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Bridging land and seascape restoration for ecoscape recovery

The escalating loss and degradation of coastal habitats significantly affect coastal communities, ocean biodiversity, and planetary health. A special Collection launched in *npj Ocean Sustainability* on "Bridging Land and Seascape Restoration for Ecoscape Recovery" aimed to establish a widely applicable foundation for scalable approaches that support integrated multi-habitat coastal ecosystem restoration and recovery. In this Editorial, we define the concept of "ecoscape restoration" and highlight the key themes emerging from the Collection.

Scaling-up restoration

The escalating loss and degradation of coastal habitats significantly affect coastal communities, ocean biodiversity, and planetary health[1–3]. Coastal habitat restoration is now a vital tool for regaining lost ecological functions and associated socio-economic benefits[4,5]. Broadly, we define ecological restoration as the practice of assisting in the recovery of degraded ecosystems. Restoration encompasses varied goals and may focus on the recovery of function or structure of species, communities, or habitats of various scales, typically relative to a chosen reference state[6]. Policies and frameworks such as the Global Biodiversity Framework, the United Nations (UN) Decade on Ecosystem Restoration, and the European Union's (EU) Nature Restoration Law emphasize the role of ecological restoration in addressing the noteworthy decline of coastal ecosystems and achieving environmental sustainability goals[7,8]. Such initiatives represent critical steps towards restoring degraded ecosystems and, in some cases, establishing legally binding requirements. Following these calls for policy action, there is a need to ensure that the state of restoration science and practice is ready for implementation at scale to achieve ambitious targets.

Despite the urgency, marine restoration initiatives have been dominated by small-scale and single-species initiatives with high failure rates[9]. While there has been a recent shift towards scaling-up, with a meta-analysis suggesting that marine restoration is being tried at various scales in certain ecosystems[10], progress has been slow. Common barriers to successful restoration include unsuitable restoration methodologies, adverse environmental conditions[10], inadequate governance arrangements, fragmented conservation policies[11], stressors not easily addressed by local interventions[12], and limited sustained financing[13]. The linking of marine restoration to the relatively more advanced restoration of terrestrial areas remains neglected, including where synergies could exist to advance both[14]. The disconnect between marine and terrestrial research and policy applications often reflects siloed political units and overlooks the deeply interconnected and interdependent nature of these systems[15,16], limiting the potential for effective restoration across the land-sea continuum. This, and the relatively high cost of marine restoration[9,10], have led to negative perceptions in both the scientific community and the general public about the viability and value of restoration[17].

These barriers to restoration also allow uncoordinated restoration efforts occurring across temporal and spatial scales to perpetuate. Few programs evaluate ecological and social consequences generated by restoration, particularly over longer (i.e., over 1 year) timescales[18,19]. On a national and regional scale, spatial management processes, such as marine spatial planning (MSP)[20], seldom incorporate systematic restoration opportunities into plans and thus do not sufficiently address the recovery of interconnected habitats across ecosystems. As global efforts to restore coastal ecosystems increase, attention is turning to scaling-up restoration efforts. A shift from the current predominant focus on single-habitat restoration towards a broader and more holistic multi-habitat restoration across ecosystems is needed to maximize the potential for ocean restoration, recovery, and regeneration.

The need for ecoscape restoration

Multi-habitat restoration is essential for recovering ecosystem functioning and resilience on a degraded planet in which *connectivity* (the interdependence of species and the services they provide on heterogeneous habitats spanning land-sea boundaries) has been damaged[20–22]. Conceptually, an ecoscape fits with the hierarchical array of ideas that describe how our world is structured (i.e., biosphere, ecoscape, ecosystem, community, population, organism). The biosphere is composed of 'scapes' (i.e., landscapes, seascapes) that are, in turn, comprised of ecosystems including a variety of natural habitats and linked human communities[23,24] (Fig. 1). An ecoscape has elements of seascapes, landscapes, or both, and may go beyond them in size and scope, as defined by ecological and social processes. The concept of ecoscapes, was described by Backhaus and Murungi[25] as "the geographicity of ecosystem", and later considered in relation to restoration law by Telesetsky[26]. At its core are the interconnections between human activities and nature in offshore, nearshore, coastal, estuarine, watershed, and land-based habitats[26].

The boundaries of an ecoscape should thus define the working unit for coastal restoration, including the sources of manageable pressures on land, freshwater, and sea that need to be addressed through restoration. Here, we define "ecoscape restoration" as an approach that considers the interconnected recovery of landscapes and seascapes in tandem at large geographical and long temporal scales (Box 1). Related approaches across the literature use a range of terms, from wholescapes to landscape-scale restoration or seascape restoration (Box 1). But despite a proliferation of terms related to ecoscape restoration, a unifying approach has not emerged to date. Efforts to advance these related concepts typically focus only on one side of the land-sea interface. In addition, practical applications of broad-scale restoration across the land-sea interface are few and far between. Ecoscape restoration goes beyond a seascape or a landscape; it includes both, connected by multidirectional flows of water, nutrients, organisms, and other ecological material across land, sea, freshwater, and atmosphere.

Ecoscape restoration is conceptually rooted in both *ecosystem-based management* (EBM)[27,28] and *landscape-scale conservation* principles[29]. It acknowledges the importance of considering ecological connectivity that dictates the flows of nutrients, energy, materials and organisms, including humans, across multiple habitats. Further, ecoscape restoration prioritizes enhancing ecosystem function across the broader system in ecological restoration planning and implementation. By focusing on coordinated restoration action at a broad scale, ecoscape restoration is not simply the recognition that 'bigger is better'. Instead, an ecoscape restoration approach necessitates strategic analysis of where, when, and how coordinated multi-habitat restoration across the land and sea interface can catalyze the recovery of ecosystem function when more reductionist approaches fail. Ecoscape restoration is thus the holistic restoration of multiple, interconnected, and interdependent social-ecological systems across the land-sea continuum.

The special collection

In June 2023, we launched the topic Collection *Bridging Land and Seascape Restoration for Ecoscape Recovery* in *npj Ocean Sustainability*[30,31]. The goal was to establish a widely applicable foundation for scalable approaches that support integrated multi-habitat coastal ecosystem restoration and recovery. The Collection welcomed submissions until August 2024, and in the end, it accepted eight pieces: four original research *Articles*, two *Review Articles*, and two *Comments*.

The pieces featured in this Collection come from the combined work of 88 authors from institutions across 10 countries. Of those 10 countries, four are in the Global South, represented by 17 authors (19%). Researchers affiliated with institutions in only three countries (United Kingdom, United States, and Australia) comprised 77% of all authors, and 75% of lead authors. While many authors' own nationalities are not reflected in the location of their institution(s), this skew in where research is funded and produced. This highlights the need for procedural equity, particularly where studies require place-based context or seek to influence policy. In terms of reflecting other under-represented perspectives in the Collection, 45 authors (51%) are women, including five of the eight lead authors (63%). This Collection also includes papers led by teenage and early-career researchers (38%) and others working primarily beyond academia on advocacy or practice.

The publications in the Collection are pioneering examples of ecoscape restoration. They reflect a variety of biophysical and social contexts across a range of scales and highlight the promises and challenges of designing and implementing ecoscape restoration. By showcasing work focused on ecoscape recovery with goals uniquely tailored to specific contexts, this collective work establishes a vision of what is possible in the recovery of interlinked habitats, ecosystems, and human communities. Indeed, the eight publications together reveal that the emergent idea of ecoscape restoration is becoming a reality. Four key themes emerged from this Collection, and we address each of these elements in more detail below. We further note that while these four key elements are common to all pieces, this Collection acknowledges that using a diversity of interdisciplinary approaches will prove most resilient and impactful in the long-term and the best way to tailor and sustain restoration to ensure it is maximally effective and just.

Four key emerging themes

Addressing land-sea connections (theme 1). Efforts to protect and restore ecoscapes must address multiple, complex, and interacting stressors at the land-sea interface. Several papers across the Collection consider land-sea connections as key to advancing ecoscape restoration (Fig. 2). In their research *Article*, Delevaux et al.[32] address land-based biocultural restoration in the Pacific, offering a unique perspective by extending the quantification of the benefits of forest restoration, connecting the outcomes across the land-sea interface and ultimately to downstream reef fish production. This holistic view of native forest habitat restoration ensures that the landscape and adjacent coral reefs are healthier, with fish populations rebounding, enhancing human health and well-being. Similarly, the *Article* by Kankam et al.[33] highlights the connections between land management, landscape restoration, urban greening decisions, and ecosystem services. These holistic views of restoration are rare, however. The *Article by* Preston et al.[34] emphasizes the importance of land-sea connectivity and stresses that this approach may require a whole-system consideration of both horizontal and vertical linkages across the landscape and seascape. In most places where policies and approaches such as MSP and coastal zone management promote restoration opportunities, a connection to terrestrial habitats and related land use planning is often lacking. Preston et al.[34] highlight that restoration site selection could be improved by approaching seascape restoration as being

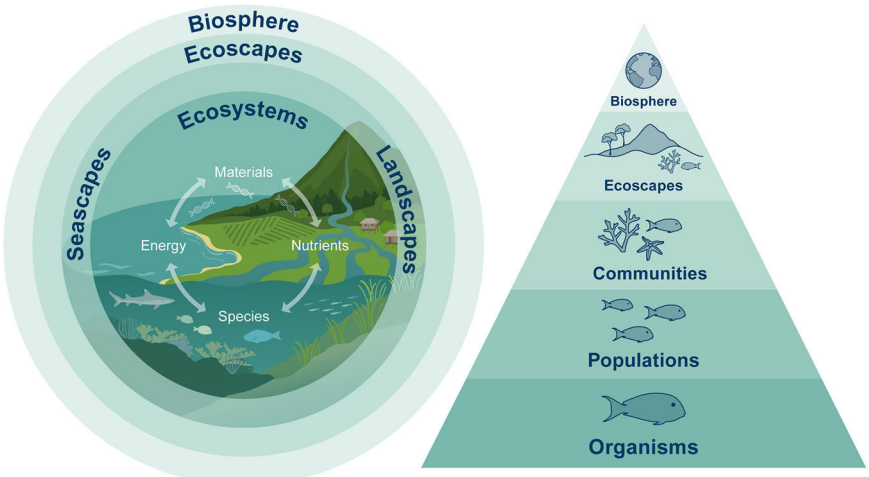

Fig. 1 | Ecoscape hierarchy conceptual diagrams. Ecoscapes are situated within the biosphere and have elements of seascapes, landscapes, or both. Ecoscapes are made up of ecosystems that are comprised of communities, populations, and individuals

Box 1 | Ecoscape restoration definition and related concepts

Definition

Ecoscape restoration. The strategic design and implementation of multi-habitat restoration along the land-sea interface to facilitate the recovery of social-ecological functions and structures across interconnected landscapes and seascapes at large geographical and long temporal scales.

Related Concepts

Ecological connectivity. Links between and among habitats over time and space that allow for the movement of organisms, nutrients, or other ecologically relevant material[22].

Ecosystem-based management. A holistic, place-based approach that focuses on a specific ecosystem and the range of activities affecting it, recognizing the existing connectivity amongst all of its elements, including humans[28].

Integrated watershed management. Consideration of connected watersheds, generally regarding freshwater systems, acknowledging the influence of land use, connection to the sea, and often including social considerations[43].

Landscape-scale conservation. The protection of ecological characteristics across multiple habitats and scales, including interactions among habitats, that may be applied with or without consideration of social context[29].

Landscape restoration. The process of regaining ecological function or structure and enhancing human well-being across deforested or degraded landscapes[8].

Multi-habitat restoration. Reinstating the ecological function or structure of multiple connected, interacting habitats, leveraging synergies and co-benefits which exist among and between them[44,45].

Ridge-to-reef conservation. A way to view management as connected from the highest points (ridges) to marine systems (reefs), marked by an emphasis on sequential, unidirectional transport (e.g., of nutrients, sediments, pollutants) through watersheds[46–48].

Seascape restoration. The process of helping to recover damaged, degraded, or destroyed seascapes is the physical mosaic of interacting habitats occupying the coastal environment across time and space[34,49,50]. Can include watershed management, but extends to marine management in nearshore areas directly influenced by land/ freshwater.

Wholescape. A way of thinking about the environment and society that considers the interconnectedness of land, rivers, coasts, and seas. Rather than restoration, wholescapes emphasize governance and institutional arrangements for partnerships[51].

driven by nature-based solutions within a larger-scale climate-smart MSP framework to help overcome short policymaking timeframes.

Restoring ecosystem function (theme 2). Large-scale, multi-habitat restoration is essential for maintaining and recovering lost ecological functions. Studies in this Collection give insights into the restoration design conditions that facilitate functional recovery. They demonstrate that coordinating multi-habitat restoration enables practitioners to account for the ecological roles of focal species targeted for recovery, as well as the relevant scales at which these species' functions play out across habitat mosaics[34–37]. For example, the *Article by* Preston et al.[34] demonstrates that ecosystem functioning relies on a healthy, interconnected mosaic of coastal habitats that enables the flows of matter between them. Also, the comprehensive *Review* by Vozzo et al.[37] highlights how the passive restoration of fish species (i.e., their protection) at a seascape scale enhances the movement of terrestrial nutrients from restored nearshore habitats offshore. The authors highlight how ecological functions depend on the orchestration of habitat-specific processes carried by the biological communities whose transport and movement connect them across the ecoscape. However, these facilitation processes require practitioners to appropriately target interventions at their operating scale. At the same time, the *Comment* by Fitzsimons et al.[36] demonstrates that when restoration is viewed through the lens of recovering habitat-dependent species, 'scaling up' is essential for recovering biogenic habitat-forming populations to levels above which they can, in turn, support the recovery of broad-ranging resident species. Finally, Kızılkaya et al.'s.[35] *Article* highlights a key opportunity in restoring ecosystem function: using functional traits to select target organisms for enhancement during the restoration process. In their work, restoring both apex predators and grazing fish strengthens the resilience of food web structure and mitigates the impact of invasive species.

Knowledge co-evolution (theme 3). From participating in planning exercises to sustaining the physical labor required to replant damaged corals or mangroves, this Collection highlights that ecoscape restoration requires going beyond repairing frayed ecological relationships to rebuilding the relationships between coastal peoples and the biophysical environment. For too long, scientists and managers have focused on the ecological and environmental elements of the seascape as separate from the people who live and work by, in, or on the sea. Local and Indigenous peoples deeply understand the structure and function of the ecosystems they depend on. However, many scientists and managers have focused too little attention on the value of Indigenous, local, and traditional ecological knowledge when defining problems and pathways to solutions. Several pieces in this Collection point to the potential of engaging knowledges beyond Western science to clarify fundamental problems and potential solutions in the pursuit of restoration that achieves ecoscape recovery. Drawing from varied perspectives—emphasizing under-represented and marginalized groups—can build justice, improve scientific results, and uncover alternative solutions. In this Collection, a *Comment* by Kruesopon and Kruesopon[38] demonstrates that youth-led marine restoration initiatives can empower environmental stewardship in coastal communities through engaged action, ranging from immersive restoration activities to education. Fostering collective awareness and building individual accountability to restore degrading ecosystems through place-based responsibility has been key to rekindling the human-nature connection. Furthermore, in a comprehensive *Review*, Armstrong et al.[39] characterize *knowledge co-evolution* as the process of listening and learning among formally trained scientists, managers and coastal residents. At the same time, the *Article* by Kankam et al.[33] finds that expert scientific insight is essential in shaping ecosystem service restoration outcomes scenarios. In the case of adaptive co-management, the authors find that when scenario analysis is done via an equitable, participatory, and respectful process, shared knowledge can evolve toward a clearer understanding of fundamental problems and possible solutions. Approaches to restoration can co-evolve from the union of local knowledge and

Fig. 2 | Four key themes emerging from the special Collection. The special Collection publications together reveal four key emergent themes related to ecoscape restoration: (1) addressing land-sea connections; (2) restoring ecosystem function; (3) knowledge co-evolution and; (4) scaling in restoration.

formal scientific perspectives in a way that both achieves shared restoration goals and benefits local communities.

Scaling in restoration (theme 4). Ecoscape recovery is not just about restoration at larger spatial scales, but rather envisioning and actioning restoration across a range of hierarchical temporal and spatial scales that align with social and ecological recovery goals. For instance, the work by Fitzsimmons et al.[36] on continental-scale shellfish reef restoration in Australia illustrates the temporal scale over which such regional restoration initiatives must be sustained to see true functional benefits. Armstrong et al.[39] also stress the importance of long-term investment in restoration projects, including parallel long-term investment in engaging local communities. Furthermore, Kızılkaya et al's.[35] work in Gokova Bay, Turkey, demonstrates how a multi-scale focus on restoration is possible: the restoration action itself is focused on a smaller scale, yet it occurs across a network of no-take marine protected

areas and harnesses existing and influences new national policies. While Armstrong et al.[39] focus on equitable local-scale community engagement, we recognize a range of solutions that need to be considered in a wider context and across scales. For instance, the Australia case study by Fitzsimons et al.[36], which may be regarded as a top-down, big-picture approach, highlights a place for large-scale restoration projects involving equitable national-scale governance overseeing broader action. Yet, the Collection also highlights the key role that communities play on a very local scale—such as Kızılkaya et al.'s.[35] case study in Turkey—to achieve restoration that has reciprocal benefits for nature and human health. Finally, Preston et al.[34] synthesizes the scientific evidence of temperate ecosystem recovery when multi-habitat connectivity is considered across a range of scales, and highlights policy opportunities and avenues to deliver seascape benefits from restoration at scale.

Future directions for ecoscape restoration

Multidirectional flows of materials and organisms across the land, coastal sea, and beyond facilitate ecosystem functioning and resilience across the ecoscape and ensure that nature's contributions to people continue. For example, organisms moving nutrients from land-based sources to ocean environments during ontogenetic habitat shifts can support fish biomass production, as well as fisheries that harvest this biomass. Understanding cross-habitat linkages that facilitate ecosystem functioning requires moving across boundaries and scales to investigate the roles of facilitative processes at the land-sea interface and their influence on restoration design and practice. As multi-habitat restoration proceeds at scale, considering complementarity in the attributes (i.e., traits) of focal species targeted for restoration across individual habitats will be essential for ensuring the sum is more than just the aggregate of the parts[40,41]. Key questions to advance the recovery of facilitation processes in multi-habitat restoration could include: *How might restoration scientists generate knowledge around cross-habitat processes that facilitate restoration project success? To what extent can practitioners integrate knowledge of the temporal and spatial scales of key facilitative processes across an ecoscape into multi-habitat restoration design, particularly when the ecoscape spans jurisdictions?*

While restoration is often viewed as a technical problem requiring technical solutions, with such a mindset, we may be set up for 'a surprise' when local communities and decision-makers oppose restoration actions based solely on scientific rationale. This is especially true when restoration costs are high, and only some potential benefits are communicated or realized. Further, stakeholders may perceive the activities driving degradation differently - placing different values on different aspects of ecosystem recovery. Current institutional fragmentation of restoration mandates across government and regulatory agencies impedes large-scale ecoscape restoration by complicating the channels through which stakeholders engage in planning processes, as does the reliance on top-down frameworks that limit meaningful opportunities for community or individual engagement. We see the value of progressive leadership that understands the importance of stakeholder engagement, knowledge co-evolution, co-management, and participatory restoration[42].

As we reflect on the latest advances in ecoscape restoration in this special Collection, we can speculate why there are so few examples. By organizing the special Collection, we hope and expect to reveal innovative examples, challenge current practices, and inspire restoration action in new ways that support the biodiversity, health, and productivity of coastal social-ecological systems. For ecoscape restoration initiatives to be fully implemented and meet their true potential, partnerships and long-term financing are needed to support and monitor the outcomes of these efforts. There may be a universal reluctance among agencies to tackle big, wicked environmental problems, even though we now have the experience of successfully using technology and tools to restore many different marine and coastal ecosystems altogether.

However, it might be the case that the most important reason we do not yet see many examples of ecoscape restoration is that people – who are intricately connected with ecoscapes – are rarely brought into the visioning, planning, and implementation of restoration projects. While many coastal ecosystems worldwide are in 'crisis', degradation can also be viewed as presenting opportunities to consider actions to ensure progress. We need to further include social dimensions in restoration processes. To seize such opportunities, time must be taken to understand how degradation affects human communities, why it concerns them, and how those concerns can lead to the development of political will and provide the necessary support over the multiple years required to recover most ecoscapes.

We hope the lessons from this special Collection offer practical pioneering case studies and the needed conceptual framework for successful implementation, helping to turn the tide and inspire change in how we approach nature recovery. As the practice of ecoscape restoration matures, lessons learned from successes and failures will improve the effectiveness of restoration efforts, as is urgently needed. In the future, we hope to be able to update the Collection with many more examples of how ecoscape restoration can be achieved in a timely, just, and effective manner to support ocean sustainability.

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References

1. Lotze, H. K. et al. Depletion, degradation, and recovery potential of estuaries and coastal seas. *Science* **312**, 1806–1809 (2006).
2. Talukder, B. et al. Climate change-accelerated ocean biodiversity loss & associated planetary health impacts. *J. Clim. Change Health* **6**, 100114 (2022).
3. Worm, B. et al. Impacts of biodiversity loss on ocean ecosystem services. *Science* **314**, 787–790 (2006).
4. Gagnon, K. et al. Rapid faunal colonization and recovery of biodiversity and functional diversity following eelgrass restoration. *Restor. Ecol.* **31**, e13887 (2023).
5. Su, J., Friess, D. A. & Gasparatos, A. A meta-analysis of the ecological and economic outcomes of mangrove restoration. *Nat. Commun.* **12**, 5050 (2021).
6. Gann, G. D. et al. International principles and standards for the practice of ecological restoration. *Restor. Ecol.* **27**, S1–S46 (2019).
7. European Commission. Biodiversity strategy for 2030. https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en (2024).
8. Leadley, P. et al. Setting ambitious international restoration objectives for terrestrial ecosystems for 2030 and beyond. *PLOS Sustain. Transform.* **1**, e0000039 (2022).
9. Bayraktarov, E. et al. The cost and feasibility of marine coastal restoration. *Ecol. Appl.* **26**, 1055–1074 (2016).
10. Danovaro, R. et al. Assessing the success of marine ecosystem restoration using meta-analysis. *Nat. Commun.* **16**, 3062 (2025).
11. Wood, G. V. et al. Upscaling marine forest restoration: challenges, solutions and recommendations from the Green Gravel Action Group. *Front. Mar. Sci.* **11**, 1364263 (2024).

12. Stewart-Sinclair, P. J. et al. Blue Restoration – Building Confidence and Overcoming Barriers. *Front. Mar. Sci.* **7**, 541700 (2020).
13. Zhang, Z., Cao, D., Ma, T., Liu, H. & Mao, Z. International cooperation for a biodiverse future: opportunities and challenges under the kunming-montreal global biodiversity framework. *Glob. Ecol. Conserv*. e03385 https://doi.org/10.1016/j.gecco.2024.e03385 (2025).
14. Carlson, R. R. et al. Synergistic benefits of conserving land-sea ecosystems. *Glob. Ecol. Conserv.* **28**, e01684 (2021).
15. Wakwella, A. et al. Integrated watershed management solutions for healthy coastal ecosystems and people. *Camb. Prisms Coast. Futur.* **1**, e27 (2023).
16. Webb, T. J. Marine and terrestrial ecology: unifying concepts, revealing differences. *Trends Ecol. Evol.* **27**, 535–541 (2012).
17. Abelson, A. et al. Challenges for restoration of coastal marine ecosystems in the anthropocene. *Front. Mar. Sci*. **7**, 544105 (2020).
18. Tedesco, A. M. et al. Beyond ecology: ecosystem restoration as a process for social-ecological transformation. *Trends Ecol. Evol.* **38**, 643–653 (2023).
19. Wortley, L., Hero, J. & Howes, M. Evaluating ecological restoration success: a review of the literature. *Restor. Ecol.* **21**, 537–543 (2013).
20. Erdős, L. et al. Habitat heterogeneity as a key to high conservation value in forest-grassland mosaics. *Biol. Conserv.* **226**, 72–80 (2018).
21. Larned, S. T., Datry, T., Arscott, D. B. & Tockner, K. Emerging concepts in temporary-river ecology. *Freshw. Biol.* **55**, 717–738 (2010).
22. Sheaves, M. Consequences of ecological connectivity: the coastal ecosystem mosaic. *Mar. Ecol. Prog. Ser.* **391**, 107–115 (2009).
23. Farina, A. Ecoscape vs. landscape: riding a transition. in *Principles and Methods in Landscape Ecology* (Springer International Publishing, 2022).
24. Lidicker, W. Z. Levels of organization in biology: on the nature and nomenclature of ecology's fourth level. *Biol. Rev.* **83**, 71–78 (2008).
25. Backhaus, G. & Murungi, J. *Ecoscapes: Geographical Patternings of Relations* (Lexington Books, 2006).
26. Telesetsky, A. Ecoscapes: the future of place-based ecological restoration laws. *Vt. J. Environ. Law* **14**, 493–548 (2013).
27. Long, R. D., Charles, A. & Stephenson, R. L. Key principles of marine ecosystem-based management. *Mar. Policy* **57**, 53–60 (2015).
28. McLeod, K., Leslie, H. & Aburto, M. *Ecosystem-Based Management for the Oceans* (Island Press, 2014).
29. Sayer, J. et al. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. *Proc. Natl. Acad. Sci. USA* **110**, 8349–8356 (2013).
30. Frazão Santos, C., et al. Advancing interdisciplinary knowledge for ocean sustainability. *Npj Ocean Sustain.* **2**, 18 (2023).
31. Wedding, L. M., Agardy, T., Green, S. & Crowder, L. B. Collection: Bridging Land and Seascape Restoration for Ecoscape Recovery. *Npj Ocean Sustain*. www.nature.com/npjoceansustain/collections, (2023).
32. Delevaux, J. M. S. et al. Scaling biocultural initiatives can support nature, food, and culture from summit to sea. *Npj Ocean Sustain.* **4**, 5 (2025).
33. Kankam, S., Koo, H., Inkoom, J. N. & Fürstac, C. Modeling coastal land use scenario impacts on ecosystem services restoration in Southwest Ghana, West Africa. *Npj Ocean Sustain*. (in press).
34. Preston, J. et al. Seascape connectivity: evidence, knowledge gaps and implications for coastal ecosystem restoration practice and policy. *Npj Ocean Sustain*. **4**, 13 2025).
35. Kızılkaya, Z. et al. Progress and challenges of multi-habitat marine restoration in the eastern Aegean Sea, Türkiye. *Npj Ocean Sustain*. **4**, 12 (2025).
36. Fitzsimons, J. A., Valesini, F., Branigan, S. & Hancock, B. Continental-scale shellfish reef restoration in Australia. *Npj Ocean Sustain.* **3**, 62 (2024).
37. Vozzo, M. L. et al. Achieving at-scale seascape restoration by optimising cross-habitat facilitative processes. *Npj Ocean Sustain.* **3**, 57 (2024).
38. Kruesopon, P. (Pleng) S. & Kruesopon, P. (Pyn) S. Care for Coral: Thailand's largest youth-led initiative to empower environmental stewards through immersive marine conservation experiences. *Npj Ocean Sustain*. **4**, 1–5 (2025).
39. Armstrong, K. C. et al. A framework for just seascape restoration. *Npj Ocean Sustain.* **4**, 4 (2025).
40. Green, S. J. Trait-based tools aid conservation planning for predator range shifts. in *Navigating Our Way to Solutions in Marine Conservation* (ed. Crowder, L. B.) (Open Book Publishers, 2025). https://doi.org/10.11647/OBP.0395.
41. Green, S. J., Brookson, C. B., Hardy, N. A. & Crowder, L. B. Trait-based approaches to global change ecology: moving from description to prediction. *Proc. R. Soc. B Biol. Sci.* **289**, 20220071 (2022).
42. Wedding, L. M. et al. Integrating the multiple perspectives of people and nature in place-based marine spatial planning. *Npj Ocean Sustain.* **3**, 43 (2024).
43. Wang, G. et al. Integrated watershed management: evolution, development and emerging trends. *J. For. Res.* **27**, 967–994 (2016).
44. McAfee, D. et al. Multi-habitat seascape restoration: optimising marine restoration for coastal repair and social benefit. *Front. Mar. Sci*. **9**, 910467 (2022).
45. Vozzo, M. L. et al. To restore coastal marine areas, we need to work across multiple habitats simultaneously. *Proc. Natl. Acad. Sci. USA* **120**, e2300546120 (2023).
46. Bainbridge, Z. et al. Fine sediment and particulate organic matter: a review and case study on ridge-to-reef transport, transformations, fates, and impacts on marine ecosystems. *Mar. Pollut. Bull.* **135**, 1205–1220 (2018).
47. Carlson, R. R., Foo, S. A. & Asner, G. P. Land use impacts on coral reef health: a ridge-to-reef perspective. *Front. Mar. Sci.* **6**, 562 (2019).
48. Fache, E. & Pauwels, S. The ridge-to-reef approach on Cicia Island, Fiji. *Ambio* **51**, 2376–2388 (2022).
49. Pittman, S. J. *Seascape Ecology* (John Wiley & Sons, 2017).
50. Wedding, L. M. et al. Five ways seascape ecology can help to achieve marine restoration goals. *Landsc. Ecol*. https://doi.org/10.1007/s10980-025-02099-9.
51. Maltby, E., Acreman, M., Maltby, A., Bryson, P. & Bradshaw, N. *Wholescape Thinking: Towards Integrating the Management of Catchments, Coast and the Sea through Partnerships – a Guidance Note*. https://www.naturalcapitalinitiative.org.uk/portfolio-items/wholescapes_guidance/ (2019).

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Competing interests

L.M.W. and S.G. are Associate Editors, T.A. and L.B.C. are Guest Editors, and C.F.S. is an Editor-in-Chief (co) of npj Ocean Sustainability. The authors declare no other conflicts of interest.