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Long-term adaptation planning for sustainable coasts

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The coastal areas of our planet are under increasing pressure. In addition to growing population in the already densely populated coastal areas (*Neumann* et al. 2015), natural resources and habitats for fauna and flora are becoming ever more scarce (*Bendixen* et al. 2019). Adaptation to climate-induced rising sea levels constitutes an additional challenge that raises the question of how our coasts can adapt in ways that do not compromise their future sustainability. Commitment to sea-level rise (*Nicholls* et al. 2007) makes imperative the need for long-term adaptation planning, which will in turn greatly influence the future sustainability of coastal regions.

This Special Issue contributes to the discussion of how long-term adaptation planning needs to be driven by considerations, from different perspectives, regarding the sustainability of coastal regions. It is based on a series of empirical studies that are located in different continents and encompass various scales. What becomes apparent in the first place is the variety of answers that people all over the world give to the question of what sustainable coastal adaptation actually means. These various understandings are based on different (financial) capacities, socio-political, historical and cultural contexts and ideas, diverging interests and priorities as well as wishes for the future. However, through the different case studies we show that our different understandings are connected to similar challenges that can be observed in many parts of the world, and to 'big ideas' or discourses of our times that travel globally and are interpreted and modified on the ground (*Weisser* et al. 2014; *de Wit* et al. 2018). This suggests that sustainable coastal adaptation is shaped by global discourses and 'travelling ideas' (*Weisser* et al. 2014), such as climate change adaptation and nature conservation, and by scientific knowledge and technologies. At the same time the case studies presented in this Special Issue illustrate how these global "mobile policies" (*Cochrane* and *Ward* 2012: 7), which are connected to sustainable coastal protection, are interpreted and modified in specific locations and living environments through practice. The case studies further demonstrate that these practices are connected to different views of what sustainable coastal protection should look like and how it should be materialized. Different regionally specific and culturally situated socio-spatial (*Healey* 2004) and sociotechnical imaginaries (*Jasanoff* 2015; *Gesing* 2019, this Special Issue) underlie and shape coastal adaptation interventions and are discussed in our case studies from around the globe.

The various discourses, human and non-human actors and materials of varying scales that contribute to coastal protection suggest that a separation of coastal nature and coastal culture can be misleading. Our analytical concepts try to find more holistic ways of dealing with complex coastal *naturecultures*. The necessity of inter- and transdisciplinary approaches

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and of discussing and bridging ontological and epistemological gaps becomes obvious if we want to understand and promote sustainable coastal protection today and in the future. Involving culture and society in the analysis of coasts has also led to the inclusion of approaches that originate from the social sciences and the humanities and have more constructivist notions of looking at human environment interactions. Today, calls for more holistic approaches in coastal protection increasingly aim to achieve culturally and socially adequate coastal adaptation measures that include the different interests, necessities and coastal imaginaries of coastal populations (*Walsh* 2018; *Gesing* 2019, this Special Issue; *Ratter* et al. 2019, this Special Issue). These sometimes conflicting factors can result in adverse complex interactions causing wicked problems and barriers to adaptation that can lead to long-term degradation (*Brown* et al. 2014; *Hinkel* et al. 2018). The need to integrate different perspectives and disciplines in dealing with coastal adaptation has led to different approaches being employed in this Special Issue to address the complex challenges involved in realizing sustainable coastal adaptation.

Besides these thoughts concerning what sustainable adaptation could involve, we can identify different trends and key trajectories (*Herbeck* and *Flitner* 2019, this Special Issue) in coastal adaptation worldwide. Our case studies demonstrate that, currently, sustainable coastal adaptation is mainly connected to the question of how climate change adaptation is framed and interpreted: which public or private actors play a role and plan and finance or even benefit from climate change adaptation interventions at the coast (see *Bisaro* 2019, *Gain* et al. 2019 and *Herbeck* and *Flitner* 2019 in this Special Issue). Very often this question seems to be linked to how the coast can be further commodified and (economically) developed and how coastal protection measures can be 'sustainably' integrated into ongoing coastal development. This trend, which is illustrated by our case studies (see *Portman* 2019, *Bisaro* 2019, *Gesing* 2019 and *Gain* et al. 2019 in this Special Issue) not only leads to a further *valorization* (*Herbeck* and *Flitner* 2019, this Special Issue) of the coasts in the fight against loss of land and against erosion; but also shows that gaining and reclaiming land as a climate change adaptation measure, for example, through artificial islands (*Portman* 2019, this Special Issue), is increasingly emerging as a viable adaptation option.

Furthermore, framed as coastal adaptation measures, climate change adaptation or disaster risk reduction (*Herbeck* and *Flitner* 2019, this Special Issue), policy measures exist that can lead to gentrification, securitization, dispossession and other, sometimes new forms of inclusion and exclusion, as part of the coastal '(bio-) politics of nature' (*Latour* 2011; *Atteridge* and *Remling* 2018). What is also involved here and what is more-or-less actively negotiated amongst the different actors and interests, are aspects of access and of distributive and procedural justice (*Holland* 2017). With this in mind, we see the necessity to politicize coastal protection and climate change adaptation. Often these matters are framed in terms of apolitical, technical questions while the deeper layers of genuinely political aspects are not openly discussed and the people affected are not included in decision-making processes (*Klepp* and *Chavez-Rodriguez* 2018). This is problematic for establishing democratic negotiation processes concerning how we want to use our coasts as a public good, as well as for sustainable coastal protection. Such processes can lead to, for example, social exclusion, denial of access to (formerly) public areas, a lack of ownership and malfunctioning infrastructures as people, local knowledge and contexts are not adequately included in the planning and realization of coastal adaptation interventions (*Gesing* 2019, this Special Issue). Different temporal and spatial scales of planning, the long-term nature of climate change and the associated uncertainties being at odds with electoral cycles and local decisions constitute enormous challenges for coastal adaptation planning. Particular attention is therefore required for improving procedural justice in decision-making and to avoid making participatory processes an unjust exercise that benefits those property owners or economically strong actors who have the power and the resources to shape these decision-making process (*Hayward* 2008; *Garrelts* et al. 2018). An example of the kind of more inclusive approaches that allow, for example, smooth collective action and a discussion on which types of institutional characteristics and external factors lead to effective (in terms of social and ecological sustainability) governance of coastal floodplains are discussed by *Gain* et al. 2019 (this Special Issue) through the study of three tidal river management projects in the Ganges-Brahmaputra Delta in Bangladesh.

Another important aspect highlighted by the different case studies of coastal adaptation is the recently emerging trend of soft protection measures, ecosys-

tem based adaptation and *building with nature,* with the means of, for example, the conservation and restoration of coastal wetlands or beaches and dunes (*Stive* et al. 2013; *Temmerman* et al. 2013). Offering coastal protection, usually in combination with other measures, and providing additional benefits and services such as mitigation, poverty alleviation and disaster risk reduction, ecosystem based adaptation is now increasingly being considered as one of the main adaptation options. Our case studies from New Zealand, Israel and the Maldives (*Gesing* 2019; *Portman* 2019; *Ratter* et al. 2019, this Special Issue) explore how this type of adaptation is locally and regionally enacted, interpreted and modified as emerging sociotechnical imaginary (*Jasanoff* 2015; *Gesing* 2019, this Special Issue). Here the material dimensions of coastal adaptation infrastructure and the different interpretations and imaginaries people have regarding a safe coastal environment – physically, aesthetically and normatively – become apparent. Our case studies point to different concepts of nature, sustainability and related rationales in planning and building, and demonstrate that some of the portrayed adaptation and coastal protection measures can conflict with long-term sustainability, as shown in the Maldives and south-east Asian mega cities (*Ratter* et al. 2019; *Herbeck* and *Flitner* 2019, this Special Issue).

One important dimension of this Special Issue is reflecting on what coastal regions and their inhabitants interpret and develop as sustainable coastal adaptation, how they deal with their natural resources and how inclusive they are in their decision-making processes. The other dimension where this Special Issue aims to make a fruitful contribution involves the different disciplines, perspectives and range of methods that are used by our case studies to address the complex interactions in coastal realms. This complexity is being increasingly recognized in recent literature, and multidisciplinary systems approaches and the inclusion in planning and sustainability of perspectives from the social sciences and the humanities have given coastal adaptation a wider perspective, where climate change is not the only focus (*Brown* et al. 2014). Different notions and calls to integrate the various disciplines and epistemic communities have led, for example, to a flourishing of different ecosystem approaches that include socio-economic aspects in their analysis of coastal adaptation (*Barbier* et al. 2011), and to the development of integrated assessment models that combine knowledge from various disciplines to support coastal adaptation planning (e.g. *Hinkel* et al. 2009; *Hinkel* et al. 2014). This philosophy further manifests itself in holistic management approaches such as Integrated Coastal Zone Management (ICZM; *Portman* et al. 2015) and integrated decision making and adaptation planning approaches, such as the adaptation pathways approach (*Haasnoot* et al. 2019), that promote an improved understanding of drivers of change and associated responses and can strengthen adaptation planning.

As science is always a way of reducing complexity to make the world and research topics accessible, it is particularly interesting to see different approaches attempting to do so in the context of this Special Issue. From more interpretative approaches to systems-based and quantitative perspectives, it is possible to learn from different methods that lend themselves to different foci and scales of analysis. These studies also open up different coastal realities as they deal in different ways with their empirical material. The articles focus their analysis on various scales and aspects, whether they are normative, look at rationales in a constructivist way or are more descriptive and positivistic.

Recent research acknowledges that effective and sustainable coastal adaptation involves much more than just technical considerations (*Gesing* 2016; *Walsh* 2018 *Nicholls* 2018; *Gesing* 2019, this Special Issue). To put these and other different epistemological ways of understanding the coast into dialogue will be a major task and challenge for the future, and the sustainability of our coasts will also depend on how successful we are in this endeavour.

References

Atteridge, A. and *E. Remling* 2018: Is adaptation reducing vulnerability or redistributing it? – Wiley Interdisciplinary Reviews: Climate Change **9** (1): e500, doi:10.1002/wcc.500

Barbier, E.B., S.D. Hacker, C. Kennedy, E.W. Koch, A.C. Stier and *B.R. Silliman* 2011: The value of estuarine and coastal ecosystem services. – Ecological Monographs **81** (2): 169-193, doi:10.1890/10-1510.1

Bendixen, M., J. Best, C. Hackney and *L.L. Iversen* 2019: Time is running out for sand. – Nature **571**: 29-31, doi:10.1038/d41586-019-02042-4

Bisaro, A. 2019: Coastal adaptation through urban land reclamation: Exploring the distributional effects. – Die Erde **150** (3): 131-144, doi:10.12854/erde-2019-453

Brown, S., R.J. Nicholls, S. Hanson, G. Brundrit, J.A. Dearing, M.E. Dickson, S.L. Gallop, S. Gao, I.D. Haigh, J. Hinkel, J.A. Jimenez, R.J.T. Klein, W. Kron, A.N. Lazar, C.F. Neves, A. Newton, C. Pattiaratachi, A. Payo, K. Pye, A. Sanchez-Arcilla, M. Siddall, A. Shareef, E.L. Tompkins, A.T. Vafeidis, B. van Maanen, P.J. Ward and *C.D. Woodroffe* 2014: Shifting perspectives on coastal impacts and adaptation. – Nature Climate Change **4**: 752-755, doi:10.1038/nclimate2344

Cochrane, A. and *K. Ward* 2012: Researching the Geographies of Policy Mobility: Confronting the Methodological Challenges. – Environment and Planning A: Economy and Space **44** (1): 5-12, doi:10.1068/a44176

de Wit, S., A. Pascht and *M. Haug* 2018: Translating Climate Change: Anthropology and the Travelling Idea of Climate Change. – Sociologus **68** (1): 1-20, doi:10.3790/soc.68.1.1

Gain, A.K., Md. Ashik-Ur-Rahman and *D. Benson* 2019: Exploring institutional structures for Tidal River Management in the Ganges-Brahmaputra Delta in Bangladesh. – Die Erde **150** (3): 184-195, doi:10.12854/erde-2019-434

Garrelts, H., J. Herbeck and *M. Flitner* 2018: Leaving the comfort zone: Regional governance in a German climate adaptation project. – In: *Klepp, S.* and *L. Chavez-Rodriguez* (eds.): A Critical Approach to Climate Change Adaptation: Discourses, Policies, and Practices. – London/New York: 206-221, doi:10.4324/9781315165448

Gesing, F. 2016: Working with Nature in Aotearoa New Zealand: An Ethnography of Coastal Protection. – Bielefeld

Gesing, F. 2019: The politics of artificial dunes: Sustainable coastal protection measures and contested socio-natural objects. – Die Erde **150** (3): 145-157, doi:10.12854/erde-2019-423

Haasnoot, M., S. Brown, P. Scussolini, J. Jimenez, A.T. Vafeidis and *R. Nicholls* 2019: Generic adaptation pathways for coastal archetypes under uncertain sea-level rise. – Environmental Research Communications (in press)

Hayward, B. 2008: Nowhere Far From the Sea': Political Challenges of Coastal Adaptation To Climate Change in New Zealand. – Political Science **60** (1): 47-59, doi:10.1177/003231870806000105

Healey, P. 2004: The treatment of space and place in the new strategic spatial planning in Europe. – International Journal of Urban and Regional Research **28** (1): 45-67, doi:10.1111/j.0309-1317.2004.00502.x

Herbeck J. and *M. Flitner* 2019: Infrastructuring coastal futures: Key trajectories in Southeast Asian megacities. – Die Erde **150** (3): 118-130, doi:10.12854/erde-2019-451

Hinkel, J., and *R.J. Klein* 2009: Integrating knowledge to assess coastal vulnerability to sea-level rise: The development of the DIVA tool. – Global Environmental Change **19** (3): 384-395, doi:10.1016/j.gloenvcha.2009.03.002

Hinkel, J., D. Lincke, A.T. Vafeidis, M. Perrette, R.J. Nicholls, R.S.J. Tol, B. Marzeion, X. Fettweis, C. Ionescu and *A. Levermann* 2014: Coastal flood damage and adaptation costs under 21st century sea-level rise. – Proceedings of the National Academy of Sciences **111** (9): 3292-3297, doi:10.1073/pnas.1222469111

Hinkel, J., J.C. Aerts, S. Brown, J.A. Jiménez, D. Lincke, R.J. Nicholls, P. Scussolini, A. Sanchez-Arcilla, A.T. Vafeidis and *K.A. Addo* 2018: The ability of societies to adapt to twenty-first-century sea-level rise. – Nature Climate Change **8** (7): 570-578, doi:10.1038/s41558-018-0176-z

Holland, B. 2017: Procedural justice in local climate adaptation: political capabilities and transformational change. – Environmental Politics **26** (3): 391-412, doi:10.1080/09644016.2017.1287625

Jasanoff, S. 2015: Imagined and Invented Worlds. – In: *Jasanoff, S.* and *S-H. Kim* (eds.): Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power. – Chicago: 321-341

Klepp, S. and *L. Chavez-Rodriguez* (eds.) 2018: A Critical Approach to Climate Change Adaptation: Discourses, Policies, and Practices. – Routledge Advances in Climate Change Research. – London/New York

Latour, B. 2011: Politics of nature: East and West perspectives. – Ethics & Global Politics **4** (1): 71-80, doi:10.3402/egp.v4i1.6373

Nicholls, R.J., P.P. Wong, V.R. Burkett, J.O. Codignotto, J.E. Hay, R.F. McLean, S. Ragoonaden and *C.D. Woodroffe* 2007: Coastal systems and low-lying areas. In: *Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden* and *C.E. Hanson* (eds): Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. – Cambridge: 315-356

Neumann, B., A.T. Vafeidis, J. Zimmermann and *R.J. Nicholls* 2015: Future coastal population growth and exposure to sea-level rise and coastal flooding – a global assessment. – PloS ONE **10** (3): e0118571, doi:10.1371/journal.pone.0118571

Nicholls, R.J. 2018: Adapting to Sea-Level Rise. – In: *Zommers, Z.* and *K. Alverson* (eds.): Resilience: The Science of Adaptation to Climate Change. – London: 13-29

Portman, M.E., T.M. Dalton and *J. Wiggin* 2015: Revisiting Integrated Coastal Zone Management: Is It Past Its Prime? – Environment: science and policy for sustainable development **57** (2): 28-37, doi:10.1080/00139157.2015.1001693

Portman, M. 2019: Detached islands: Artificial islands as adaptation challenges in the making. – Die Erde **150** (3): 158-168, doi:10.12854/erde-2019-430

Ratter, B., A. Hennig and *Zahid* 2019: Challenges for shared responsibility – Political and social framing of coastal protection transformation in the Maldives. – Die Erde **150** (3): 169-183, doi:10.12854/erde-2019-426

Stive, M.J., M.A. de Schipper, A.P. Luijendijk, S.G. Aarninkhof, C.

van Gelder-Maas, J.S. van Thiel de Vries, S. de Vries, M. Henriquez, S. Marx and *R. Ranasinghe* 2013: A new alternative to saving our beaches from sea-level rise: The sand engine. – Journal of Coastal Research **29** (5): 1001-1008, doi:10.2112/JCOASTRES-D-13-00070.1

Temmerman, S., P. Meire, T.J. Bouma, P.M. Herman, T. Ysebaert and *H.J. De Vriend* 2013: Ecosystem-based coastal defence in the face of global change. – Nature **504** (7478): 79, doi:10.1038/nature12859

Walsh, C. 2018: Metageographies of Coastal Management: Negotiating Spaces of Nature and Culture at the Wadden Sea. – Area **50** (2): 177-185, doi:10.1111/area.12404

Weisser, F., M. Bollig, M. Doevenspeck and *D. Müller-Mahn* 2014: Translating the 'adaptation to climate change' paradigm: the politics of a travelling idea in Africa. – The Geographical Journal **180** (2): 111-119, doi:10.1111/geoj.12037