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## **When it's time to let go: Re-imagining coastal urban living in the face of rising seas**

Elnaz Torabi and Aysin Dedekorkut-Howes

**Abstract:** Sea cities are at the forefront of the climate change. Globally, the developed coastline of many cities is at high risk of sea level rise, coastal flooding, and storm surge. Such risks, however, can turn into important opportunities for re-imagining the future of cities and their resilience and sustainability. Despite being controversial, unsesttlement, re-settlement, retreat, temporary and permanent relocation, and climigration are concepts that are rapidly becoming an inevitable urban policy and planning consideration. Yet, the idea of a nomadic city, a city that moves, is not new. In fact, the oldest forms of human adaptation to coastal hazards have been through relocation to higher grounds. While temporary forms of relocation have long been prominent in disaster risk reduction efforts, permanent retreat and relocation of urban communities are increasingly becoming critical discussions in climate change adaptation. This chapter focuses on urban resilience to coastal hazards and explores strategies ranging from temporary retreat and managed retreat to migration as a land use policy that can create transformative opportunities for adaptation and re-imagines the future of sea cities in a changing climate. Case studies from around the world are presented, exploring the potential of policy responses as well as the key barriers and drivers for their implementation.

### **Introduction**

The increasing impacts of climate change put pressure on many cities around the world that are already dealing with urbanisation and rapid population growth issues. Today, nearly half (44%) of the world's population lives near the coast (United Nations n.d.). Coastal hazards including flooding triggered by sea level rise and increased frequency/intensity of storm surge and cyclones will impact many cities (IPCC 2018). In response, cities will need to build their resilience and adapt to the impacts of climate change. Adaptation is defined as “the process of adjustment to actual or expected climate and its effects” in order to moderate harm and exploit beneficial opportunities (IPCC 2014: 1785), while resilience is the capacity of a city to not only return back and restore its previous functions, but also adjust to change (for example by building back better) and/or transform the way it deals with the impacts of hazards (Rockefeller Foundation n.d., Torabi 2017).

Traditionally, cities have built their resilience and adapted to the impacts of disasters by *protecting* the vulnerable areas where population, economic activity, and natural resources are located, *accommodating* the impacts by enhancing the capacity of the natural and built environment and people to deal with the impacts while continuing to use vulnerable areas, and/or *retreating* people and structures from vulnerable areas via temporary or permanent relocation to safer areas (Dronkers et al. 1990). There are arguments for or against each

strategy. Protection and defence via engineering structures have been the typical planning responses for many major cities around the world as they are easier to implement and do not disrupt the existing institutional and social contexts (Dedekorkut-Howes et al. 2020).

However, engineering solutions are only as good as their design benchmarks and protect for the short-term. Peterson (2019: 203) warns against planning for individual temporary hazards “rather than the combined effect of more extensive storm surges followed by permanent inundation of increasing amounts of coastal land” and deems attempts at defence a “losing battle” which will only incur further expense of removal in the long run. Dedekorkut-Howes et al. (2020) agree that retreat will eventually become inevitable for some cities as they cannot be defended indefinitely. According to Siders et al. (2019: 761) “the question is no longer whether some communities will retreat—moving people and assets out of harm’s way—but why, where, when, and how they will retreat.” Cities increasingly need to recognise the need to consider other options including a shift from fighting water to living with it (Rijke et al. 2012).

Considering the increasing cost of investment in protection and accommodation strategies (see Donner and Webber 2014), many governments around the world are considering retreat as a viable strategy for the long-term (Dedekorkut-Howes et al. 2020; Hanna et al. 2020; Hino et al. 2017; Peterson 2019). The retreat strategy applies to a wide range of risks including those associated with sea level rise and coastal flooding, inland flooding, bushfires, and landslides. Retreat also spans across different spatio-temporal scales, involving planned or managed relocation of entire communities, strategic relocation of critical infrastructure, and/or more asset-based responses (Dedekorkut-Howes et al. 2020; Hanna et al. 2019; 2020; Tadgell et al. 2018). Accordingly, different terminology has been used in framing retreat in urban practice, policy, and research including relocation or realignment; planned or managed retreat; unsettlement, resettlement, migration, abandonment (Dedekorkut-Howes et al. 2020; Hanna et al. 2019), or as Matthews and Potts (2018) term it climigration (climate-related immigration and displacement). King (2017: 66-67) distinguishes between relocation and resettlement in that the former is “the ad hoc migration of people” whereas the latter denotes “the permanent or long-term movement of a community from one site to another”, and in this sense, resettlement is often the preferred option.

The various forms of retreat can be categorised as: 1) *vertical retreat* which involves elevating structures, 2) *engineered retreat* which involves land reclamation and filling, 3)

*temporary relocation* during hazards, 4) *horizontal planned retreat* or managed realignment involving moving permanently to higher land, and 5) *migration* which involves permanent abandonment of an area (Dedekorkut-Howes et al. 2020). Peterson (2019: 204) distinguishes between tactical retreat which may involve “relocating buildings landward on the same property” from larger scale strategic relocation which relocates “coastal neighborhoods, infrastructure, communities, or ecosystems to new, safer sites”.

While retreat can enhance the natural coastal processes and is less costly in some cases compared to hard protection (Abel et al. 2011; Harman et al. 2013), it is still a controversial “dirty word” or a “last resort” in planning and decision making, sometimes considered to be surrender or defeat in the fight against climate change. For example, the negative connotations of the term retreat have led to the use of “managed realignment” as a more politically acceptable term in countries such as the UK (Harman et al. 2013; Pethick 2002).

The implications of retreat can be very complex, involving difficult decisions. It will require significant resources, communities will lose their homes and neighbourhoods, and there will be interruptions to business and the economy (Lonsdale et al. 2008; Scott et al. 2012). Some view retreat as an unsuitable option for developed urban areas and argue that it can lead to inequality by disproportionately affecting the community, and cause loss of heritage in areas of historical significance (Harman et al. 2013; Lonsdale et al. 2008). There are several barriers to implementation of managed retreat. For instance, existing settlement patterns and lack of suitable land for relocation can be a physical limitation (Harman et al. 2013; Munji et al. 2013; Primo 1997; Scott et al. 2012). Retreat can lead to the clearing of more mangroves and trigger environmental problems (Munji et al. 2013). It is also very likely to result in major legal disputes and have considerable impact on property values (O’Donnell 2019; Scott et al. 2012). Land use controls that prohibit or limit new development in high risk areas can be challenged in the courts as the “taking” of private land and create land tenure and liability issues for local governments (Dedekorkut-Howes et al. 2020; Primo 1997).

The socio-political cost of retreat is high, making it a publicly unacceptable option (Harman et al. 2013; Lonsdale et al. 2008; Sahin et al. 2013). This is mainly due to communities’ desire to live close to water (Torabi et al. 2018) and attachment to their existing lifestyles and cultural heritage (Donner and Webber 2014; Douglas et al. 2012; Primo 1997). The attachment of a community to a place is closely linked to sense of pride and belonging to a community and considered to be the most powerful contributor to a final decision regarding

migration and retreat (Jamero et al. 2017). It is important to consider the socioeconomic impacts of population dispersal and mixing as part of retreat due to cultural perception of land loss and community preference for in situ (structural) adaptation options (Harman et al. 2013; Lonsdale et al. 2008). There are also negative political implications for land use planning, as local governments are perceived to be withholding tenable land from the market (Alexander et al. 2012). Wealthy property owners want to build along the coasts and politicians waver between managing community demand and responding to increasing coastal risks. This translates into significant financial burden on the community (Harman et al. 2013).

Yet, retreat also provides unique opportunities for re-imagining the future of cities in the age of climate change and resource depletion that are so far unexplored (Siders 2019; Black et al. 2011). Many cities around the world have to deal with the legacy development and infrastructure that have been laid out without any consideration of future hazards and climate change. Retreat can provide a second chance for good planning and undoing past mistakes. This chapter focuses on urban resilience to coastal hazards and explores strategies ranging from temporary retreat and managed retreat to migration as a land use policy that can create transformative opportunities for adaptation and re-imagines the future of sea cities in a changing climate.

## **Living Harmoniously with Water**

Relocation to higher grounds is an old form of human adaptation to coastal hazards. This involves relocation to temporary houses or use of relocatable structures for housing that can be easily transferred to higher grounds, as traditionally practiced in many island and delta communities in the Philippines, Federated States of Micronesia, and Indigenous communities in Australia (Primo 1997; Munji et al. 2013; Jamero et al. 2017). Historically, some sea nomad communities such as the Bajo in Southeast Sulawesi, Indonesia have also spent their entire lives on houseboats (Kusuma et al. 2017).

Temporary relocation allows communities to retain temporary houses on the low-lying areas for their livelihood, while using permanent houses on the relocated areas during natural hazards. The underground cities of Cappadocia in Turkey dating back to 1200 BC provide an interesting example of temporary resettlement. They were designed to serve as temporary shelter to tens of thousands of people during enemy invasions (Çiner and Aydar 2019; Bertini

2010). While temporary relocation has long been prominent in disaster risk reduction, permanent retreat and relocation of urban communities are increasingly becoming critical discussions in climate change adaptation (Nalau and Handmer 2019).

In the context of western societies, the idea of a nomadic city is also getting traction in the literature. Fry (2011) proposed the concept of the *urmadic* city to connote urban nomadism and describe non-permanent, moving cities. The idea of an *urmadic* city, a city that moves, is not new. As opposed to moving existing cities, the *urmadic* city is designed to move if and when it becomes necessary. These examples throughout history across the globe provide us with opportunities to take lessons from the past to apply them to the future. But this requires the transformation of traditional assumptions that underpin urban planning. Floating houses and neighbourhoods are no longer part of a utopian dream, but a possibility of a new form of sustainable urban living, as supported by the United Nations (United Nations 2019). Yet, a recent systematic review of the literature (Dedekorkut-Howes et al. 2020) shows a gap in research on the complexities of decision making and planning in this context.

## **Managed Retreat and Resettlement**

There are several examples of managed retreat and resettlement projects across the world, both successful and unsuccessful. Here we provide a brief overview of some of them focusing on barriers and drivers of their implementation and opportunities they provide.

### **Australia**

With 85% of its population living in coastal areas Australia is extremely exposed to the impacts of climate change, yet despite the urgency of the matter, it does not have a national coastal policy. The lack of leadership from the national level had made coastal adaptation a responsibility of the states and territories, leading to a variety of inconsistent responses (Howes and Dedekorkut-Howes 2016). A review of the coastal policies and plans of all Australian states and territories shows that while some states such as South and Western Australia provide more policy guidance on retreat at higher strategic level there is little on implementation.

Managed retreat has been implemented in Australia in several cases, in less populated areas (towns) and usually as an ad hoc response to a disaster. One well-known case of failure to

retreat is the town of Byron Bay in New South Wales, Australia. The significance of this case relates to its demonstration of the critical role of the community for implementation of managed retreat policies. In response to coastal storms in 1970, the local council adopted a managed retreat policy (in 1988), which received significant community backlash (England 2013; Harman et al. 2013). In 2009, coastal storms caused severe damage to private property along the beach. Despite the Council's plans for retreat of property and refusal to reinstate existing sandbag walls, in a legal challenge the community demanded action from the Council to reinstate the sandbags to continue to live in the same area (Leitch 2009). Ironically, a few years later, the continued exposure of the community led the Council to consider more engineering protection measures such as seawalls to defend existing settlements, much like the Gold Coast across the state border (Torabi et al. 2017a). This decision faced significant backlash from the local community that demanded the public amenity of the beach (Lovejoy 2015; O'Donnell 2016). Similar resistance by the community to government initiatives of retreat was also experienced at Smith Island in the Chesapeake Bay in the United States of America (US) after hurricane Sandy causing tens of millions of dollars to be committed to protection (Peterson 2019). The island nation of Kiribati (Figure 1) provides another example of backing away from proactive relocation despite previously purchasing land in Fiji for planned resettlement (Walker 2017).



Figure 1. The central Pacific island of Tarawa in Kiribati (Government of Kiribati, 2005, Creative Commons Attribution 3.0 Unported, <https://creativecommons.org/licenses/by/3.0/deed.en>)

On the opposite side of the coin, managed retreat has proved to be successful where appropriate institutional setting is in place and the affected community is properly engaged in the process. The town of Grantham in Queensland was hit hard by flash flooding in 2011 (Figure 2). After the floods the government implemented a land swap strategy to facilitate the relocation of the community. The local government in Grantham purchased a parcel of land on higher ground near the existing flood affected town. Through communication of its land swap strategy by using maps and engaging with the community, the local council facilitated the relocation of the entire community. The proximity of the new area to the existing flood affected community proved helpful as it facilitated engagement: people could see what the new estate looked like and were more interested in the program (Simmonds 2020). Grantham's experience highlights the importance of existing planning regulations which can hinder action, local political leadership, collaboration between all sectors involved, community participation, and ongoing assessments for the success of resettlement process (Okada et al. 2014; Sipe and Vella 2015). However, the more common approach in Australia is relocation through voluntary buy-back schemes particularly after disasters (King et al. 2014).



Figure 2. Motor vehicles and motor boat colliding with the railway bridge during the floods in Grantham, Queensland, 2011 (Geoff Purton, John Oxley Library, State Library of Queensland, Image No: 28510-0145-0018)

## The United States

Much like Australia, the US is highly exposed to coastal impacts of climate change. In the US flood management has historically focused on enabling people and infrastructure to remain in the same area. Unlike Australia, however, the US has the longest-running programs of managed retreat globally, driven by its national government (Hino et al. 2017). Voluntary buyouts of flood prone properties funded by US federal agencies, especially the Federal Emergency Management Agency (FEMA), underpins the country's approach to retreat (Dyckman et al. 2014). There has, however, been significant equity concerns around managed retreat in the US. (Siders 2019). A recent review of FEMA-funded voluntary buyouts by Mach et al. (2019) showed that local governments in counties with higher population and income were more likely to administer buyouts, whereas within cities the buyouts were concentrated in more socially vulnerable neighbourhoods. There are examples such as Soldiers Grove, Wisconsin where managed retreat created opportunities. The deliberate relocation of the business centre of the city away from the river and closer to the highway in 1978 created economic opportunities for a city that is now known as a Solar Town (Siders 2019, David and Mayer 1984). In San Francisco's Ocean Beach, efforts are under way via the *Ocean Beach Master Plan* (2012) to address sea level rise, protect existing infrastructure, restore coastal processes, and improve public access to the beach. An important part of the masterplan is the rerouting of parts of the Great Highway. Retreat of the existing road in this case, combined with other measures such as asphalt overlays to redirect water runoff and sewer/drainage improvements, is used as an opportunity to improve public access (pedestrian and bicycle) and connections to the beach (SPUR 2012) as shown in Figure 3.



Figure 3. Artist's sketch of Ocean View Master Plan's vision (courtesy of SPUR and AECOM)

The fourth *National Climate Assessment* (USGCRP 2018: 1329) remarked that “in all but the very lowest sea level rise projections, retreat will become an unavoidable option in some areas along the U.S. coastline” but acknowledged that “the potential need for millions of people and billions of dollars of coastal infrastructure to be relocated in the future creates challenging legal, financial, and equity issues that have not yet been addressed.” So far, the examples of managed retreat are small scale such as the relocation of a bike path and parking lot inland in Surfers Point, Ventura, CA (Kochnowier et al. 2015). An example of community resettlement is the Biloxi-Chitimacha-Choctaw Tribe who reside in Isle de Jean Charles in southeastern Louisiana. The ideal resettlement scenario produced by the community highlight the opportunities provided by resettlement: “The residents envision a sustainable community that utilizes ground-breaking technology and resilience measures while integrating the history, traditions, and culture of the Biloxi-Chitimacha-Choctaw tribe” (King 2017: 313). The features of the new community include stormwater detention in community parks, treating water as a resource through family gardens, water management technology, and strategic tree planting and forest and water features that allow for crawfish ponds and migratory bird sanctuaries. The success of the resettlement depends on it being community-led and voluntary. So far, the state of Louisiana has named the master planner of the project and selected a site approximately 40 miles northwest of the Isle de Jean Charles (Crepelle 2018). However, the project is not without its critics. Crepelle (2018) questions why the resettlement funding cannot be used for restoration and erosion prevention and Marino (2018) suggests that Isle de Jean Charles' exclusion from the levee project due to the cost-benefit analysis may have been a politically sanctioned sacrifice. Jessee (2020) reports that the State's recent redefinition of the scope of the resettlement and lack of commitment to the existing tribal vision has confirmed the fears of the community that it was turning the tribal resettlement into a subdivision.

On a larger scale, Hawaii is in the early stages of exploring the feasibility and implications of managed retreat (OP-CZM 2019). The Office of Planning's project report found that managed retreat is more likely after a catastrophic event (as in the case of Australia's Grantham) when resources and the resulting political and social will to relocate are more plentiful and urgent. Yet, it is currently not possible to develop a step-by-step plan to

implement managed retreat given the various unknowns and competing priorities (OP-CZM 2019).

## **The Netherlands**

The Netherlands is the most famous example of a country with a long history of living with water, implementing multiple managed retreat strategies including the realignment of the shoreline to create space for coastal habitat development and a natural buffer zone for flood protection (Stronkhurst and Mulder 2014). The country's *Room for the River* program focused on strategic retreat and removed human-built barriers, reshaping landscapes at more than 30 locations around the country. As part of this program and through extensive consultation with the community, a managed retreat strategy was pursued to lower the existing dikes in De Noordwaard while 75 households were resettled elsewhere in elevated mounds or outside the area (Rijke et al. 2012; Schut et al. 2010; Hino et al. 2017). In this case, residents who initially opposed retreat came around after several repeated inundation events. The project created several opportunities for the landscape, housing, and the agricultural businesses in the area including nature, economic activity, and recreation. The retreat strategy in this case was combined with measures to accommodate the impacts of flooding including safe in-situ housing opportunities, evacuation guidelines, construction of a high-water channel to drain large volumes of water to the sea, building higher quays for more sustainable agriculture practices, as noted by the Directorate-General for Public Works and Water Management (Rijkswaterstaat n.d.).

A more urban example from the *Room for the River* program is Nijmegen, one of the Netherlands' oldest cities. The city's high density centre is located in close proximity to the Waal River, extremely exposed to flooding. Here the development along the river did not leave any space to set back from the river or bulk up seawalls. In close collaboration with the residents, the government successfully bought 50 homes, using the space to move the defence structures inland and create a recreational space (Baurick 2020).

## **The United Kingdom**

One retreat approach is to provide compensation (or support) for private owners whose homes are threatened. Through the UK *Coastal Change Pathfinder Programme*, five local councils relocated or bought out households at high risk from coastal hazards. Between 2009

and 2011, the programme funded pilot projects and bought out properties, relocating around ten households in different communities (OECD 2019). The North Norfolk District Council was one of the five councils in the UK to receive major funding (£3 million) in 2009-10 under the programme (DEFRA 2012). Owners of the nine houses at immediate risk of coastal hazards were paid a market value. The project initially planned to test the strategy of “buy-and-lease back”, but ultimately this was not pursued due to lack of sufficient funding and perceived financial risk to the Council. This project is reported to have increased the Council’s understanding of coastal management strategies and created a sense of community and cohesion (DEFRA 2012).

Currently the Environment Agency and local councils are developing *Shoreline Management Plans* (SMPs) in England and Wales to manage the threat of coastal change (Environment Agency 2019). These include “holding the line” policies which protect settlements and infrastructure with hard defences either for part of this century or all the way to the end of the century with an estimated implementation cost of £18 - 30 billion. However, a recent report by the UK’s Committee on Climate Change (2018) suggests that this policy is for the most part not cost-beneficial, thus unlikely to get funded raising the need for realistic plans to adapt. The *Draft National Flood and Coastal Erosion Risk Management Strategy for England* accepts that some areas will flood and promotes managed realignment in areas of high flood risk from rivers. The 2012 *Shoreline Management Plan* for the area encompassing 600-household village of Fairbourne in Wales (Figure 4) has recommended realignment of the coast and eventual decommissioning of Fairbourne eventually prompting lawsuits from residents who argued that the value of their properties decreased (Buser 2020, Peterson 2019). This case of the first and largest UK community to be abandoned also highlights the importance of involving affected residents in the planning process early and in meaningful ways and the need for a robust communication plan that involves the media (Buser 2020).



Figure 4. Beach at Fairbourne showing the dragon's teeth sea defences, 2011 (cc-by-sa/2.0 - © SMJ - [geograph.org.uk/p/1459592](http://geograph.org.uk/p/1459592)).

## **New Zealand**

In line with the IPCC recommendations, adaptation strategies were integrated in the *New Zealand Coastal Policy Statement*, which provides a national policy direction for coastal management. The policy focuses on managed retreat “by relocation or removal of existing structures or their abandonment in extreme circumstances, and designing for relocatability or recoverability from hazard events” (Department of Conservation 2010: 24). Despite being controversial and facing opposition from the affected communities, managed retreat has been implemented by some local councils in New Zealand (Bloomfield 2018). Yet the path towards retreat and relocation of communities has not always been clear. A case in point is Matatā, a town in the Bay of Plenty in the North Island of New Zealand hit by debris flows in 2005 after exceptionally heavy rainfall (Figure 5). In the absence of a guiding framework, regulations and the necessary resources, the local council faced significant challenges in managed retreat of affected properties. This resulted in disputes between residents and local government as well as trauma and stress on the community and the officers involved (Hanna et al. 2020). After 14 years, and while some residents continued to be exposed to risk, the Whakatāne District Council, the Bay of Plenty Regional Council, and the Department of

Internal Affairs agreed on a joint funding for property acquisition in this area. Yet the ad hoc approach to managed retreat has been criticised as being “disruptive and inequitable” resulting in a fragmented risk management approach (Hanna et al. 2020).



Figure 5. Debris flow in Matatā in May 2005 (courtesy of Whakatāne Beacon)

A successful case of retreat, on the other hand, was carried out by the Waitakere City Council in Auckland. In 2002, the Council developed the *Project Twin Streams*, running for 10 years to reduce flood risk and improve ecological functioning of the waterways (Bell et al. 2017). Rather than using compulsory acquisition of land through the *Public Works Act 1981*, the council adopted a voluntary buy back approach through an inclusive participatory process engaging property owners and community representatives such as politicians as well as the Māori. As a result, 78 full purchase and 78 partial purchases of properties were successfully negotiated to allow for flood plain redesign, linking managed retreat objectives with broader environmental, social, economic, and cultural goals (Bell et al. 2017). In this case, managed retreat created an important opportunity to strengthen the social fabric of the community by providing new public infrastructure (parks, cycle ways, and walkways) and accommodating the needs of those who moved to other areas (Vandenbeld and Macdonald 2013). This was in the main achieved by effective and efficient approach of the Council to engagement by building on the local knowledge of the affected people, having extended periods of

engagement to accommodate people's needs, and negotiating equitable and individualised solutions (Bell et al. 2017).

### **Opportunities: Re imagining the future of sea cities in a changing climate**

Fighting with the ocean is a losing battle. Managed retreat is a promising but controversial approach to adaptation. In theory, the idea of removing people and property out of the harm's way is a no regrets best practice approach to address sea level rise and coastal flooding. However, in practice it is politically sensitive and contentious. To make the technically sound solutions politically acceptable, managed retreat policy and practice needs to be better informed.

Managed retreat can create many opportunities for the community. For instance, it can provide funding opportunities for the people who want to leave but cannot afford to do so (Siders 2019). The abandoned areas can then be used to restore the natural amenity of the coastline, create opportunities for absorbing flood waters, or can be used as public amenity spaces (Dedekorkut-Howes et al. 2020; Siders 2019). Above all, managed retreat is an opportunity for social, economic, and ecological transformation and new beginnings (Freudenberg et al. 2016; Siders 2019). Realising the opportunities provided by managed retreat requires a transformational approach to adaptation, adding long-term innovative approaches to change the existing ways of life and practices (Matyas & Pelling, 2015, Torabi et al. 2018). This approach is underpinned by a change to embed long-term planning, proactive social learning, critical re-appraisal of the economy, fostering creativity and openness, and incorporating future uncertainty in decision making (Restemeyer et al. 2015; Tchakert and Dietrich 2010).

There is an increasing need for embedding managed retreat as a viable option in long-term strategic planning. Siders et al. (2019) emphasise the importance of strategic, managed retreat rather than ad hoc reactive actions to ensure opportunities to contribute to broader societal goals (such as sustainability) and economic development are not missed. Key dimensions of such strategic retreat would include decision-making and planning at larger geographic and temporal scales; involvement of multiple agencies and jurisdictions; addressing of multiple hazards; and integration into planning for economic, social, and environmental goals. Ryan et al. (2015) develop five key principles to govern the large-scale relocation of jobs and housing: 1) out of harm's way, 2) minimise stress, 3) receiving capacity, 4) build it back

better, and 5) feasibility of implementation. Two of these principles illustrate the opportunities provided by relocation. Careful selection of relocation sites would not only protect them from risk of flooding but also other risk factors such as steep slopes, contaminated brownfields, polluted areas, and areas adjacent to heavy industry. Relocation also provides the opportunity to build back better where a holistic plan can be prepared to consider all aspects of sustainable development from energy and water footprints of settlements to opportunities for more active and public transport. Managed retreat can be a catalyst for a resilient and sustainable future, one that includes water sensitive and smart cities, supported by blue-green infrastructure, and providing equitable opportunities for everyone in the city.

To be effective managed retreat needs to be implemented on a larger scale, as the retreat of an isolated section of the coast can increase erosion in the remainder of the system, especially if constrained by coastal defence structures (French 2008; Pethick 1993). Often the focus on logistics of moving people and settlements as an ad hoc response to a disaster can undermine the strategic direction and benefit from these opportunities in the longer-term (Siders et al. 2019). Effective governance and management are critical for administering retreat. In Peru, for example, due to limited institutional capacity to ensure the sustainability of the changes, residents of flood prone areas returned to their original housing (Lavell 2016). Such long-term strategic planning needs to be complemented by a comprehensive community engagement for the success of managed retreat (Abel et al. 2011; Alexander et al. 2012). This creates opportunities to not only inform and engage the community about the change process, but also shifts the negative connotation of retreat to a positive experience by strengthening the sense of community and creating a common purpose (Siders et al. 2019). The availability of financial resources also plays a big role. For example, retreat of communities can depend on the possibility of obtaining low priced housing in new areas (Douglas et al. 2012; Jamero et al. 2017) and availability of jobs can directly impact the willingness of a community to migrate (Donner and Webber 2014). As the examples in this chapter show, there is also a need for a tailored approach to every context. For instance, relocation of inland communities (in most cases to similar neighbourhoods) is considered to be less contentious compared to the relocation of coastal communities that might lose their immediate connection with the coast (Bloomfield 2018).

Several financial and regulatory tools can facilitate the process of managed retreat and

exploiting opportunities. These include land use planning, market-based incentives/disincentives, and community engagement (Dedekorkut-Howes et al. 2020; Peterson 2019). Land use planning includes zoning regulations and overlays requiring increased buffers, setback, and density conditions that can limit development of high-risk areas in cities (Susskind 2010; Harman et al. 2013). Planning policies can facilitate phasing out existing development and/or promote more conditional development options (Frazier et al. 2010). Temporary development (such as ephemeral buildings) can be built in high-risk areas with conditions to abandon properties on specific timeframes or when the risk is too high (Harman et al. 2013). Incentives include facilitating land swaps that trade ownership of developed areas near the coast via transferrable development rights for land owned by the government located outside risk zones (Frazier et al. 2010; Susskind 2010), and providing legal foundations for government buy-outs such as establishing and funding a buy-out program as discussed in the case studies. Rolling conservation easement, transfer of development rights, mandatory disclosure of risk in real estate transactions are important policy tools in this context (Alexander et al. 2012; Peterson 2019; Siders 2019; Susskind 2010).

## **Conclusions**

To be effective, a managed retreat policy needs to be supported by government leadership at all levels (Taylor et al. 2013; Peterson 2019). Higher levels of government play an important role as local governments do not necessarily have the capability to manage legal, political, and financial risks associated with managed retreat (Harman et al. 2013). Recently there has been a call for national level leadership in the area globally as an opportunity to redesign underlying norms and infrastructure of our cities (Sider 2019). In fact, Peterson (2019) believes that a national relocation framework that illustrates the financial infeasibility of structural protection everywhere will improve the chances of relocation to be considered as a policy option. Research also demonstrates that local governments are more likely to act when there are guidance, benchmarks, and requirements from higher level governments (Dedekorkut-Howes et al. 2020; Dedekorkut Howes and Vickers 2017; Torabi et al. 2017b).

Yet, such an approach will require significant shifts in institutions and behavioural change to support the transformation. There is a need for a collaborative and integrated approach to planning, underpinned by reliable and large scale hazard data to better inform decision

making. This is an important consideration for sea cities globally, as climate change may cause hazard information, such as local council flood maps, to be dangerously outdated (Meyer 2020). In conclusion, managed retreat will require many difficult decisions to be made, implementation of which will require reconceptualising our relationship with our properties and neighbourhoods (Siders 2019), imagining urmadic cities and communities moving across land and the ocean that are not bounded by land, but on sociocultural values that create communities (Fry 2011).

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