Nature Human Behaviour, Volume 8, May 2024, pp. 814-822
DOI:10.1038/s41562-024-01875-y

We need collaboration and co-creation to address challenges facing coastal communities.

Debadayita Raha[1*], Katherine Sian Davies-Vollum[2*], Sarah L. Hemstock[3], Isaac Boateng[4], Mohammed Tariqul Islam[5], Charles A E Pierce[6]

1. Lincoln International Business School, University of Lincoln, Lincoln, United Kingdom
2. Faculty of Arts, Science and Technology, University of Northampton, Northampton, United Kingdom
3. Drua Centre for Resilience, Resilient Development Solutions, Lincoln, United Kingdom
4. Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development (AAMUSTED), Kumasi, Ghana
5. School of Water, Energy and Environment, Cranfield University, Bedford, United Kingdom
6. Department of Climate Change, Government of Vanuatu, Port Vila, Vanuatu

*DRaha@lincoln.ac.uk

* sian.davies-vollum@northampton.ac.uk

Abstract

Coastal communities across the globe are faced with multifaceted, interconnected challenges with competing environmental, social, and economic needs. In rural coastal communities of the Global South, the challenges presented by climate change are complicated by those related to development, resource management and sustainable livelihoods. The rapid growth of such coastal communities exacerbates these challenges and reinforces the need for effective and sustainable governance. Such governance requires a move from top-down approaches to human-centred approaches. Human-centred coastal governance engages multiple stakeholders and combines multidisciplinary knowledge, participatory approaches, co-creation of solutions and multi-institutional partnerships. Here we present case studies from coastal communities in Vanuatu, Ghana, and Bangladesh. These illustrate several of the complex challenges facing such communities, and the collaborative and empowering strategies that have been used to meet them. Based on these case studies we present a transdisciplinary framework to inform the co-creation of coastal management strategies that meet interconnected human and environmental needs.

Published by Springer. This is the Author Accepted Manuscript.
The final published version (version of record) is available online at DOI:10.1038/s41562-024-01875-y. Please refer to any applicable publisher terms of use.

Keywords: coastal management, transdisciplinary, participatory, multi-institutional, Global South, collaboration, co-creation

1. Introduction

The wicked global problems of climate change, poverty, and unequal progress working towards sustainable development are grounded in a complex interconnectivity between humans and their environment. Finding solutions to such challenges requires viewing them through multiple approaches that unite public policy and management with the complexities of human behaviour[1]. There is no better context to comprehend this than in coastal communities. Such communities are among the most acutely affected by the threats of global climate change, population growth and natural resource depletion[2]. The coastal populations who experience this are the fastest growing on earth[3], estimated to exceed one billion globally by the end of the 21st century[4]. The resultant increasing pressure on coastal land and resources compounds the impacts of climate change[5,6].

This is particularly prevalent in the Global South, where there is a dependency on primary resources[7,8]. Here, in the low elevation coastal zones, vulnerable rural communities are exposed to the impacts of climate change and declining natural resources[9], aggravated by barriers to sustainable livelihoods and development problems. The impacts of climate change affect coastal communities globally. Sea level rise (SLR) results in erosion[4], flooding and freshwater salinization, and increased tropical storminess exacerbates the effects of SLR[10].The physio-chemical condition of coastal waters is altered through changes to temperatures and rainfall, as well as acidification from dissolved carbon dioxide[11-13]. Changes to coastal waters lead to adjustments in coastal ecosystems[14] and a decline in marine species[15]. This then results in the depletion of natural resources. Many coastal communities of the Global South depend on local natural resources to meet their essential needs, thus they are particularly susceptible to climate change[5-8]. This is exacerbated by structural inequality which means that such communities also often face unplanned development, limited waste disposal infrastructure and lack of sanitation resulting in inferior living environments and water quality[16].

These wicked problems are by definition complex, open-ended and intractable[1,16]. From an individual perspective, they are confusing, overwhelming and disabling: it is difficult to know how to approach them, how to prioritise competing challenges, and which stakeholders to involve[1]. Historically, governance and policy that is pertinent to coastal environments and communities in the Global South has taken a neo liberal top-down approach[17], coming from the national level, with limited translation to local management[18,19]. Examples of this are

widespread and diverse including coastal fishing policy from Pakistan[20], climate change adaptation policy in South Africa[21], and coastal protection policy in the Maldives[22].

Participatory approaches to coastal policy, legislation and governance, are not common[23] and multiple stakeholders are often excluded from decision-making[24,25]. Despite a history of community-based management and decentralised governance in the Global South[26], social-cultural processes are often still ignored[27]and stakeholder values and needs are not always taken into account[1]. Furthermore, sectoral perspectives of government can be biased with distinctive agendas that do not take a broad, multidisciplinary perspective[22].

Here we propose a framework for developing integrated solutions to address the interconnected challenges experienced by rural coastal communities of the Global South that emphasise the human perspective and experience. The framework draws on previous research and case studies from Ghana, Bangladesh, and Vanuatu. It illustrates the challenges that communities face, and describes the economic, environmental, and social strategies that can be employed, as well as the transdisciplinary approach needed to address these challenges.

We acknowledge the limitations of using the term Global South for our framework. Using this single term obscures the diversity and nuances of the coastal communities considered. Global South as a classification is also somewhat geographically inaccurate as high-income countries exist in the southern hemisphere[28]. However, the term is useful in highlighting inequalities, and developmental differences and has fewer negative hierarchical and racist connotations than other descriptors[29].

2. Case studies

We use three case studies to illustrate the complexities of challenges and diversity of approaches, as well as to represent three different coastal geographies and situations (Figure 1). Ghana is a lower middle-income country with a mixed economy[30] [2.1, Box 1]. Bangladesh is one of the world's fastest-growing market-based economies[31] and one of the fastest growing low-income countries [2.2, Box 2]. Vanuatu's main economic portfolio contributions are agriculture, tourism, offshore financial services, and raising cattle[32] [2.3, Box 3].

3. Framework

3.1 Challenges

The challenges experienced by coastal communities include the impacts of climate change, threats to traditional livelihoods, unsustainable natural resource use and socio-economic challenges (Table 1). Additionally, each of the case study countries have complex colonial histories that have affected the socio-economic inequalities and environmental challenges they experience, in a similar way to other Global South countries[40].

These challenges are interconnected[41,42] and not experienced by all coastal communities in the same way. For example, on Pele Island (Vanuatu), climate change is the primary challenge with land loss from SLR, and tropical storms causing salinization of water and water shortages. In Ghana shoreline erosion and coastal flooding associated with SLR are problematic. In the TWF (Bangladesh) climate change is acknowledged but not perceived as a main challenge by the community.

The challenges of sustainable livelihoods and resource management are inseparable in resource dependent communities. In our case studies, small scale fishing (SSF) predominates in Ghana and Pele and small-scale agriculture in TWS. Unregulated resource use in the three locations has resulted in depletion of fish stocks (Pele, Ghana – livelihood related), sand (Ghana, TWS), coastal vegetation (Ghana, TWS) and endangered species (TWS – livelihood related). The TWS case study exemplifies the link between livelihoods and resource use: communities here responded to an increased need for farmland to maintain their agricultural livelihood by clearing coastal forest, and engaging in logging and hunting to supplement income. This has led to resource depletion. Many similar examples of resource depletion are recorded from other coastal communities of the Global South[29,43-47]. The degradation of natural resources not only harms and inter-connects with resource-dependent livelihoods[42,48,49] but exacerbates the effects of climate change[11,12,50]. In Ghana deforestation of mangroves has reduced natural coastal protection[51] and in both Ghana and TWS mining of beach sand has potentially increased coastal erosion[35,36] and flooding[46].

At the same time, the effects of climate change can degrade natural resources. On Pele Island SLR caused salinisation of fresh water and in both Ghana and Pele it has resulted in land and habitat loss. Socio-economic inequality is multifarious, exacerbated by population growth and migration and interwoven with ineffectual resource management[43] and lack of infrastructure. At TWS, the lack of alternative energy sources has forced residents to use wood for cooking and this has led to the depletion of forest resources. A lack of sanitation and poor waste management in Ghana is connected to unplanned settlements and inefficient and insufficient infrastructure, which has led to poor water quality[52].

3.2 Strategies

The three case studies illustrate economic, environmental, and social strategies to address the challenges outlined above (Table 1).

Economic strategies seek to provide livelihoods beyond a dependency on traditional natural resources, and ensure regular income generation. Often, this overlaps with the need for sustainable management of resources and the environment. For example, community-based organisations on Pele Island, with external training from NGOs, successfully supported a variety of livelihood adaptations, including coral gardening, fish farming, solar fruit drying and honey-bee husbandry. At TWS, government projects established livelihood diversification that focused on eco-tourism, which also provided financial support for conservation initiatives. Livelihood diversification is a popular economic strategy in many contexts[23,27,53-55], and can also provide benefits through giving community members access to credit and insurance[49]. In addition to regular income, this can offer a community stability and opportunity for regular, reliable alternative income, and reduce reliance on undependable and irregular traditional livelihoods. These examples suggest that when adequate training and financial start-up support is provided, the diversification of livelihoods can provide an alternative to income generated by resource depletion.

Environmental strategies can take several approaches including resource management, habitat conservation and coastal engineering, with mixed success. On Pele livelihood diversification emphasised sustainable resource management and protection from the effects of SLR, merging the safeguarding of natural resources with economic needs. At TWS strategies focused on conservation and safeguarding of local forest resources. This approach worked for the indigenous population but not migrants, highlighting the importance of recognising the divergent interests of stakeholders who are using natural resources[11,12]. In Ghana, environmental strategy took a research-based approach that favoured coastal engineering rather than a nature-based approach via the conservation of mangroves. Ironically, the mismanagement of mangroves has contributed to weakened resilience to sea level rise in Ghana[7,56] a situation mirrored in many coastal communities of the Global South[36,51,57-59]. Recognising this, mangrove reforestation projects have now been introduced in Ghana alongside engineering approaches[36,51]. These examples show the importance of ensuring that environmental strategies take a place-based approach that is founded on robust evidence, and which may be broad in scope to include resource management, conservation, and hazard management.

Social strategies focus on training and education as well as the importance of existing networks and groups. On Pele Island, community members received training on vulnerability and adaptation assessment and combined this with local knowledge. At the TWS, community training for conservation and climate adaptation ensured local management. Women and youths were integral to the project. Existing groups were deployed in all case studies to ensure

project success: at the TWS it was the women's group; on Pele Island the established indigenous social network was leveraged to create a Marine and Land Protected Area Network; in Ghana, the academic community was deployed to take advantage of international funding. From these examples we can see that successful social strategies focus on building local capacity, involve all community members as well as other stakeholders, and use existing networks to their full advantage.

3.3 Approaches

Our three case studies, together with other examples from the literature, reinforce the need for a systemic framework[42,60] for coastal management that addresses both humans and their environment (Table 1). Effective governance of coastal communities in the Global South needs to cut across the challenge areas and applied strategies of the framework to create a holistic, multidisciplinary approach that involves multiple institutions and is inherently participatory. This is known as a transdisciplinary approach founded on the participatory co-creation of knowledge, and its importance is widely recognized[61-64].

A transdisciplinary approach requires us to co-create research, empower diverse voices, redescribe power relations, navigate differences, and reframe agency. This requires in-depth understanding of local context and the specific dynamics of communities[65]. Successful multi-disciplinary approaches and solutions are evident from TWS and Pele Island. At the TWS, conservation of natural resources was enhanced by including a business proposition and introducing tourism. On Pele Island diversification of livelihoods was holistic, encompassing resource management, solutions to the impacts of climate change and augmentation of agricultural practices. However, in Ghana a management approach that focused solely on engineering solutions for coastal erosion caused further environmental problems, and this has led to a shift to a broader approach, illustrating the importance of transdisciplinarity.

A transdisciplinary approach must engage stakeholders from all sectors. These may include research institutes, universities, colleges, non-governmental organisations (local and international), governmental departments, regional consortia, and decentralised agencies as well as coastal communities themselves. Working across sectors and with communities enables the inter-weaving of research, education and practitioner experience and facilitates the co-creation of knowledge and solutions[66,67] but needs to acknowledge the principles and ethos that are driving these institutions.

Throughout the South Pacific, regional frameworks such as the Coping with Climate Change in the Pacific Islands Region (CCCPIR) programme, Pacific Islands Framework for Action on Climate Change (PIFACC) and USP-European Union Global Climate Change Alliance (EUGCCA) have supported holistic coastal governance and via the WIA approach enabled governments, NGOs, academics, and local communities to work together and exchange knowledge. On Pele

the University of South Pacific facilitated community training and supported co-creation of climate adaptation activities; the inclusion of a local NGO has assured longevity of these. At TWS national and local government agencies and community representatives worked together to establish co-management and supply training for local communities to successfully manage coastal resources.

In West Africa, the regional Guinea Current Large Marine Ecosystem (GCLME) consortia facilitated sharing of coastal management practice, secured international funding and enabled work with international research institutes to increase knowledge and build capacity. The Involvement of multiple institutions enhances different policy mechanisms and institutional governance vehicles that deliver development solutions to coastal communities, but it must happen in participation with coastal communities.

Participatory and community-based governance in the Global South has a long and rich history[68]. However, a renewed focus and embedding of the participatory approach is needed. This will require policymakers to acknowledge the heterogenous needs, capacities, beliefs, and practices of all community members. For example, on Pele the WIA embedded community participation, empowering communities by ensuring ownership of adaptation projects. The introduction of livelihood practices here succeeded because it was done in participatory consultation with communities. Similarly, at TWS, local ownership and empowerment resulted in successful management of resources, only hampered by in-migration that overwhelmed the practice. In Ghana, after the failure of top-down governance, a participatory approach was legislated via the local government act, which supported local ownership and community champions.

An integrated and coordinated[42] response that puts the knowledge and practices of people as central, as in the WIA, is optimal. It allows local narratives to be used to frame problems and provides an entry point for co-creating solutions and integration of created knowledge[66,67,69] rather than externally produced knowledge[68]. Such an approach enables comprehensive application to a bigger systemic framework[42,60], which can bridge the gap between policy discourse and implementation in the community[66,69].

Our proposed framework (Figure 2) illustrating the interconnected challenges impacting coastal communities in the Global South, the arrows indicate the inter-connected nature of challenges and do not represent directional flows. The framework is built on real-world examples from Ghana, Vanuatu, and Bangladesh with additional information from the academic literature.

4. Application and recommendations

Table 2 illustrates the important lessons learned from the case studies. Three key actionable points can secure the efficacy of the transdisciplinary approach advocated in this framework:

1. Co-create solutions that draw on the diversity of knowledge within a community, including indigenous knowledge. This enables the interweaving of theory with people's lived experience.

2. Counter top-down management by integrating and facilitating collaboration between different actors, institutions and practitioners. In effect this combines a top-down with a bottom-up approach. It specifically enables vertical and horizontal collaborations to reduce both the intentional and unintentional fragmented legislation of power, politics, and practices.

3. Advance both the theory and practice underpinning policy implementation that considers climate change alongside livelihood, resource management and socio-economic inequality -related challenges to co-create governance solutions and achieve long-term benefits to communities.

Successfully addressing the wicked problems faced by resource-dependent coastal communities of the Global South requires a transdisciplinary approach with appropriate governance systems and structure[17]. In practice, successful approaches need to be community-centred and locally focused[65] with bottom-up governance and co-management of solutions that are co-created and context-specific[64,65,69]. This is governance based on 'integrative systems thinking', that requires transformative approaches to environmental sustainability, poverty alleviation and social justice[17,70] and which can then inform policy and decision making[18,65].

Caveats and limitations

Previous coastal management frameworks have advocated for community-based management and decentralisation of governance[71-73]. Our framework challenges the neoliberal approach of top-down governance and policy, and replaces it with a primary focus on participation and collaboration. Enacting such a post- neoliberal framework is difficult in practice and requires integration of diverse knowledges, increasing pluralism and recognising colonialism and the deep-seated inequalities that exist[29]. Rural coastal communities are not homogenous and have complex social stratification with embedded inequalities. Our case

studies demonstrate how three very different coastal locations have approached complex challenges by adopting transdisciplinary approaches. We cannot fully illustrate all aspects of a coastal governance framework for the Global South, as every coastal community will have its own specific challenges. Our framework is designed to be adapted to difference contexts, and situated alongside others such as Integrated Coastal Zone Management (ICZM), the Driver-Pressure-State-Impact-Response (DAPSIR) and Drivers, Activities, Pressure, Impacts, Welfare, Responses, Measures (DAPSI(W)R(M)) approaches[69,74-77].

5. Conclusion

Neoliberal approaches have not addressed the needs of coastal populations because of their narrowly focused, top-down ethos and failure to include place-based and socio-cultural contexts. Based on an evaluation of three case studies, and in the context of the broader understanding of coastal communities of the Global South, our framework considers the complex lived experience of these communities in terms of climate change, resource management, livelihoods, and contextual socio-economic inequalities. It frames strategies to address these collective challenges around combined social, economic, and environmental perspectives. We emphasise the need for a co-creational approach for coastal management to translate policy discourse into practice. Successful application of this conceptual framework is reliant on human-centred interventions that integrate theory with lived experience, connecting concepts with reality. Policymakers and researchers should seek to create platforms for collaboration and knowledge exchange between stakeholders. Our aim should be to co-create strategies, and ensure that top-down management does not prevail.

Acknowledgements: Authors would like to thank Daniel Koomson, Andy Agyekumhene, the Ghanaian Forestry Commission, Oliver Tomlinson (for all the maps and illustrations), and funding for research from UoD, UEW, BGU. Also, Wulf Killman, Hannah Sabass, Chris Bartlett, Willie Kenneth, William Bani, and the people of Pele Island.

The author declares no competing interests.

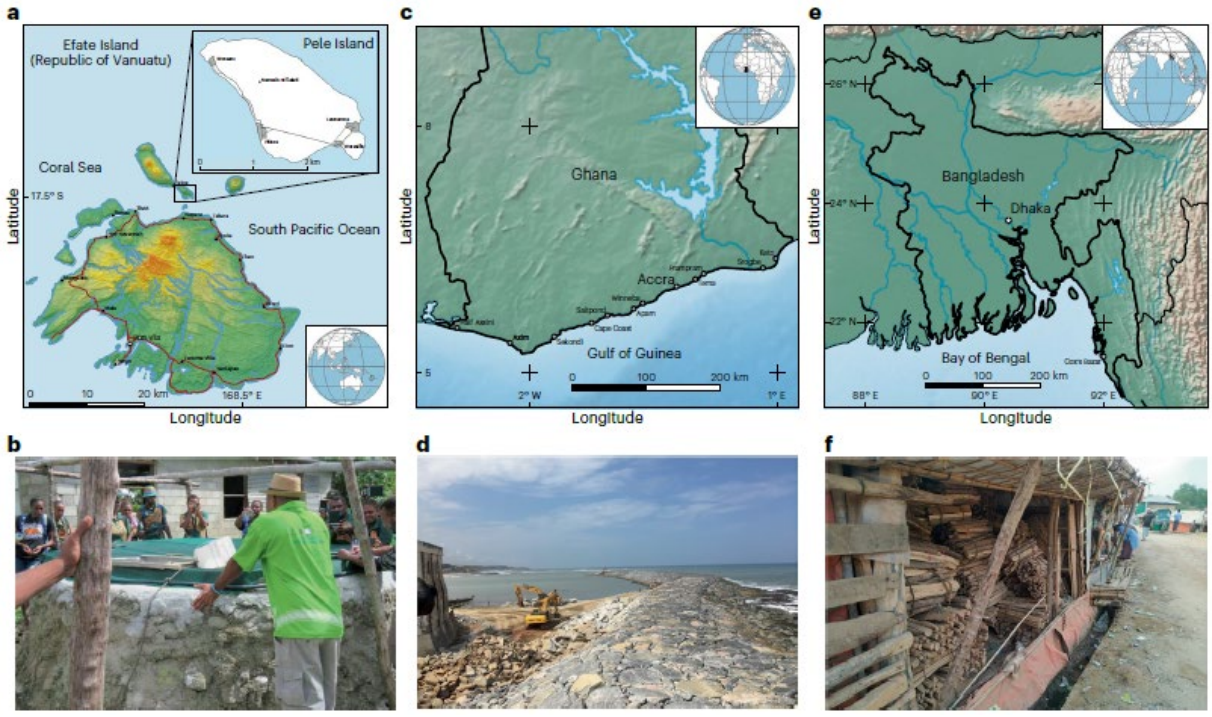


Figure 1: Case study pictures and maps.
(i)(a) The Vanuatu archipelago is a series of volcanic islands in the South Pacific. Pele island is part of that archipelago. It has an area of 4km2, a shoreline length of approximately 8km and a population of 260.
(ii)(b) Ghana is an equatorial country in West Africa with a shoreline of 550km. The coast is home to more than 25% of the nation's estimated population of 31 million and 80% of the nation's economic assets.
(iii)(c) Bangladesh is located on the Bay of Bengal. The Teknaf Wildlife Sanctuary is situated on the narrow coastal strip in the southeast of the country. It covers 116 square kms and has a shoreline length of 580 km with a population of 120,000.

Source: Pictures Vanuatu (CP), Ghana (SDV) and Bangladesh (MTI). Map created by OT from data sources: Made with Natural Earth Data (naturalearthdata.com) & Open Street Map (openstreetmap.org). Terrain data for Efate from SRTM V3.0 (earthdata.nasa.gov).

2.1 Vanuatu Case Study Box 1

The Republic of Vanuatu is a Pacific small island developing state (P-SIDS), an archipelago of volcanic islands in the South Pacific Ocean (Figure 1) recognised as the most vulnerable nation to natural hazards. Pele is representative of the islands of Vanuatu, where coastal communities face challenges of SLR, tropical cyclones and water shortages. Its population live in coastal villages traditionally dependent on fishing for livelihood but recently receiving income from tourism. In 2010 coastal communities with support from development partners, regional inter-governmental agencies and The University of the South Pacific adopted a Whole Island Approach (WIA) to adaptation. The WIA was community-focused and participatory with training to support resource management, resilience to sea level rise and livelihood diversification. USP trained local communities to conduct adaptation assessments and set up multiple adaptation initiatives. The adaptation projects were devastated by Hurricane Pam in 2015. As a response to the hurricane, the Vanuatu government established a National Climate Change and Disaster Risk Reduction Policy. Instigation of regional frameworks have further strengthened coastal governance in the region. Under this governance, adaptation initiatives on Pele recovered with specific support from the local Marine and Land Protected Area Network (MLPA), a non-governmental organisation founded on existing social networks in indigenous communities on Pele and neighbouring Nguna. The ownership engendered by the participatory approach of the MPLA has secured the continuity of adaptation initiatives. A national over-arching framework for the continuation of the WIA was established in 2019 with support from USP and the EU.

Key events and activities

- 2009: Coping with Climate Change in the Pacific Island Region (CCCIPR) and WIA framework established (ran to 2018).
- 2010: WIA established in Vanuatu
- 2011: Pele adopts WIA
- 2012-13: Training on adaptation assessments and initiatives takes place on Pele
- 2014: 21 Adaptation initiatives established on Pele
- 2015: Cyclone Pam destroys adaptation initiatives
- 2016: Vanuatu National Climate Change and Disaster Risk Reduction Policy established (runs to 2030)
- 2017: Instigation of regional frameworks: PIFACC; Regional Framework for Action on Disaster Risk Management (RFA); Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management
- 2018: 9 pre-cyclone adaptation initiatives re-established supported by local MLPA
- 2019: European Union Global Climate Change Alliance (EUGCCA) SUPPA+ project starts, active to 2024; framework for the continuation of WIA established under the National Advisory Board on Climate Change and Disaster Risk Reduction (NAB)

2.2. Ghana Case study: Box 2

Ghana is a sub-Saharan African nation on the Gulf of Guinea (Figure one). Its coastline is experiencing uncontrolled development and growing urban and industrial areas[33], Davies-Vollum, Koomson and Raha (2024). Coastal communities face development and climate related challenges related to habitat loss, deforestation, flooding, sand extraction, waste, limited sanitation, and poor water quality. Traditionally, Ghana has operated a top-down, poorly integrated, ad hoc approach to coastal management[34]. Coordination and focus improved through the support of two internationally backed initiatives. The Global Environment Fund supported 16 coastal West African countries that constitute the Guinea Current Large Marine Ecosystem (GCLME) in an initiative to address common coastal problems. This was followed by the Ghana-focused USAID-funded Hen Mpoano project. These initiatives identified the need for information and resources to help formulate coastal policies and management strategies. They emphasised monitoring and understanding coastal physical processes and as a result a Handbook of Coastal Processes was published to inform decision making for coastal management projects. The resultant policy focused on the physical environment and emphasised the need for hard engineering to manage the coastline. Projects lacked a national framework thus activity ended when international funding ceased and although they engaged with coastal stakeholders, they did not take a participatory approach with minimal consideration of the experiences of coastal communities[35,36]. In 2016 this changed as a result Ghana's local government Act 936. The Act, which is not specific to coastal settings, enforces stakeholder participation and uses participatory structures in decision-making processes. It has been critical for securing sustainable coastal management and has led to an evolution of coastal policy. Former top-down approaches have been challenged by legislated requirements to involve local communities in the co-creation of projects and governance. This approach has secured local ownership, assuring projects meet local needs and have longevity.

Key events and activities

- Pre 2000s: Uncoordinated approaches to coastal management
- 2004-2010: Guinea Current Large Marine Ecosystem (GCLME) initiative
- 2010-2013: Hen Mpoano project
- 2013: Handbook of Coastal Processes published
- 2016: Ghana's local government Act 936
- 2016 – 2024 and beyond: Increasing participatory approaches to coastal governance

2.3 Bangladesh Case Study: Box 3

The Teknaf Wildlife Sanctuary (TWS) is located in Cox's Bazar on the coastal strip of southeast Bangladesh (Figure one). The Sanctuary was established in 1983 under the Bangladesh Wildlife (Preservation) Amendment Act. It comprises a sandy coastline with mangroves, backed by hilly sub-tropical rain forests of high biodiversity. The area supports a diverse population that live in small communities dependent on local resources with small scale farming as their main livelihood. Influxes of refugees placed pressure on local resources and resulted in Illegal harvesting of firewood from the coastal forest[37]. Without resource management and stewardship of The Sanctuary, some wildlife and plant species became locally extinct[38]. To address the problems of resource depletion the TWS Co-management Committee (CMC) was established in 2006 following a situational analysis of the Sanctuary. The Committee had wide-ranging goals: to conserve endangered species, protect and promote climate-resilient resource management, diversify livelihoods, mobilise young people as environmental stewards and provide a forum for consultation and conflict resolution. It was the first initiative of its kind in Bangladesh. The CMC took a participatory approach with national and local government agencies and community representatives working together. All stakeholders were involved in forest protection, and communities became responsible for management of the Sanctuary[38-39]. A protected park area was set aside that generated income through park fees and eco-tourism. Community training for conservation and climate adaptation was also established. The CMC was successful in conserving coastal resources. The role of women trained to protect the Sanctuary was key and was recognised by a Wangiri Mathai Award for Nature Conservation. However, in 2017 the relocation of more refugees to camps in the area placed new pressure on forest resources, particularly harvesting wood for cooking. Gas stoves were provided to the camps as an alternative but illegal harvesting continued and, with the refugee camps outside the remit of the CMC, the committee was limited in its ability to halt reduction in forest cover.

Key events and activities

- 1983: Teknaf wildlife sanctuary designated a game reserve
- 1983-2006: Unsustainable resource use of coastal forest
- 2004: Situational analysis of Teknaf conducted
- 2006: Co-management begins with development of CMC
- 2009: Government of Bangladesh gives enhanced status to Wildlife Sanctuary
- 2012: Women's groups receive Wangiri Mathai Award for Nature Conservation
- 2006-16: Reforestation of coastal forest
- 2017: Influx of refugees
- 2018: Forest cover reduced

Table 1: A comparison of three case studies indicating how each informed the framework

	Vanuatu (Pele)	Ghana	Bangladesh (TWS)
Challenges faced in the case study communities			
Impacts of Climate change	Sea level rise, flooding Tropical cyclones	Sea level rise, flooding Coastal erosion	Noted as a factor, no specifics
Threats to Traditional livelihood	Fishing Tourism	Fishing	Farming
Unsustainable Natural resource use	Land loss Water shortage Sustainability of fishing	Habitat loss (mangroves) Sustainability of fishing Sand extraction	Logging Hunting Clearance for farming Sand extraction
Socio-economic challenges	Not specified	Waste management Sanitation Water quality Unplanned settlements	Wood for cooking Migration
Strategies being employed			
Economic	Livelihood diversification and adaptation Reliance on NGO funding	None specified	Tourism
Environmental	Resource management Water management	Coastal engineering	Resource management Conservation
Social	Training and education Use of social networks	None specified	Training and education (women and youths)
Transdisciplinary Approaches to be adopted, adapted and applied			
Disciplines (and sectors) addressed	Climate change Resource management Agriculture	Originally only coastal processes and systems considered	Conservation Agriculture Resource management Energy resources Tourism
Actor and multi-institutional partnerships (collaboration)	Regional frameworks (South Pacific) National government Local NGOs Academia	Regional frameworks (West Africa) National government Academia	National government Local government

Co-creation (and participatory)	Whole island approach Local ownership and empowerment Indigenous communities and knowledge	Originally not recognised. Later legislation supporting local ownership and community champions	Local ownership and empowerment. Hampered by in-migration.

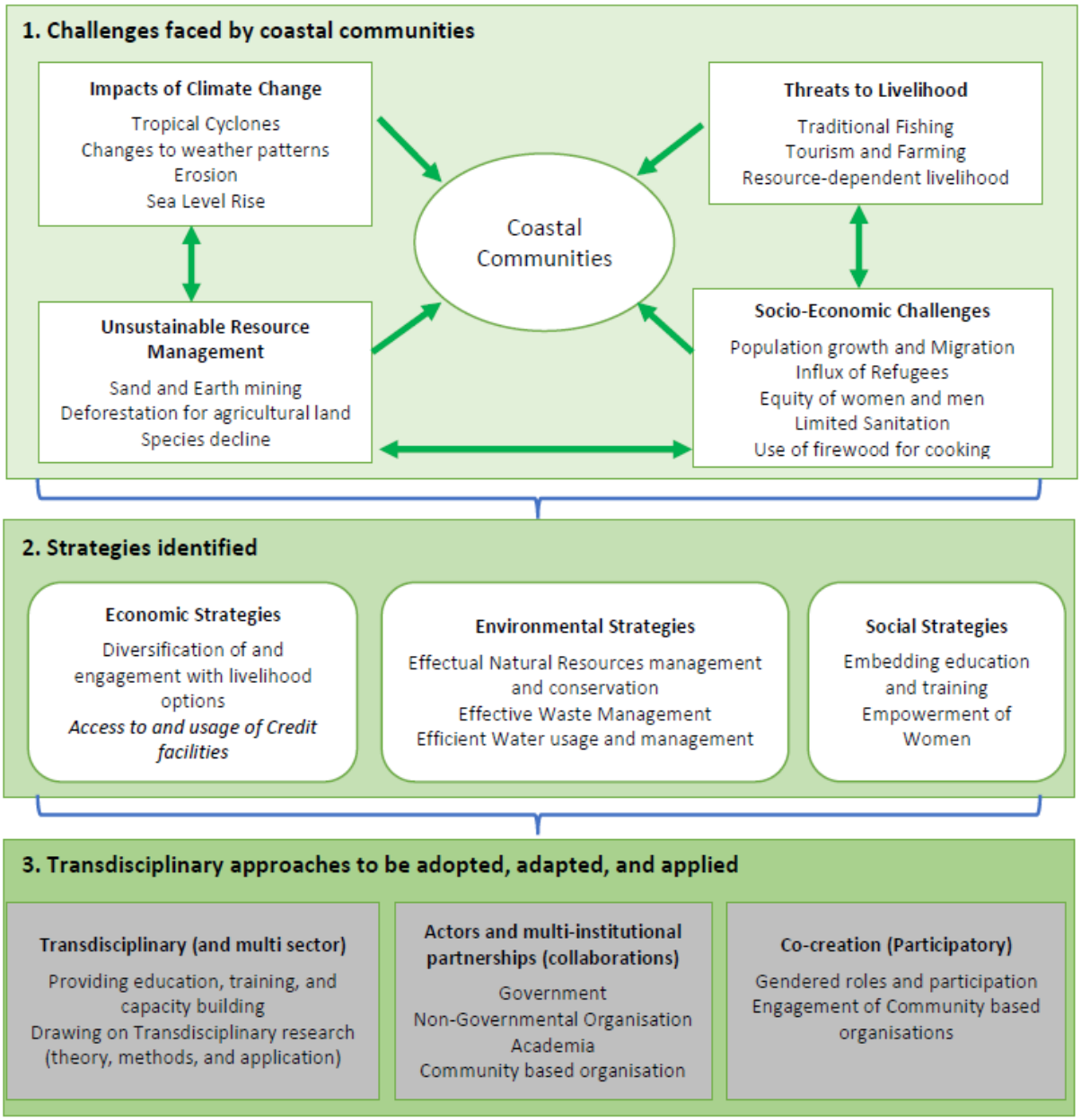


Figure 2: Framework illustrating the interconnected challenges impacting coastal communities in the Global South and recommended people-centred strategies and approaches to address them.

Note: The themes mentioned in italics were identified from the literature but were not present in the case studies

Table 2: Key recommendations: "lessons learned" from case studies.

	Vanuatu (Pele)	Ghana	Bangladesh (TWS)
Transdisciplinary (includes disciplinary principles and sectoral ethos)	Employ a holistic view of self-identified needs and capacity building to create livelihood, resource management and climate adaptation strategies	Avoid focussing on one aspect of coastal challenges. Account for the lived experience of coastal stakeholders to bring the human and social perspective into coastal strategies	Consider economic perspective of conservation and protection through ecotourism initiatives
Actor and Multi-institutional partnerships (collaboration)	Work with international organisations to create over-arching frameworks for coastal governance. Provide training and capacity building for communities using expertise of multiple institutions	Work with international organisations to build research capacity and enhance funding opportunities.	Create governance structures that enable institutions to work together

Co-creation (and participatory)	Ensure longevity of initiatives through oversight from local, indigenous groups and organisations Empower communities to create solutions to challenges through education and training. Establish local participation in governance	Empower community champions to ensure local ownership and longevity of projects. Legislate stakeholder participation in the decision-making processes. Establish local participation in governance	Establish structures for the co-management of natural resources. Develop community-based organisations for stewardship of natural resources. Use local initiatives to finance good practice in coastal management. Establish local participation in governance

References

1 Head, B. W. *Wicked Problems in Public Policy*. Vol. 1 (Palgrave Macmillan Cham, 2022).

2 Michael Elliott, J. W. D., Ramesh Ramachandran, Eric Wolanski Chapter 1 - A Synthesis: What Is the Future for Coasts, Estuaries, Deltas and Other Transitional Habitats in 2050 and Beyond? *Coasts and Estuaries*, 1 - 28 (2019). https://doi.org:https://doi.org/10.1016/B978-0-12-814003-1.00001-0

3 Hauer, M. E. *et al.* Sea-level rise and human migration. *Nature Reviews Earth & Environment* **1**, 28-39 (2019). https://doi.org:10.1038/s43017-019-0002-9

4 Neumann, B., Vafeidis, A. T., Zimmermann, J. & Nicholls, R. J. Future coastal population growth and exposure to sea-level rise and coastal flooding--a global assessment. *PLoS One* **10**, e0118571 (2015). https://doi.org:10.1371/journal.pone.0118571

5 Hinkel, J. *et al.* Sea-level rise impacts on Africa and the effects of mitigation and adaptation: an application of DIVA. *Regional Environmental Change* **12**, 207-224 (2011). https://doi.org:10.1007/s10113-011-0249-2

6 Nicholls, R. J., P. P. Wong, & V.R.Burkett, J. O. C., J.E.Hay, R.F.McLean, S.Ragoonaden, C.D.Woodroffe,. in *Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (ed O.F.Canziani M.L.Parry, J.P.Palutikof, P.J.van der Linden, C.E. Hanson) 315 - 356. (Cambridge University Press,, Cambridge, UK,, 2007).

7 K Sian Davies-Vollum, Z. Z., Andrews Agyekumhene Impacts of lagoon opening and implications for coastal management: case study from Muni-Pomadze lagoon, Ghana. *Journal of Coastal Conservation* **23**, 293 - 301 (2019). https://doi.org:https://doi.org/10.1007/s11852-018-0658-1

8 Wu, C.-C. & Tsai, H.-M. A capital-based framework for assessing coastal and marine social–ecological dynamics and natural resource management: A case study of Penghu archipelago. *Journal of Marine and Island Cultures* **3**, 60-68 (2014). https://doi.org:10.1016/j.imic.2014.10.001

9 Almutairi, A., Mourshed, M. & Ameen, R. F. M. Coastal community resilience frameworks for disaster risk management. *Natural Hazards* **101**, 595-630 (2020). https://doi.org:10.1007/s11069-020-03875-3

10 Dasgupta, S., Laplante, B., Murray, S., Wheeler, D. . Exposure of developing countries to sea-level rise and storm surges. *Climate Change* (2011). https://doi.org:10.1007/s10584-010-9959-6.

11 Ranasinghe, R. On the need for a new generation of coastal change models for the 21(st) century. *Sci Rep* **10**, 2010 (2020). https://doi.org:10.1038/s41598-020-58376-x

12 Ranasinghe, R. Assessing climate change impacts on open sandy coasts: A review. *Earth-Science Review*, 320 - 332 (2016). https://doi.org:https://doi.org/10.1016/j.earscirev.2016.07.011

13 Frank Melzner *et al.* Future ocean acidification will be amplified by hypoxia in coastal habitats. *Marine Biology*, 1875 – 1888 (2012). https://doi.org:https://doi.org/10.1007/s00227-012-1954-1

14 Bernhardt, J. R. & Leslie, H. M. Resilience to climate change in coastal marine ecosystems. *Ann Rev Mar Sci* **5**, 371-392 (2013). https://doi.org:10.1146/annurev-marine-121211-172411

15 Hastings, R. A. *et al.* Climate Change Drives Poleward Increases and Equatorward Declines in Marine Species. *Curr Biol* **30**, 1572-1577 e1572 (2020). https://doi.org:10.1016/j.cub.2020.02.043

16 Rittel, H. W. J. & Webber, M. M. Dilemmas in a general theory of planning. *Policy Sciences* **4**, 155 - 169 (1973). https://doi.org:https://doi.org/10.1007/BF01405730

17 Ferreira, A., Seixas, S. & Marques, J. C. Bottom-up management approach to coastal marine protected areas in Portugal. *Ocean & Coastal Management* (2015). https://doi.org: 10.1016/j.ocecoaman.2015.05.008
18 Pleasant, M. M. *et al.* Managing cultural ecosystem services. *Ecosystem Services* **8**, 141-147 (2014). https://doi.org:10.1016/j.ecoser.2014.03.006
19 Mauerhofer, V., Kim, R. E. & Stevens, C. When implementation works: A comparison of Ramsar Convention implementation in different continents. *Environmental Science & Policy* **51**, 95-105 (2015). https://doi.org:10.1016/j.envsci.2015.03.016
20 Ullah, Z. *et al.* Improving coastal and marine resources management approach: a case study of Pakistan. *Environmental Research Communications* **4**, 025003 (2022). https://doi.org:https://doi.org/10.1088/2515-7620/ac5088
21 Rölfer, L. *et al.* Assessing collaboration, knowledge exchange, and stakeholder agency in coastal governance to enhance climate resilience. *Regional Environmental Change* **24**, 6 (2023). https://doi.org:10.1007/s10113-023-02163-7
22 David, C. G. *et al.* Considering socio-political framings when analyzing coastal climate change effects can prevent maldevelopment on small islands. *Nature Communications* **12**, 5882 (2021). https://doi.org:10.1038/s41467-021-26082-5
23 Machado, M. R. Emergent livelihoods: A case study in emergent ecologies, diverse economies and the co-production of livelihoods from the Afram Plains, Ghana. *Geoforum* **94**, 53-62 (2018). https://doi.org:10.1016/j.geoforum.2018.06.009
24 Conway, D. & Mustelin, J. Strategies for improving adaptation practice in developing countries. *Nature Climate Change* **4**, 339 - 342 (2014). https://doi.org:https://doi.org/10.1038/nclimate2199
25 Butler, J. R. A. *et al.* Integrating Top-Down and Bottom-Up Adaptation Planning to Build Adaptive Capacity: A Structured Learning Approach. *Coastal Management* **43**, 346-364 (2015). https://doi.org:10.1080/08920753.2015.1046802
26 Porter, G. & Young, E. Decentralized environmental management and popular participation in Coastal Ghana. *Journal of International Development* **10**, 515 - 526. (1998). https://doi.org:10.1002/(SICI)1099-1328(199806)10:4<515::AID-JID542>3.0.CO;2-1
27 Gehrig, S., Schlüter, A. & Jiddawi, N. S. Overlapping identities: The role of village and occupational group for small-scale fishers' perceptions on environment and governance. *Marine Policy* **96**, 100-110 (2018). https://doi.org:10.1016/j.marpol.2018.06.017
28 Lees, N. The Brandt Line after forty years: The more North–South relations change, the more they stay the same? *Review of International Studies* **47**, 85 - 106 (2020). https://doi.org:https://doi.org/10.1017/S026021052000039X[Opens
29 Khan, T., Abimbola, S., Kyobutungi, C. & Pai, M. How we classify countries and people-and why it matters. *BMJ Glob Health* **7** (2022). https://doi.org:10.1136/bmjgh-2022-009704
30 World Bank. *The World Bank in Ghana*, <https://www.worldbank.org/en/country/ghana/overview> (2023).
31 World Bank. *The World Bank In Bangladesh*, <https://www.worldbank.org/en/country/bangladesh/overview> (2023).
32 World Bank. *Dealing with Disasters : Analyzing Vanuatu's Economy and Public Finances Through the Lens of Disaster Resilience*, <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/289451643709153886/dealing-with-disasters-analyzing-vanuatu-s-economy-and-public-finances-through-the-lens-of-disaster-resilience> (2021).
33 Ghana Statistical Service. *Census Preliminary Report*, <https://census2021.statsghana.gov.gh/gssmain/fileUpload/reportthemelist/PRINT_COPY_VERSION_FOUR%2022ND_SEPT_AT_8_30AM.pdf> (2021).
34 Davies-Vollum, K. S., Raha, D. & Koomson, D. in *African Handbook of Climate Change Adaptation* (eds Walter Leal Filho *et al.*) 1-25 (Springer International Publishing, 2020).

35 Boateng, I., Mitchell, S., Couceiro, F. & Failler, P. Mapping Vulnerability and Risk of Ghana's Coastline to Sea Level Rise. *Coastal Management* (2020). https://doi.org: 10.1080/08920753.2020.1803565

36 Boateng, I., Wiafe, G. & Jayson-Quashigah, P.-N. Mapping Vulnerability and Risk of Ghana's Coastline to Sea Level Rise. *Marine Geodesy* **40**, 23-39 (2016). https://doi.org:10.1080/01490419.2016.1261745

37 Alam, S., Misbahuzzaman, M., Rahman A, M. & Kabir, M. Threats to the Teknaf Wildlife Sanctuary of Bangladesh. *Journal of Environmental Science and Natural Resources* **7**, 233 – 239 (2015). https://doi.org:http://dx.doi.org/10.3329/jesnr.v7i1.22176

38 Ullah, S. M. A. & Tani, M. Fuelwood Consumption and its Impact on Forests in the Teknaf Peninsula on the Southern Coast of Bangladesh. *American Journal of Environmental Sciences* **13** (2017). https://doi.org:10.3844/ajessp.2017.225.232

39 Ullah, S. M. A., Tsuchiya, J., Asahiro, K. & Tani, M. Exploring the socioeconomic drivers of deforestation in Bangladesh: The case of Teknaf Wildlife Sanctuary and its surrounding community. *Trees, Forests and People* **7** (2022). https://doi.org:10.1016/j.tfp.2021.100167

40 Sultana, F. The unbearable heaviness of climate coloniality. *Political Geography* **99**, 102638 (2022). https://doi.org:https://doi.org/10.1016/j.polgeo.2022.102638

41 Scoones, I. *et al.* Transformations to sustainability: combining structural, systemic and enabling approaches. *Current Opinion in Environmental Sustainability* **42**, 65-75 (2020). https://doi.org:10.1016/j.cosust.2019.12.004

42 Gianelli, I., Horta, S., Martínez, G., de la Rosa, A. & Defeo, O. Operationalizing an ecosystem approach to small-scale fisheries in developing countries: The case of Uruguay. *Marine Policy*, 180 - 188 (2018). https://doi.org:https://doi.org/10.1016/j.marpol.2018.03.020

43 Geddes, A., Adger, W. N., Arnell, N. W., Black, R. & Thomas, D. S. G. Migration, Environmental Change, and the 'Challenges of Governance'. *Environment and Planning C: Government and Policy* **30**, 951-967 (2012). https://doi.org:10.1068/c3006ed

44 Buchori, I. *et al.* Adaptation to coastal flooding and inundation: Mitigations and migration pattern in Semarang City, Indonesia. *Ocean & Coastal Management* **163**, 445-455 (2018). https://doi.org:10.1016/j.ocecoaman.2018.07.017

45 Adger, W. N., Hughes, T. P., Folke, C., Carpenter, S. R. & Rockstrom, J. Social-ecological resilience to coastal disasters. *Science* **309**, 1036-1039 (2005). https://doi.org:10.1126/science.1112122

46 Appeaning Addo, K. Managing Shoreline Change Under Increasing Sea-Level Rise in Ghana. *Coastal Management* **42**, 555-567 (2014). https://doi.org:10.1080/08920753.2014.964820

47 Giri, C. *et al.* Status and distribution of mangrove forests of the world using earth observation satellite data. *Global Ecology and Biogeography* **20**, 154-159 (2011). https://doi.org:10.1111/j.1466-8238.2010.00584.x

48 Fischer, A. P. Pathways of adaptation to external stressors in coastal natural-resource-dependent communities: Implications for climate change. *World Development* **108**, 235-248 (2018). https://doi.org:10.1016/j.worlddev.2017.12.007

49 Hossain, M. A. R., Ahmed, M., Ojea, E. & Fernandes, J. A. Impacts and responses to environmental change in coastal livelihoods of south-west Bangladesh. *Sci Total Environ* **637-638**, 954-970 (2018). https://doi.org:10.1016/j.scitotenv.2018.04.328

50 Dasgupta, S., Laplante, B., Murray, S., Wheeler, D. . Exposure of developing countries to sea-level rise and storm surges. *Climate Change* (2011). https://doi.org:10.1007/s10584-010-9959-6.

51 Aheto, W. D. *et al.* Community-based mangrove forest management: Implications for local livelihoods and coastal resource conservation along the Volta estuary catchment area of Ghana. *Ocean and Coastal Management* **127**, 43 - 54 (2016). https://doi.org:https://doi.org/10.1016/j.ocecoaman.2016.04.006

52 Takyi, R. *et al.* Adaptive management of environmental challenges in West African coastal lagoons. *Science of The Total Environment* **838**, 156234 (2022). https://doi.org:https://doi.org/10.1016/j.scitotenv.2022.156234

53 Knudsen, M. Poverty and Beyond: Small-Scale Fishing in Overexploited Marine Environments. *Human Ecology* **44**, 341 - 352 (2016). https://doi.org:10.1007/s10745-016-9824-y

54 Venugopal, S., Gau, R., Appau, S., Sample, K. L. & Pereira, R. C. F. Adapting traditional livelihood practices in the face of environmental disruptions in subsistence communities. *Journal of Business Research* **100**, 400-409 (2019). https://doi.org:10.1016/j.jbusres.2018.12.023

55 Maynard, S., James, D. & Davidson, A. Determining the value of multiple ecosystem services in terms of community wellbeing: Who should be the valuing agent? *Ecological Economics* **115**, 22-28 (2015). https://doi.org:10.1016/j.ecolecon.2014.02.002

56 Koomson, D., Davies-Vollum, K. S. & Raha, D. Characterising the vulnerability of fishing households to climate and environmental change: Insights from Ghana. *Marine Policy* **120** (2020). https://doi.org:10.1016/j.marpol.2020.104142

57 Islam, M. M. & Shamsuddoh, M. Coastal and marine conservation strategy for Bangladesh in the context of achieving blue growth and sustainable development goals (SDGs). *Environmental Science & Policy* **87**, 45 -54 (2018). https://doi.org:https://doi.org/10.1016/j.envsci.2018.05.014

58 Nurhidayah, L. & McIlgorm, A. Coastal adaptation laws and the social justice of policies to address sea level rise: An Indonesian insight. *Ocean & Coastal Management* **171**, 11-18 (2019). https://doi.org:10.1016/j.ocecoaman.2019.01.011

59 Sowman, M. & Raemaekers, S. Socio-ecological vulnerability assessment in coastal communities in the BCLME region. *Journal of Marine Systems* **188**, 160-171 (2018). https://doi.org:10.1016/j.jmarsys.2018.01.008

60 Melzner, F. *et al.* Future ocean acidification will be amplified by hypoxia in coastal habitats. *Marine Biology*, 1875 – 1888 (2012). https://doi.org:https://doi.org/10.1007/s00227-012-1954-1

61 Saunders, F. P. *et al.* Transformation of small-scale fisheries — critical transdisciplinary challenges and possibilities. *Current Opinion in Environmental Sustainability* **20**, 26-31 (2016). https://doi.org:10.1016/j.cosust.2016.04.005

62 Newton, A. & Elliott, M. A Typology of Stakeholders and Guidelines for Engagement in Transdisciplinary, Participatory Processes. *Frontiers in Marine Science* **3** (2016). https://doi.org:10.3389/fmars.2016.00230

63 Norström, A. V. *et al.* Principles for knowledge co-production in sustainability research. *Nature Sustainability* **3**, 182-190 (2020). https://doi.org:10.1038/s41893-019-0448-2

64 Serrao-Neumann, S. *et al.* Advancing transdisciplinary adaptation research practice. *Nature Climate Change* **11**, 1006-1008 (2021). https://doi.org:10.1038/s41558-021-01221-4

65 Chambers, J. M. *et al.* Six modes of co-production for sustainability. *Nature Sustainability* **4**, 983-996 (2021). https://doi.org:10.1038/s41893-021-00755-x

66 Vanderlinden, J.-P. *et al.* Meaning in the face of changing climate risks: Connecting agency, sensemaking and narratives of change through transdisciplinary research. *Climate Risk Management* **29** (2020). https://doi.org:10.1016/j.crm.2020.100224

67 DeLorme, D. E., Kidwell, D., Hagen, S. C. & Stephens, S. H. Developing and managing transdisciplinary and transformative research on the coastal dynamics of sea level rise: Experiences and lessons learned. *Earth's Future* **4**, 194-209 (2016). https://doi.org:10.1002/2015ef000346

68 Jones, P. J. S. & Long, S. D. Analysis and discussion of 28 recent marine protected area governance (MPAG) case studies: Challenges of decentralisation in the shadow of hierarchy. *Marine Policy* **127** (2021). https://doi.org:10.1016/j.marpol.2020.104362

69 Serrao-Neumann, S. *et al.* One human settlement: A transdisciplinary approach to climate change adaptation research. *Futures* **65**, 97-109 (2015). https://doi.org:10.1016/j.futures.2014.08.011

70 Rittel, H. W. J. & Webber, M. M. Dilemmas in a general theory of planning
. *Policy Sciences* **4**, 155 - 169 (1973). https://doi.org:https://doi.org/10.1007/BF01405730

71 Fontalvo-Herazo, M. L., Glaser, M. & Lobato-Ribeiro, A. A method for the participatory design of an indicator system as a tool for local coastal management. *Ocean & Coastal Management* **50**, 779-795 (2007). https://doi.org:https://doi.org/10.1016/j.ocecoaman.2007.03.005

72 Matos, F. A., Alves, F., Coelho, C., Lima, M. & Vizinho, A. Participatory Approach to Build Up a Municipal Strategy for Coastal Erosion Mitigation and Adaptation to Climate Change. *Journal of Marine Science and Engineering* **10**, 1718 (2022).

73 Okafor-Yarwood, I., Kadagi, N. I., Belhabib, D. & Allison, E. H. Survival of the Richest, not the Fittest: How attempts to improve governance impact African small-scale marine fisheries. *Marine Policy* **135**, 104847 (2022). https://doi.org:https://doi.org/10.1016/j.marpol.2021.104847

74 Newton, A. *et al.* An overview of ecological status, vulnerability and future perspectives of European large shallow, semi-enclosed coastal systems, lagoons and transitional waters. *Estuarine, Coastal and Shelf Science* **140**, 95 - 122 (2014). https://doi.org:http://dx.doi.org/10.1016/j.ecss.2013.05.023

75 Elliott, M. *et al.* "And DPSIR begat DAPSI(W)R(M)!" - A unifying framework for marine environmental management. *Mar Pollut Bull* **118**, 27-40 (2017). https://doi.org:10.1016/j.marpolbul.2017.03.049

76 El Mahrad, B. *et al.* Social-Environmental Analysis for the Management of Coastal Lagoons in North Africa. *Frontiers in Environmental Science* **8** (2020). https://doi.org:10.3389/fenvs.2020.00037

77 Clarke, B. *et al.* Enhancing the knowledge–governance interface: Coasts, climate and collaboration. *Ocean & Coastal Management* **86**, 88-99 (2013). https://doi.org:10.1016/j.ocecoaman.2013.02.009



https://dspace.org/

We need collaboration and co-creation to address challenges facing coastal communities

Raha, Debadayita; Davies-Vollum, Katherine Sian; Hemstock, Sarah L.; Boateng, Isaac; Islam, Md Tariqul ...

2024-05-01
Springer
https://doi.org/10.1038/s41562-024-01875-y
Raha D, Davies-Vollum KS, Hemstock SL, et al., (2024) We need collaboration and co-creation to address challenges facing coastal communities. Nature Human Behaviour, Volume 8, May 2024, pp. 814-822

Downloaded from a DSpace repository. https://dspace.org/