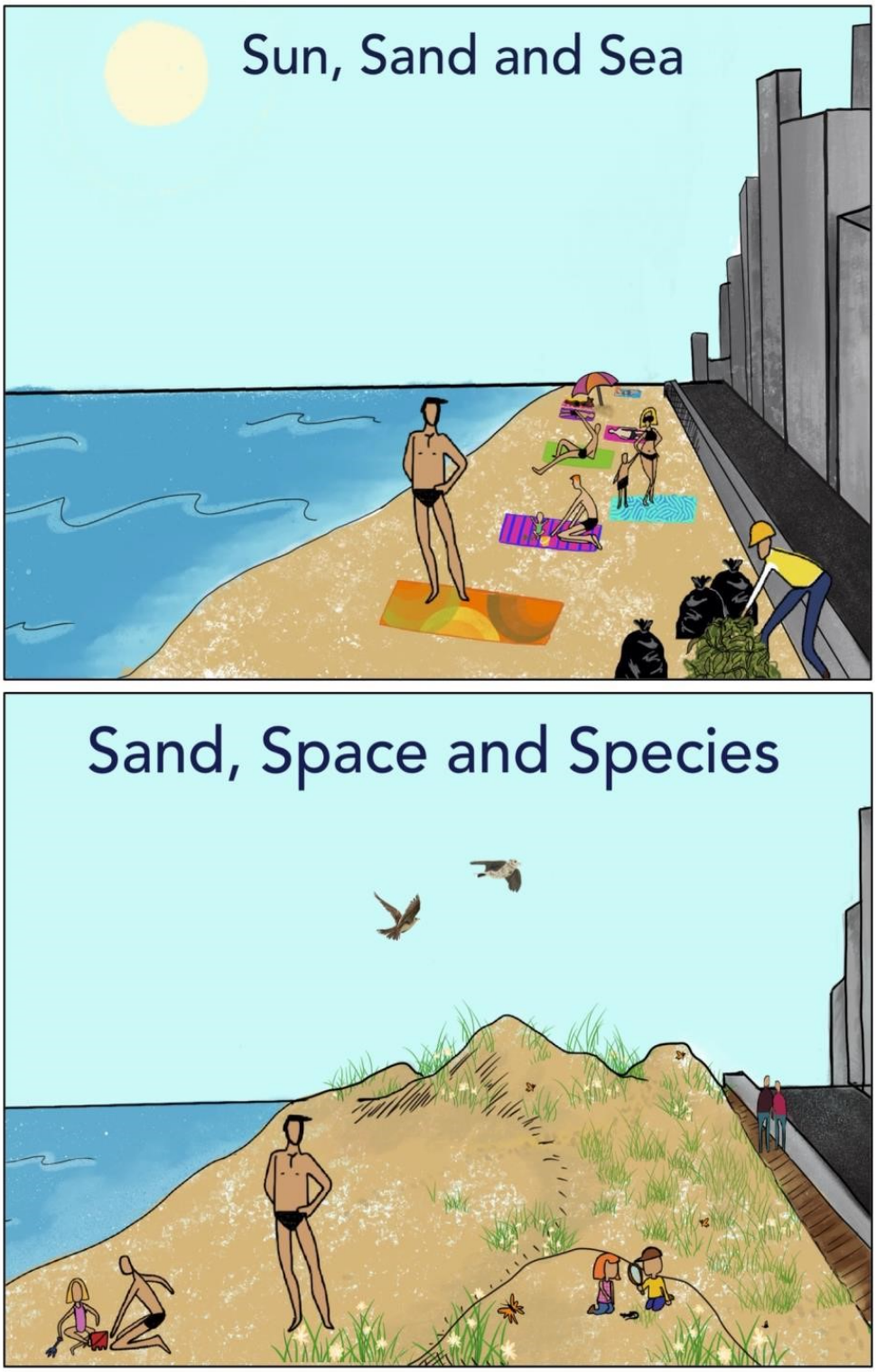


Figure 1. The idea of the 3Ss (top panel) has become synonymous with what constitutes a quality beach (and by association, a quality dune). This is a simple, clean place devoid of annoying plants or animals. The re-imagining of the 3Ss (bottom panel) allows for a shared space, where a healthy beach-dune system can be enjoyed for recreation and provide better coastal protection along with a greater range of ecosystem goods and services.

Sand: here we have one word as a *conversation starter* for one of the essential ingredients of a healthy beach-dune environment. Self-evident as it seems, many initiatives usually start with the erroneous assumption that an erosion event is in itself a long-term trend. Therefore, beginning with a discussion of processes such as sediment supply, sediment transport pathways, the two-way connection between the beach and the nearshore will draw out the complexity of these very dynamic environments. Or how accumulations of sand as hills and hollows creates the geodiversity that contributes to niche coastal habitats. When this becomes too technical, as all the variables and drivers of change are added to the mix, returning to the key element will ground conversations.
Grounding question: do we have enough sand to maintain the beach and dune in the long-term?

Space: a vital component in implementing the concept of 'working with natural processes' or an ecosystem-based approach is allowing space for these processes to occur. At a time when the combined pressures of coastal development and sea-level rise are leading to 'coastal squeeze' the vital conversations for stakeholders to have are around the need to allow space and time for nature to function. The rigidization of our coasts as a form of *resistance* to coastal storms has been shown to have serious negative impacts on coastal habitats, as well as being a very expensive, short-term solution (Cooper and Pile, 2014; Lithgow et al., 2019). Indeed armouring the coast may increase the vulnerability of coastal communities, where perceived safety encourages new development (e.g., Lazarus et al., 2018; Glavovic, 2013b). Climate change exacerbation of existing coastal risks, especially of flooding and erosion, demands a more adaptive, long-term set of solutions. For beach-dune systems to be an effective part of future coastal protection strategies, they will require sufficient space to adjust to future conditions.
'Space' also relates to how we manage multiple shared uses of our beaches and dunes (Drius et al., 2019a; Simpson, 2008). If planned properly there is no reason that healthy systems cannot support nature *and* allow for our more utilitarian needs – like tourism and recreation – while at the same time recover naturally from individual storm events. That is to say, healthy beach-dune systems not only improve coastal resilience but also enhance scenic beauty and appeal to the consumer (Rangel-Buitrago, 2018).
Grounding question: have we left enough space for sand to move by wind and wave action?

Species: Healthy beach-dunes have both a physical and a biotic component. It is well reported that nourished and engineered beaches can be practically barren environments (Peterson et al., 2006; Schlacher et al., 2012; Speybroeck et al., 2006). Introducing the way in which the plants and animals of these environments are very specialised having adapted to harsh coastal conditions piques great interest in non-scientific circles. This interest can lead to discussions around the functional role each species plays in the dynamics of these systems, including the binding capacity of plants accumulating sand and reducing erosion (Salgado and Martinez, 2017), beach invertebrates supporting wider food webs (Schlacher et al., 2007), the benefits of flowering dune plants for pollinators, to name but a few. In addition, natural processes of disturbance such as erosion and deposition cycles naturally enhance biodiversity, while human activities (e.g., quad biking, wild camping) and pressures (e.g., tourism, sports) can have severe detrimental impacts (Davenport and Davenport, 2006; Santoro et al., 2012; Silc et al., 2017). Improving the broader understanding of the role of the 'living' component of beaches and dunes will aid in the interpretation of management options and pathways for the future. In many locations discussions centred on endangered species can be an excellent way in which to introduce the overall health of the habitat and the interconnectedness of systems. For example, the plight of sea turtles could highlight, for non-experts, connections between the land and the sea, society and nature, or international law and local regulations (e.g., Summers et al., 2018)

Grounding question: are we giving plants and animals the time and space they need to thrive?

Three words to cover the entirety of our knowledge of how a healthy beach-dune environment functions may seem a stretch, but there are very few components that could not be covered under these three headings - only a few examples have been given here. The intention is not to replace existing tools for quantifying beach and dune quality, rather to establish a more engaging *introduction* into an understanding of the science and the variety of issues that should be discussed in any management or planning context (Figure 2). For nontechnically minded stakeholders the 3Ss can act not only as an entry point into discussion, but also a place to return and ground conversations if they feel uncomfortable as levels of complexity increase. They should be able to ask the grounding questions at any stage in the process and expect a straightforward explanation from the experts.

Figure 2. The newly appropriated 3Ss slogan – Sand, Space and Species - can both pique people's interest and act as a very simple tool for focusing minds on the key components for healthy beach-dune environments as they participate in deliberative processes. Lefthand panel: To facilitate deliberation with a broad set of actors, the new 3Ss act as an open door that draws in non-experts and experts to a relaxed, interesting atmosphere where participants have a sense of equal footing with each other, this is an important first step. Righthand panel: This initial trust building in step 1 should enhance - for those interested - opening doors to understanding the technical dimensions of possible options for better management and planning.

As scientists we could come together and maybe develop a 'brand' to better represent what we consider the fundamentals of beach-dune systems, with symbols, graphics and media packs to build awareness. If recent political shocks have thought us one thing it is that simple straight-forward messaging goes a long way. "Brand is a mark left on the minds and hearts of consumers … and is … thus more than just a logo, name, symbol, trademark, or label attached to a product" (Wijaya, 2013, p57). So why not use one (the 3Ss) that exists already and has been shown to be very effective.

We are at a new juncture for beach-dune habitats, as scientific fashions change over time (Sherman, 1996) it is incumbent on us to go with the flow. We have primarily tried ideas around conservation (e.g., Habitats Directive) and better management (e.g., Integrated Coastal Zone Management), and continue to see poor results on the ground. A growing public consciousness of the existential threat of climate change, is drawing society back to the importance of ecosystems as an essential support for human systems. As part of

this renewed awareness, we have a fresh opportunity to persuade society that healthy beach-dune systems will increase resilience to climate change shocks, and are preferable to the anthropocentric conception of Sun, Sand and Sea. At the core of what we as scientist are trying to achieve is sustainability (although some of our reductionist tendencies may distract us from seeing that goal), the changes and processes required to do this are highly complex, especially as local and regional contexts come into play (e.g, Glavovic, 2016; Neumann et al., 2017). Therefore, achieving strong sustainability and effective deliberative democracy should include attempts at appealing to the masses, as mass tourism clearly does, to facilitate wider participation in deliberations on our shared future (Bubela et al., 2009).

The challenge here is not to 'dumb down' our science, but to distil the complexity of the geomorphological understanding of beach-dune dynamics into a form that connects with a wide audience. The 3Ss slogan repurposed as - Sand, Space and Species - can be used as a door into the complex issues around beach-dune environments. It is already imbedded in the global consciousness and as such may be too good of an opportunity to miss.

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Reference List

Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E.W., Stier, A.C., Silliman, B.R., 2011. The value of estuarine and coastal ecosystem services. Ecological Monographs 81, 169-193.

Birch, T., Reyes, E., 2018. Forty years of coastal zone management (1975-2014): Evolving theory, policy and practice as reflected in scientific research publications. Ocean & Coastal Management 153, 1-11.

Bodin, O., 2017. Collaborative environmental governance: Achieving collective action in social-ecological systems. Science 357, 659-+.

Bubela, T., Nisbet, M.C., Borchelt, R., Brunger, F., Critchley, C., Einsiedel, E., Geller, G., Gupta, A., Hampel, J., Hyde-Lay, R., Jandciu, E.W., Jones, S.A., Kolopack, P., Lane, S., Lougheed, T., Nerlich, B., Ogbogu, U., O'Riordan, K., Ouellette, C., Spear, M., Strauss, S., Thavaratnam, T., Willemse, L., Caulfield, T., 2009. Science communication reconsidered. Nature Biotechnology 27, 514-518.

Cooper, J.A.G., Jackson, D.W.T., 2019. Coasts in Peril? A Shoreline Health Perspective. Frontiers in Earth Science 7.

Cooper, J.A.G., McKenna, J., 2008. Working with natural processes: the challenge for coastal protection strategies. Geographical Journal 174, 315-331.

Cooper, J. A. G., Pile, J., 2014. The adaptation-resistance spectrum: A classification of contemporary adaptation approaches to climate-related coastal change. Ocean & Coastal Management 94, 90-98.

Davenport, J., Davenport, J.L., 2006. The impact of tourism and personal leisure transport on coastal environments: A review. Estuarine Coastal and Shelf Science 67, 280-292.

Defeo, O., Elliott, M., 2021. The 'triple whammy' of coasts under threat - Why we should be worried! Marine Pollution Bulletin 163.

Defeo, O., McLachlan, A., Schoeman, D., Schlacher, T., Dugan, J., Jones, A., Lastra, M., Scapini, F., 2009. Threats to sandy beach ecosystems: A review. Estuarine Coastal and Shelf Science 81, 1-12.

Delgado-Fernandez, I., O'Keeffe, N., Davidson-Arnott, R.G.D., 2019. Natural and human controls on dune vegetation cover and disturbance. Science of the Total Environment 672, 643-656.

Drius, M., Bongiorni, L., Depellegrina, D., Menegon, S., Pugnetti, A., Stifter, S., 2019a. Tackling challenges for Mediterranean sustainable coastal tourism: An ecosystem service perspective. Science of the Total Environment 652, 1302-1317.

Drius, M., Jones, L., Marzialetti, F., de Francesco, M.C., Stanisci, A., Carranza, M.L., 2019b. Not just a sandy beach. The multi-service value of Mediterranean coastal dunes. Science of the Total Environment 668, 11391155.

EEA, 2020. State of nature in the EU - Results from reporting under the nature directives 2013-2018 European Environment Agency.

Fischhoff, B., 2019. Evaluating science communication. Proceedings of the National Academy of Sciences of the United States of America 116, 7670-7675.

Flannery, W., McAteer, B., 2020. Assessing marine spatial planning governmentality. Maritime Studies 19, 269–284.

Garcia-Lozano, C., Pinto, J., Daunis-i-Estadella, P., 2018. Changes in coastal dune systems on the Catalan shoreline (Spain, NW Mediterranean Sea). Comparing dune landscapes between 1890 and 1960 with their current status. Estuarine Coastal and Shelf Science 208, 235-247.

Glavovic, B., 2016. Towards deliberative coastal governance: insights from South Africa and the Mississippi Delta. Regional Environmental Change 16 (2), 353-365.

Glavovic, B.C., 2013a. Coastal Innovation Imperative. Sustainability 5, 934-954.

Glavovic, B.C., 2013b. Coastal Innovation Paradox. Sustainability 5, 912-933

Gonzalez, S.A., Holtmann-Ahumada, G., 2017. Quality of tourist beaches of northern Chile: A first approach for ecosystem-based management. Ocean & Coastal Management 137, 154-164.

Guisado-Pintado, E., Navas, F., Malvarez, G., 2016. Ecosystem Services and Their Benefits as Coastal Protection in Highly Urbanised Environments. Journal of Coastal Research, 1097-1101.

Illingworth, S., 2017. Delivering effective science communication: advice from a professional science communicator. Seminars in Cell & Developmental Biology 70, 10-16.

Lazarus, E.D., Limber, P.W., Goldstein, E.B., Dodd, D., Armstrong, S.B., 2018. Building back bigger in hurricane strike zones. Nature Sustainability, 1, 759–762,

Lithgow, D., Martínez, M.L., Gallego-Fernández, J.B., Silva, R., Ramírez-Vargas, D.L., 2019. Exploring the co-occurrence between coastal squeeze and coastal tourism in a changing climate and its consequences. Tour. Manag. 74, 43–54. McKenna, J., Cooper, A. and O'Hagan, A.M., 2008. Managing by principle: A critical analysis of the European principles of Integrated Coastal Zone Management (ICZM). Marine Policy, 32(6), pp.941-955.

Neumann, B., Ott, K., Kenchington, R., 2017. Strong sustainability in coastal areas: a conceptual interpretation of SDG 14. Sustain Sci 12, 1019–1035.

Partelow, S., Schluter, A., Armitage, D., Bavinck, M., Carlisle, K., Gruby, R.L., Hornidge, A.K., Le Tissier, M., Pittman, J.B., Song, A.M., Sousa, L.P., Vaidianu, N., Van Assche, K., 2020. Environmental governance theories: a review and application to coastal systems. Ecology and Society 25.

Pascual, U., Balvanera, P., Diaz, S., Pataki, G., Roth, E., Stenseke, M., Watson, R.T., Dessane, E.B., Islar,
M., Kelemen, E., Maris, V., Quaas, M., Subramanian, S.M., Wittmer, H., Adlan, A., Ahn, S., Al-Hafedh, Y.S., Amankwah, E., Asah, S.T., Berry, P., Bilgin, A., Breslow, S.J., Bullock, C., Caceres, D., Daly-Hassen, H., Figueroa, E., Golden, C.D., Gomez-Baggethun, E., Gonzalez-Jimenez, D., Houdet, J., Keune, H., Kumar, R., Ma, K.P., May, P.H., Mead, A., O'Farrell, P., Pandit, R., Pengue, W., Pichis-Madruga, R., Popa, F., Preston,
S., Pacheco-Balanza, D., Saarikoski, H., Strassburg, B.B., van den Belt, M., Verma, M., Wickson, F., Yagi, N., 2017. Valuing nature's contributions to people: the IPBES approach. Current Opinion in Environmental Sustainability 26-27, 7-16.

Peterson, C.H., Bishop, M.J., Johnson, G.A., D'Anna, L.M., Manning, L.M., 2006. Exploiting beach filling as an unaffordable experiment: Benthic intertidal impacts propagating upwards to shorebirds. Journal of Experimental Marine Biology and Ecology 338, 205-221.

Puente-Rodríguez, D., Giebels, D. and de Jonge, V.N., 2015. Strengthening coastal zone management in the Wadden Sea by applying 'knowledge-practice interfaces'. Ocean & Coastal Management, 108, pp.27-38.

Pilkey, O.H., Cooper, J.A.G., 2014. The Last Beach. Duke University Press.

Rangel-Buitrago, N. ed., 2018. Coastal Scenery: Evaluation and Management (Vol. 26). Springer

Rangel-Buitrago, N., de Jonge, V.N., Neal, W., 2018. How to make Integrated Coastal Erosion Management a reality. Ocean & Coastal Management 156, 290-299.

Rangel-Buitrago, N.G., Anfuso, G., Williams, A.T., 2015. Coastal erosion along the Caribbean coast of Colombia: Magnitudes, causes and management. Ocean & Coastal Management 114, 129-144.

Santoro, R., Jucker, T., Prisco, I., Carboni, M., Battisti, C., Acosta, A.T.R., 2012. Effects of Trampling Limitation on Coastal Dune Plant Communities. Environmental Management 49, 534-542.

Sarda, R., Valls, J.F., Pinto, J., Ariza, E., Lozoya, J.P., Fraguell, R.M., Marti, C., Rucabado, J., Ramis, J., Jimenez, J.A., 2015. Towards a new Integrated Beach Management System: The Ecosystem-Based Management System for Beaches. Ocean & Coastal Management 118, 167-177.

Schlacher, T.A., Dugan, J., Schoeman, D.S., Lastra, M., Jones, A., Scapini, F., McLachlan, A., Defeo, O., 2007. Sandy beaches at the brink. Diversity and Distributions 13, 556-560.

Schlacher, T.A., Noriega, R., Jones, A., Dye, T., 2012. The effects of beach nourishment on benthic invertebrates in eastern Australia: Impacts and variable recovery. Science of the Total Environment 435, 411417.

Sherman, D.J., 1996. Fashion in geomorphology. Scientific Nature of Geomorphology, 87-114.

Silc, U., Cakovic, D., Kuzmic, F., Stesevic, D., 2017. Trampling impact on vegetation of embryonic and stabilised sand dunes in Montenegro. Journal of Coastal Conservation 21, 15-21.

Simpson, M.C., 2008. Community benefit tourism initiatives - A conceptual oxymoron? Tourism Management 29, 1-18.

Soto, E., Botero, C.M., Milanes, C.B., Rodriguez-Santiago, A., Palacios-Moreno, M., Diaz-Ferguson, E., Velazquez, Y.R., Abbehusen, A., Guerra-Castro, E., Simoes, N., Mucino-Reyes, M., Souza, J.R., 2021. How does the beach ecosystem change without tourists during COVID-19 lockdown? Biological Conservation 255.

Speybroeck, J., Bonte, D., Courtens, W., Gheskiere, T., Grootaert, P., Maelfait, J.P., Mathys, M., Provoost, S., Sabbe, K., Stienen, E.W.M., Van Lancker, V., Vincx, M., Degraer, S., 2006. Beach nourishment: an ecologically sound coastal defence alternative? A review. Aquatic Conservation-Marine and Freshwater Ecosystems 16, 419-435.

Summers, T. M., Martin, S. L., Hapdei, J. R., Ruak, J. K., Jones, T. T., 2018. Endangered Green Turtles (*Chelonia mydas*) of the Northern Mariana Islands: Nesting Ecology, Poaching, and Climate Concerns. Front. Mar. Sci. 4 (428) 1-15.

Temmerman, S., Meire, P., Bouma, T.J., Herman, P.M.J., Ysebaert, T., De Vriend, H.J., 2013. Ecosystembased coastal defence in the face of global change. Nature 504, 79-83.

Tompkins, E.L., Adger, W.N., 2004. Does adaptive management of natural resources enhance resilience to climate change? Ecology and Society 9.

Wijaya, B.S., 2013. Dimensions of Brand Image: A Conceptual Review from the Perspective of Brand Communication. European Journal of Business and Management 05, 55-65.