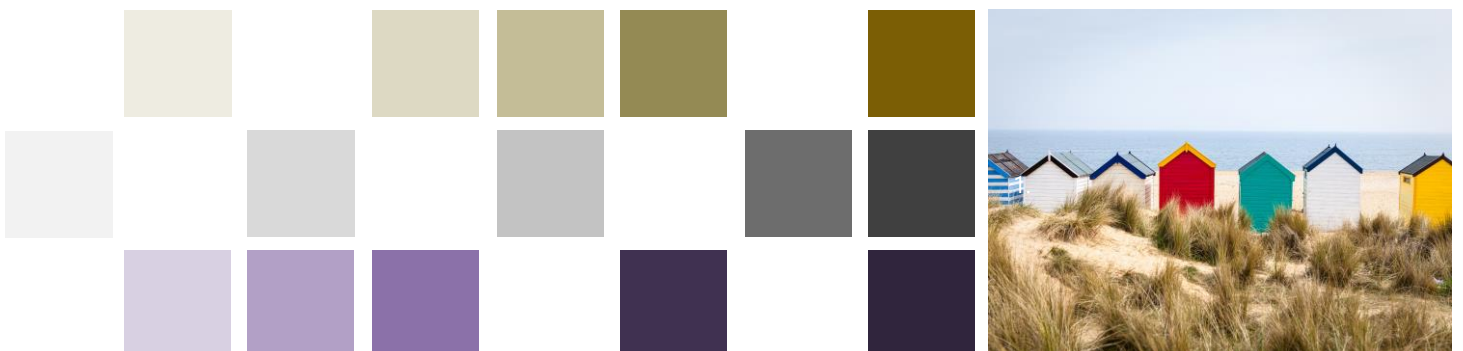


Assessment of mechanisms of managed retreat

Report prepared for the Ministry for the Environment

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11 August 2022



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Executive summary

The Ministry for the Environment (MfE) engaged us to explore the literature on managed retreat mechanisms found around the world and assess their potential advantages and disadvantages in a New Zealand context. In undertaking this assignment, we identified there is considerable literature on the topic of managed retreat, though less on its potential pre-emptive use.

A literature review and workshop with officials

We undertook a targeted literature review, a workshop to test initial findings with officials (including MfE and Treasury) and experts, and analysis and synthesis of literature against the draft National Adaptation Plan (NAP) funding principles and objectives. The scope of the literature review focuses primarily on how managed retreat is funded, and the different ways of implementing managed retreat, drawing on examples of use where possible.

Our assessment of mechanisms should not be considered exhaustive. The role of insurance as well as protection and accommodation methods of mitigating climate change impacts were out of scope and are not documented in this report.

There are challenges in applying all the use cases to New Zealand because of clear differences in legal environments (particularly Te Tiriti) and institutional settings (compared to, say, federal systems).

Context – we tend to be too optimistic

Understanding of the impacts of climate change continues to grow, as does our understanding of the threat posed to areas of New Zealand, particularly flood-prone areas on the coast and inland. This poses risk to many properties, representing significant economic and cultural value, with no integrated, coordinated, or long-term vision nationally of how to manage the risk and, where necessary, relocate people and activities out of danger. Moreover, in the past, we have been optimistic these impacts may not happen and have tended to be too optimistic about their impact, leading to a lack of proactive management of climate change issues.

Managed retreat offers potential to avoid or mitigate the effects of climate change (social, cultural, economic, and other) on at-risk locations by moving residents and activities that are at risk. Increasingly attention is now focusing on the potential for pre-emptive use of managed retreat to avoid and minimise future losses resulting from the impacts of climate change. New Zealand's first NAP includes a chapter covering managed retreat and includes action 5.1: to pass legislation to support managed retreat.¹

¹ See: <https://environment.govt.nz/assets/publications/climate-change/MFE-AoG-20664-GF-National-Adaptation-Plan-2022-WEB.pdf>

Where do the costs fall, and who pays?

There is considerable debate around who should pay for managed retreat and if public compensation is justified. Perhaps understandably, there is usually stronger public sentiment for post-disaster retreat than pre-emptive. However, overseas examples such as in the United Kingdom and United States may be quite different because of stances taken on protection of coastal areas and constitutional private property rights respectively.

There are instances in New Zealand where some form of public compensation has been provided in situations of unavoidable risk, such as following the Christchurch earthquakes. However, typically, managed retreat is funded by a combination of the affected community, local and central government, and the insurance sector. The money itself to pay for managed retreat can come from a range of sources, including debt.

Five groups of mechanisms

We have categorised the mechanisms we identified into two sections of this report – those relating to:

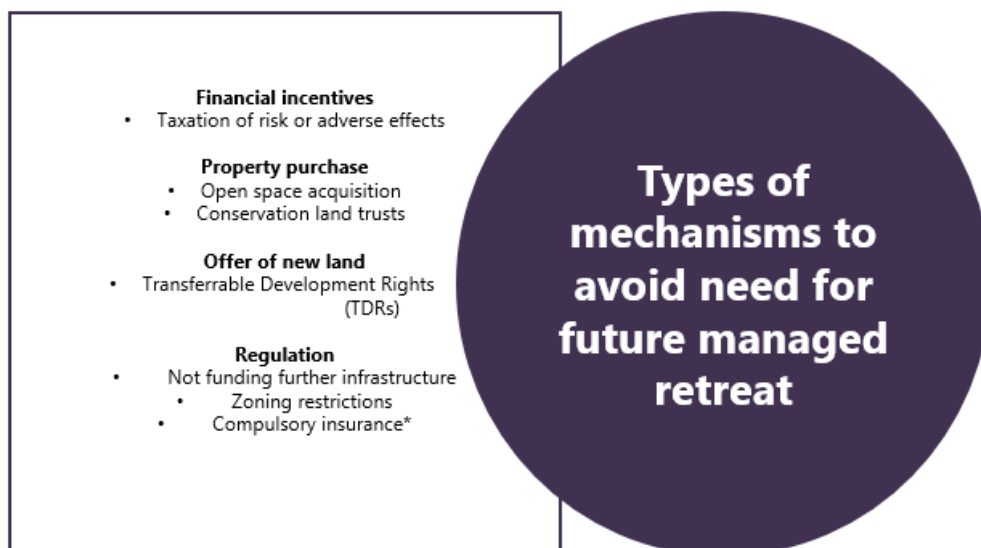
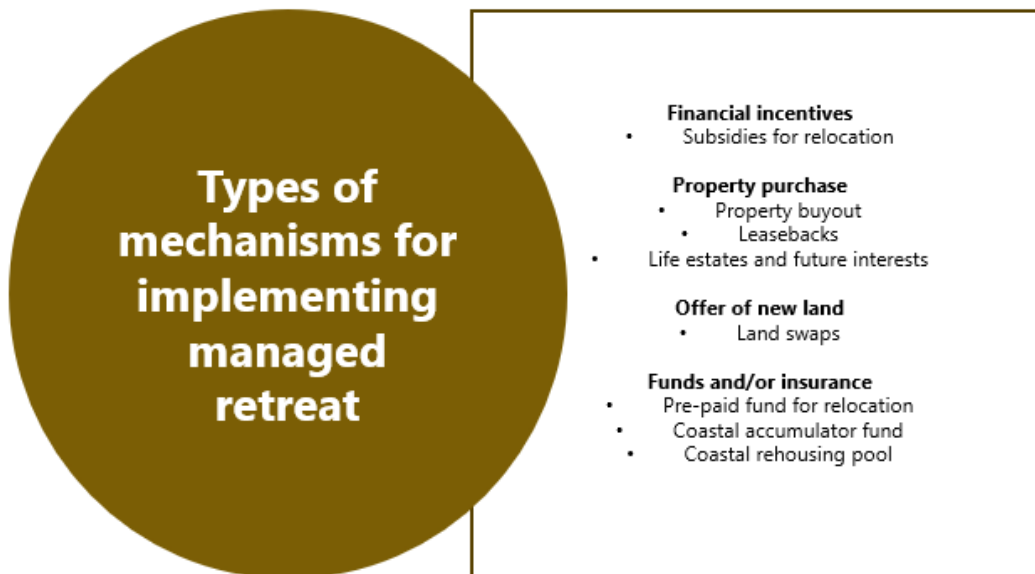
- implementing managed retreat and relocating people and activities
- preventing the need for future managed retreat. That is, they could be implemented now to avoid having to undertake, or minimise the extent of, managed retreat later.

There are five groups of mechanisms running across both sections:

- financial incentives
- property purchase
- offer of new land
- funds and/or insurance systems
- regulation.

Each of these groups of mechanisms have pros and cons, as well as trade-offs in fairness and effectiveness. These pros and cons generally flow from mechanism design and eligibility. A common example of managed retreat is a property buyout, where a party (often local or central government) purchases an at-risk property at or close to fair market value to allow people to relocate. The costs then fall on local and central government ratepayers and taxpayers.

The figure below shows the mechanisms identified.



Key design considerations to meet the draft NAP objectives and principles

A suite of mechanisms is likely to be required to effectively implement a successful managed retreat programme. To meet the draft NAP funding objectives and principles, we believe most mechanisms require proactive engagement and signalling to property owners and the market, as early as possible. More time to prepare likely means greater success.

Attention should be turned to how the mechanisms we identify can and will work in combination and how best to sequence them. Attention should be given to how to get affected communities and the likely parties involved, engaged and cooperating. This needed attention is beyond the limited scope of this analysis and is likely best undertaken with particular geographic areas in mind.

While many of the mechanisms appear simple in theory, our analysis indicates there are five factors to consider in design and implementation of mechanisms. We find that:

- **Early action** allows for a greater span of options to be available as with time. Some options may be viable that would not be options following a risk event. For instance, those that assist the community to grow funding pools over several years to help fund adaptation.
- **Signalling and information provision** assists communities to understand potential difficulties early, obtain any advice they may need, and plan ahead.
- **Zoning** changes appear to be a logical starting point for a managed retreat roadmap – these are the most essential building block to then enable a suite of mechanisms to be implemented.
- Options to **prevent (or minimise)** the need for managed retreat are likely to be most easily accepted by communities and have the least fiscal burden.
- **Eligibility** criteria appear to be the crux of most trade-offs between efficiency/effectiveness and equity/fairness. It is a key lever to deal with moral hazard problems to limit Crown liability and fiscal burden. However, we note that effective policies are likely to be expensive, so we consider the roles of different parties and eligibility criteria for different support will be important.

1. Introduction

Climate change's impacts, both now and in the future, are better understood than ever before. Many areas within New Zealand, particularly coastal and floodplain, are becoming increasingly vulnerable to climate risks such as flooding and erosion. Without some form of intervention at a significant scale, the impact of these climate risks on vulnerable areas may result in significant geographic, social, cultural, and economic loss.

A range of parties may have roles and responsibilities in climate hazard management that are relevant when considering managed retreat. In this context, officials are exploring what could be done and what options there are to support successful and systematic action to try and avoid or mitigate the effects of climate change on at-risk locations to avoid geographic, social, cultural, and economic damage and loss.

1.1 The context is managed retreat

Managed retreat is an intervention with the potential to avoid or mitigate the effects of climate change on at-risk locations. Managed risk does this by moving residents and activities away from areas that are vulnerable to climate risks, such as flooding or erosion. There has been somewhat ad hoc and reactive use of managed retreat globally, typically in the context of natural disasters where the impacts of the event have already been realised. However, greater consideration is now being given to how managed retreat could be used in a systematic, pre-emptive way in the context of climate change (rather than just natural disasters). The intent is to avoid or mitigate the effects of climate change on at-risk locations and therefore avoid geographic, social, cultural, and economic damage and loss.

Despite its potential, managed retreat comes with complex governance, policy, and funding challenges for both local and central governments. Currently in New Zealand there are no dedicated tools or processes to guide how individual households or communities might permanently shift away from areas of intolerable climate risk. Funding mechanisms in New Zealand currently rely on a disaster/event to trigger action through the Earthquake Commission and insurance after-the-fact and once damage has occurred (Owen et al., 2018).

There is also no specific risk tolerance criteria in New Zealand to determine when a particular annual loss-of-life risk is acceptable or not, making it more difficult to determine the point at which risk reduction, such as managed retreat, is required (Hanna et al., 2018).

1.2 Our focus on a range of possible options

Climate adaptation legislation (currently referred to as the Climate Adaptation Act, or CAA) is due to be introduced to Parliament in 2023, and part of this will require decisions to be made on a managed retreat system. The purpose of this report is to therefore explore the range of possible options for implementing, funding, and financing managed retreat in New Zealand based on literature and experience to date. Doing so will help to inform officials' advice on whether any of these options should form part of policies relating to managed retreat in New Zealand. This advice does not

consider what the role should be for central government or the responsibilities of different stakeholders but focuses on the options and their potential. However, it does note what some of the literature finds regarding the argument for public compensation in order to provide context for decision-making in New Zealand. We have also not systematically assessed what the current legislation allows or the changes that may be needed in New Zealand’s legislative context beyond a first-order policy consideration of potential constraints.

The Ministry for the Environment identified four key objectives and nine principles in its recent draft NAP for managed retreat (Ministry for the Environment, 2022) to guide its consideration of managed retreat. The objectives and principles are listed in Table 1 below.

Table 1: Objectives and principles of funding responsibilities

| | |
|-------------------|--|
| Objectives | To reduce hardship due to the impacts of climate change |
| | To incentivise better long-term investment decisions concerning climate change risk |
| | To reduce liabilities, including contingent liabilities to the Crown |
| | To support the role of banking and insurance in facilitating risk management |
| Principles | Limit Crown’s fiscal exposure |
| | Minimise moral hazard |
| | Solutions are designed to be as simple as possible |
| | Ensure fairness and equity for and between communities, including across generations |
| | Beneficiaries of risk mitigation should contribute to costs |
| | Minimise cost over time by providing as much advance notice as possible |
| | Solutions support system coherence and the overall adaptation system response |
| | Risks and responsibilities are appropriately shared across parties including property owners, local government, central government, and banking and insurance industries |
| | |

Source: (Ministry for the Environment, 2022)

The objectives of this assignment are to:

- review existing and conceptual relocation incentives from the literature and/or implemented elsewhere
- analyse the positives and negatives of different methods of implementing, funding, and financing managed retreat, and the conditions under which each should be used
- provide high level feasibility and options analysis, supported by a workshop held with relevant staff from the Ministry for the Environment and the Treasury
- identify any first order barriers in the New Zealand context that could prevent methods of implementing, funding, and financing managed retreat from being used domestically.

The remainder of the report is organised as follows:

- How we approached the work.

- How we have defined managed retreat for the purpose of this study, and therefore what is and is not in scope.
- A brief overview of the discussion in the literature around public compensation for managed retreat, as well as how managed retreat could be funded.
- Each of the potential mechanisms for managed retreat is discussed (first implementation mechanisms and then those that prevent/limit the need for managed retreat).
- The mechanisms are assessed against how they could be designed to meet the draft NAP objectives and principles, through which the positive and negative characteristics of mechanisms as well as the design or other relevant considerations are summarised, including high-level conclusions.

Our approach

We undertook this assignment in three stages: a literature review, subsequent analysis of the literature, and development of findings and recommendations.

1. We conducted a review of the literature and documented examples of managed retreat both in New Zealand and internationally. We identified the different mechanisms of implementing managed retreat (or avoiding the need for future managed retreat) that have been used or conceptualised. We identified relevant contextual information such as financing arrangements and the setting the mechanism was used within. The literature reviewed consisted of sources the Ministry for the Environment identified to us and literature from a pre-existing Department of Internal Affairs literature scan. This existing literature was supplemented by a further scan and review by us.
2. We conducted analysis of the literature and practical experiences to determine the advantages and disadvantages of each managed retreat mechanism, as well as the context and situation each mechanism could be suitable for. Additionally, we considered the mechanisms against the draft NAP's objectives and principles for funding a managed retreat system. We tested our analysis in a workshop with stakeholders from the Ministry and Treasury with potential current and future interests in managed retreat. This also provided an opportunity to refine and update our analysis.
3. We developed findings and recommendations based on the review of the literature and the subsequent workshop.

2. How we view managed retreat

Managed retreat is one of many management approaches for dealing with the impacts of natural and climate hazards. Figure 1 below from Hanna et al. (2017) shows how managed retreat (“Retreat” in the figure) compares to some other asset management approaches for natural and climate hazards.

Figure 1: Asset management approaches for natural and climate hazards



Source: (Hanna et al., 2017)

Protection (“Protect hard/soft”) and accommodation (“Accommodate”) methods of management are primarily about mitigating the impact of natural and climate hazards and prolonging the lifetime of assets and activities and allowing people to reside in at-risk areas for longer. Managed retreat (“Retreat”), rather, is focused on avoiding the impacts of natural and climate hazards entirely through relocation to areas with more tolerable risk levels (i.e. less exposure to natural and climate hazards), or to manage the environmental impact, demolition, or removal of buildings.

Focus on protection in the short-term is common (Lawrence et al., 2020) but gives property owners in at-risk areas a false sense of security from the ‘levee effect’² (Tobin, 1995), and encourages further development and therefore greater exposure of people and activities to climate risks. Focusing on protection also creates policy asymmetry and sets precedent, in that it increases public demand for protection in the future even in situations where cost-effectiveness, technical viability, and/or long-term utility of such measures is questionable (Lawrence et al., 2020).

² The ‘levee effect’ refers to a feedback loop where once structural protection is built, development tends to increase behind it, increasing the desire and motivation for its continuation (Hino et al., 2017).

Protection and accommodation may be viable and useful asset management mechanisms in the short-term alongside managed retreat as part of a wider climate adaptation programme. However, these interventions are out of the scope of this work and will not be investigated further in this paper.

Based on how the literature describes managed retreat (Fletcher et al., 2013; Hanna et al., 2017; Reisinger et al., 2014; Siders, 2019), and for the purpose of this work, we define managed retreat as a long-term, strategic, and coordinated approach to natural hazard and/or climate risk reduction where people, activities, and/or assets are relocated and moved out of harm's way to limit geographical, social, cultural, and economic impacts. The motivation for investment in managed retreat today (i.e. pre-emptive of a climate disaster) is to avoid costs and impacts of climate events in the future (Göransson et al., 2021).

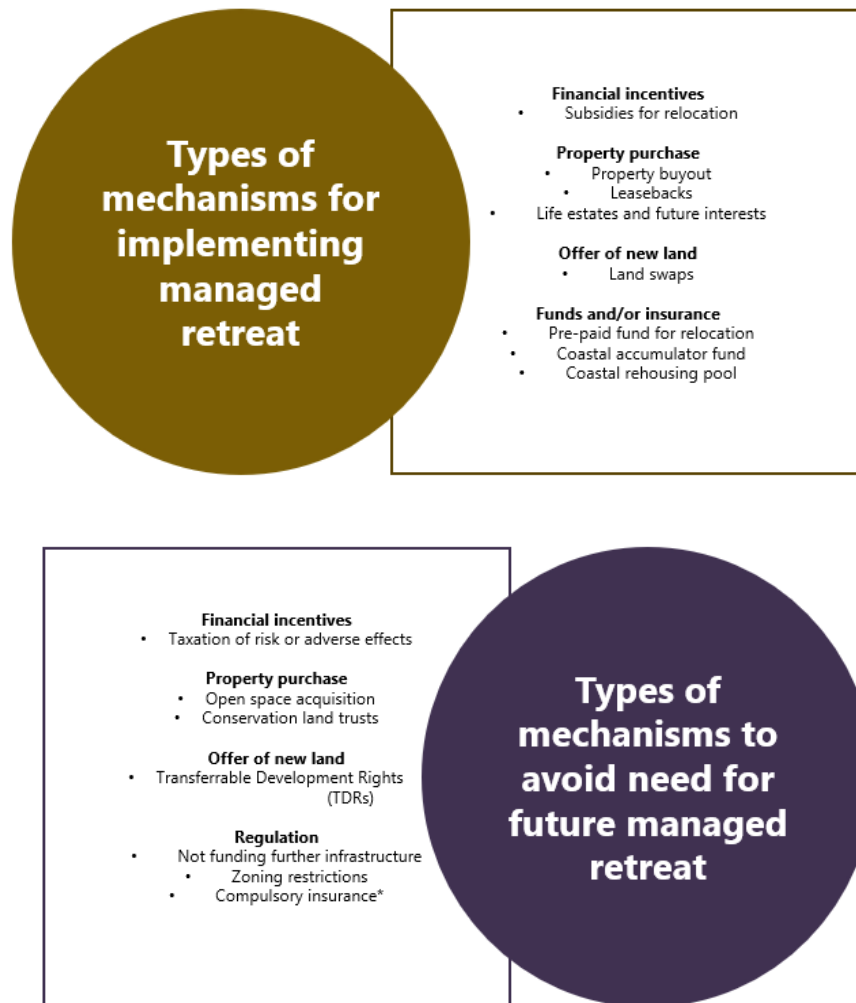
Managed retreat is often discussed in the context of flooding both coastally (Fletcher et al., 2013; Georgetown Climate Center, 2020; Hanna et al., 2017, 2018) and inland in flood-prone areas (Georgetown Climate Center, 2020; Hanna et al., 2017, 2018). There are other settings for managed retreat that may be applicable such as areas facing increasing wildfire or extreme temperature risk, or, in New Zealand, volcanic risk. For example, managed retreat has been implemented in Matatā, Bay of Plenty, New Zealand after a major debris flow from the Awatarariki river in 2005 caused damage to the settlement (Hanna et al., 2017, 2018; Macdonald, 2022; McClure, 2021; Whakatāne District Council, 2019). In the US, managed retreat is almost synonymous with property buyout (Bronen, 2015; Tubridy et al., 2022).

We consider five main groups of mechanisms which are discussed in the literature: financial incentives, property purchase, offer of new land, funds and/or insurance, and regulation. These groups of mechanisms have been split in two to reflect those that are for the implementation of managed retreat, and those that aim to avoid the need for future managed retreat (i.e. pre-emptive measures to try and avoid situations of exposure to high climate risk in the first place).

We note:

- This list of mechanisms should not be considered exhaustive. There may be other mechanisms that have had use in a managed retreat context or have the potential to be used in a managed retreat context.
- Ways of funding managed retreat may not be mutually exclusive from the mechanisms for implementing managed retreat. Some ways of implementing managed retreat may be best supported (or only supported) by certain funding arrangements, and vice versa.
- Managed retreat mechanisms are not mutually exclusive from each other. There are also likely strong cases for using combinations of mechanisms within a managed retreat programme.

Figure 2: Mechanisms relating to managed retreat



Interaction between the private insurance industry and any proposed managed retreat system is likely to be significant, complex, and vitally important for success. However, this interaction is largely outside the scope of this work. We note that some of the literature we have come across (Boston & Lawrence, 2017; Storey et al., 2020) covers issues of insurance for properties exposed to coastal hazard risks.

An important consideration of managed retreat is timing. Managed retreat can be implemented either pre-emptively (i.e. as a precautionary measure) or after a disaster or event. Examples of managed retreat processes internationally are typically post-natural disaster or event, such as:

- hurricanes and inland flooding (e.g. Queens and Staten Island, New York post-Hurricane Sandy in 2012; Charlotte-Mecklenburg County, North Carolina after two extreme floods in 1990s (Georgetown Climate Center, 2020))
- the 2011 earthquake in Christchurch, New Zealand, where residents in “red zones” were relocated.

Application of managed retreat in a reactive way (such as in the examples above) means geographical, social, cultural, and economic losses are already realised. There have been some examples of pre-emptive managed retreat in a New Zealand context, such as:

- Matatā (Hanna et al., 2018; Macdonald, 2022; McClure, 2021; Whakatāne District Council, 2019)
- on a small scale in Port Waikato in 2008 (Waikato Region Emergency Management Group, 2011)
- Hutt City acquisition of 117 properties along the Hutt River exposed to high flood risk (Boston & Lawrence, 2017).

2.1 Why managed retreat is not often used pre-emptively

Where national level funding is available for climate adaptation purposes, it is often focused on post-disaster recovery rather than pre-disaster prevention and mitigation of risk exposure due to high levels of funding required and low public acceptability of such spending pre-event (Boston, 2019; Owen et al., 2018).

The costs of managed retreat are worn by a range of parties, including (Bell et al., 2017):

- councils, who must pay for adaptation measures and delivery of services for which they are responsible under the Local Government Act
- communities, who pay for immediate damage and adjustment, in some cases costs of retreat, and personal costs of loss of place and culture
- central government, who will likely see costs arise where the ability to pay at a local level by councils and communities is challenged
- the private sector, who will see some costs of interruption to business-as-usual and may incur some retreat costs also.

Successful international examples of managed retreat have been contingent upon significant funding assistance from national and/or state-level government (Owen et al., 2018).

In the case of post-Hurricane Sandy Staten Island, two authors suggest in one article (Braamskamp & Penning-Rowsell, 2018) that “without a major trigger event a large majority of the focus group did not have confidence that adaptation considerations, particularly socially disruptive buyout programmes, would surface to political agendas or even into the public consciousness”.

Voters are generally reluctant to support the government spending heavily on mitigating risks or preventing disasters, such as pre-event risk reduction. However, voters are much more willing to support substantial public spending on post-disaster relief (Boston, 2019; Healy & Malhotra, 2009). This is because people generally tend to display optimism bias, and discount the future, valuing post-event relief higher than preventative interventions such as managed retreat (Boston, 2017a, 2017b, 2019; Dachary-Bernard et al., 2019; White & Haughton, 2017).

Managed retreat can also threaten people’s sense of permanence, identity, place attachment, and community and therefore mean reluctance to participate (Ajibade et al., 2020; Bukvic et al., 2018; Charan et al., 2017; Huang, 2018; Jessee, 2020; See & Wilmsen, 2020; Siders & Ajibade, 2021). Further,

climate uncertainties, discrepancies around property values, distrust of government, utopian imaginaries, and perceived environmental injustices have served as barriers to retreat in Manila and Lagos and may point toward wider issues with acceptance of retreat in other contexts (Ajibade, 2019).

One author (Kousky, 2014) argues in the context of the US, while budgeting practices are entrenched and unlikely to change in the near term, highlighting the costs of climate inaction can be useful in spurring risk mitigation, including pre-emptive managed retreat. For example, in 2010 a study estimated the average annual level of unfunded liability to the US Federal Government because of disasters at USD \$20 billion (Cummins et al., 2010). A choice experiment in France found that compensation criteria for managed retreat based on market prices had a significant positive influence on the acceptability of managed retreat (Rulleau et al., 2017).

Lawrence et al. (2020) highlight many financial stressors on the implementation of pre-emptive managed retreat as well as potential mitigation strategies to make pre-emptive managed retreat more politically acceptable and implementable (Table 2 below).

Table 2: Financial stressors on implementation of pre-emptive managed retreat and some mitigation strategies

| Stressors | Mitigation strategies |
|---|--|
| Inadequate overall public resources for the scale of retreat required | New funding instruments and revenue sources for pre-emptive managed retreat, including long-term pre-funding arrangements |
| Ad hoc and inconsistent funding arrangements that focus on funding post-disaster, rather than pre-emptive managed retreat | Co-funding arrangements that do not shift implementation of managed retreat to the weakest funder |
| Sub-national governments often lack borrowing rights or have limited taxation options | Negotiated political multiparty agreements on public compensation arrangements to ensure consistency and stability over time |
| Co-funding arrangements which add complexity and exacerbate delays | |
| No pre-funding of the long-term costs of managed retreat | |
| Political disagreement over public compensation for private losses | |
| | |

3. Who pays for pre-emptive managed retreat?

Who will pay for managed retreat in New Zealand is currently unclear. Ahead of the NAP, the draft NAP included objectives and principles (outlined in Table 1) to guide and inform the financial responsibilities of relevant parties, such as government, property owners, and the private sector, and the appropriate mechanisms for financing mechanisms of managed retreat.

3.1 Should there be public compensation?

There is debate about whether there should be public compensation for climate adaptation such as pre-emptive managed retreat. For context, in the UK there are no guidelines or enabling legislation for acquisition of property in at-risk areas (Tubridy et al., 2022) and typically no public compensation for property loss or devaluation due to decisions not to protect areas of the coast (Blunkell, 2017; Esteves, 2014; Wall, 2019). Comparatively in the US, pre-storm fair market values are often provided for properties (Koslov, 2016; Lynn, 2017), which is linked to constitutional protection of private property (Kim & Karp, 2012) plus a subsidised flood insurance system which provides financial incentive to reduce the number of at risk properties (de Vries & Fraser, 2017).

Boston (2019) makes the case for and against public compensation of pre-emptive managed retreat:

- **For** – collective responsibility for climate change; traditions of equitable risk pooling and social solidarity; legal and political precedents; compulsory acquisition of property and relocation; long-term cost minimisation; consistency and fairness of treatment; coordinating the funding of public infrastructure with the decision on the relocation of human settlements; minimising the risk of protracted litigation; private insurance will not address the problem.
- **Against** – excessive fiscal liability; risk of compensatory ‘creep’; providing public compensation is unfair; risk of moral hazard; co-funding is the norm in cases of social insurance.

Boston (2019) also suggests that given New Zealand’s cultural and political traditions as well as democratic process, it seems highly probable the majority of citizens would favour some sort of public compensation. Lawrence et al. (2020) highlights that, where public compensation is available for pre-emptive managed retreat, it often entails co-funding by national and sub-national agencies which adds to the required policy’s complexity, contributes to delays, raises equity issues (partly because of unequal resourcing and capabilities of sub-national governments), sets precedents as climate change worsens, and is limited by the financial resources available to sub-national governments.

Therefore, if co-funding and partnership is going to be successful between government (local and central) and others such as non-profits, regional planning commissions, and universities, there is a requirement for long-term commitment of funding and staff time that should be established upfront to set expectations and ensure the relationship is balanced (Lawrence et al., 2020).

There are some potential risk transfer products to help with the financing of adaptation which can include collectives (pools of councils e.g. Local Authority Protection Programme Disaster Fund and RiskPool), captives (insurance company ownership by the insured), catastrophe bonds, risk swaps,

contingent capital, contingent risk, and finite risk (Bell et al., 2017; Local Government New Zealand, 2016). Dobes & Chapman (2011) outlay some of the potential issues and flaws of these types of risk transfer products – for example, catastrophe insurance requires such large pools of capital available for pay-out to avoid risk of insolvency that many private firms have withdrawn from this market.

3.2 Funding managed retreat

Broadly speaking, sources of funding for managed retreat can come from affected communities, the public sector (government or public insurers, both centrally and locally), and from the private sector (mostly private insurers), or a combination of some or all. This will depend on the context of the managed retreat, which parties are involved, and what responsibilities each party has for the outcomes. Some authors suggest managed retreat is seen as more politically acceptable if public and private insurers pay rather than if the burden is on the general taxpayer or the affected community (Boston et al., 2020; Noy, 2020).

The choice of how to fund managed retreat may also vary depending on the context, which parties are involved in the managed retreat, and what responsibilities each party has for the outcomes. For example, the principles for investment (and capabilities and resources) for local government may be quite different to those of central government, which may therefore feed into the choice of mechanism(s) for implementation of managed retreat. A relatively recent report (Boston et al., 2020) canvasses examples of existing instruments and mechanisms for funding relocation and managed retreat as summarised in Table 3 below.

Table 3: Examples of existing instruments and mechanisms for funding relocation

| Types of funding instruments and mechanisms | Source of funding | Examples of application (country, hazard) |
|--|---|--|
| Dedicated tax | Taxpayers | City of Fargo, North Dakota, USA used flood control sales tax to acquire 200 properties for flood control |
| Utility fees | Utility users (water, electricity, etc.) | City of Charlotte, North Carolina, USA utilises Storm Water Services fees to fund buyouts |
| Relocation incentives | Taxpayers, subsidising homeowners | New York State's buyout plan pays owners an additional 5% percent over the pre-storm assessment if they relocate within the same county |
| Government emergency assistance funds | Taxpayers | Use in US, Japan, Netherlands, UK, Fiji, Panama, Kiribati, PNG, India, Vietnam |
| International Aid and grants | International donors (via taxpayers in donor countries) | Use in India, Guatemala, The Philippines, Mozambique |
| Trust fund | Levy payers | Fiji set up a relocation trust fund with a portion taken from the country's Environment and Climate Adaptation levy, contributing approximately \$5 million/year |
| Borrowing/bonds | Donor taxpayers provide capital; local | Use in India (low-cost loans and mortgages for resettlement), Argentina (with World Bank support, lent |

| | | |
|--------------------------------------|--|---|
| | taxpayers and homeowners need to repay loans | funds for assisted self-construction relocation), Brazil (loans from Inter-American Development Bank) |
| Insurance-linked | Those paying for insurers or taxpayers (depending on structure of the insurance mechanism) | Use in NZ (post-Christchurch earthquake, Natural Disaster Fund), France (Major Natural Risk Prevention Fund and Barnier Fund) |
| Community housing savings and groups | Local communities | Use in India, Panama, Fiji |

Source: (Boston et al., 2020)

Boston et al. (2020) also arrive at some general findings on the funding of relocation and managed retreat:

- There is a dominance of public funding sources in managed retreat, at the national and federal level, in international examples.
- The major focus of most cases of planned relocation and managed retreat has been on ex-post spending rather than pre-emptive investment.
- There are emerging cases of testing new financing instruments through private markets and using debt instruments, such as green bonds, trust funds and mitigation credits, insurance mechanisms, and dedicated climate funds. The authors of another paper (Danda et al., 2019) similarly say innovative and new financing for managed retreat is required, which could include the use of private capital and issuing of bonds, and repurposing vacated land to earn income (e.g. tourism, forestry).

4. Mechanisms of implementing managed retreat

The appropriate management strategies for retreat should be chosen so that they best fit the local context and address the full set of stakeholders affected (Siders et al., 2019). Managed retreat mechanisms that worked best in one context may not in another, and intangible community and cultural preferences as well as the legal context may also constrain what management choices are available (Siders et al., 2019).

It is important to note that this review of managed retreat mechanisms draws a lot of insight from the United States (and other countries, though less so), particularly when looking at post-disaster contexts. It is therefore necessary to consider differences in:

- Legislative environments. Of particular importance are the differences in private property rights and constitutional rights.
- Te Tiriti o Waitangi and the rights and interests of Māori when compared to other jurisdictions.
- The potential for scalability of managed retreat programmes. New Zealand is not as big as other countries, may not have the same resources, and therefore may not be able to execute managed retreat programmes at the same scale as observed in other settings.
- History – in New Zealand, there have been instances where governments have previously publicly compensated unavoidable risk such as following the Christchurch earthquakes. Other countries may have differing public expectations around compensation and/or the role of government in managing or responding to such risks.

4.1 Financial incentives

Financial incentives for implementing managed retreat include subsidies for relocation and mortgage contingent loans. Alone these financial incentives may not be strong enough to encourage uptake of managed retreat, but may be useful tools in combination with other mechanisms to nudge property owners into taking up retreat opportunities.

4.1.1 Subsidies for relocation

In general, the purpose of a subsidy is to make a desired activity less costly for the property owner such that it encourages uptake. In the context of managed retreat, subsidies for relocation are a financial incentive for relocating buildings within existing properties (e.g. moving a house back further from the edge of a property), or relocation to other properties (Turbott, 2006). A subsidy for relocation would be to encourage uptake of managed retreat programmes by reducing the cost burden of participating.

There are some examples from the managed retreat literature of the use (or proposed use) of subsidies, typically as a part of buyout programmes to incentivise property owners to move to certain areas. Boston (2019) proposes relocation allowances and rental subsidies for the transition period during a relocation. In the case of Matatā, New Zealand, the Whakatāne District Council has offered a

relocation allowance (i.e. subsidising the relocation of property) if the property is the owner's primary place of residence (Whakatāne District Council, 2020). In the case of Staten Island, New York, during a buyout programme post-Hurricane Sandy, the State of New York offered residents in designated areas a 10 per cent incentive above fair market value for the property, and 5 per cent extra if they moved into a chosen neighbourhood (Georgetown Climate Center, 2020). Subsidies could also recognise other costs of moving, property purchase, and/or sale such as reduced legal fees, rental subsidies for transition periods, and so forth.

Subsidies for relocation of buildings on existing sites would cost considerably less than purchase of properties. However, the cumulative cost of such a subsidy scheme could still be high (Turbott, 2006).

4.1.2 Mortgage contingent loans

One article (Dobes & Chapman, 2011) proposes the use of mortgage contingent loans (applied like an income-based loan, but contingent on assets), as an alternative to other mechanisms such as catastrophe bonds and insurance, for financing managed retreat to minimise government involvement and risk to taxpayers. Mortgage contingent loans are proposed to be offered to residents in at-risk areas without the means to buy a house elsewhere, which could aid homeowners who are house-asset rich but cash poor (and therefore do not have sufficient collateral to secure loans for relocation from elsewhere).

Basically, a property owner would cede abandonment of their property to the government. The government would then act as a guarantor for a commercial loan taken out by the property owner to purchase property in a low-risk area. The government would then hold the first mortgage over the new property, and the government may sell the mortgage on the commercial market.

4.2 Property purchase

Property is typically purchased by government (local and/or central) or land trusts. There are several different types of property purchase observed in the managed retreat literature:

- outright buyouts of property, which are sometimes voluntary
- leaseback arrangements
- open space acquisition (discussed in section 5)
- conservation land trusts and conservation easements (discussed in section 5).

4.2.1 Buyout

Buyout is the most prominently discussed tool for managed retreat (Keeler et al., 2022). Buyout refers to the purchase (typically by the government, either local or central, or land trusts) of property from a seller for the purpose of controlling the development of property and land in the interest of

minimising future losses or vulnerabilities due to the impacts of climate change (Georgetown Climate Center, 2022a).³

Buyout programmes may be voluntary in name, but not always in nature

Buyout programmes are typically a 'voluntary' process where property owners choose to opt in. In a lot of cases, however, buyout is perceived as an involuntary process – particularly in situations of devastation post-disaster and financial constraint where property owners feel they no longer have a choice and must accept the buyout offer (Binder & Greer, 2016; de Vries & Fraser, 2012; Elliott et al., 2020; Green & Olshansky, 2012; Greer & Binder, 2017). For example, post-earthquake in Christchurch 2011, the red zoning of neighbourhoods (and therefore the cut-off of any future viability of development) was perceived by some as providing no realistic alternative choice, other than to accept the buyout offer (Hanna et al., 2021).⁴

Retreat is not seen as voluntary when it is coupled with regulation to remove existing use rights or withdrawal of services by local authorities (Hanna et al., 2018). In the case of Matatā, the retreat was not perceived as voluntary by those being bought out since plan changes were moving faster than compensation was able to (Hanna et al., 2018).

Hanna et al. (2021) proposes the use of the word "cooperative" rather than "voluntary" to describe buyout programmes, as the presence of risk and incentives to leave or disincentives to stay inevitably influence individuals' decisions, and therefore do not allow for absolute freedom of choice.

Buyout, when voluntary, is a valuable tool in moving people away from vulnerable locations, but not sufficient alone to guarantee people move away

Buyouts offer residents in climate-vulnerable areas (such as floodplains and coastal settlements) payment to leave their property and relocate to somewhere with less exposure to climate risk. Once a property is bought out, the purchaser typically demolishes any structures and prohibits further development through deed restrictions and/or easements that limit the types of activities allowed on the property (Georgetown Climate Center, 2022a; Turbott, 2006).

Buyout is therefore a valuable tool for removing development, moving people away from existing structures, and avoiding future losses from disasters or climate change impacts, but it is not sufficient on its own to prohibit, regulate, and discourage future development in risk zones (Georgetown Climate Center, 2022a). To be successful, managed retreat needs to be considered as an integrated approach that uses information, regulation, and various mechanisms (financial and otherwise), as well as embeddedness of community voice in a fair, transparent, and inclusive way (Hanna et al., 2019).

Pairing buyout with other mechanisms, such as providing full relocation assistance, can help to increase uptake of buyout programmes (Georgetown Climate Center, 2020). In the example of Staten Island post-Hurricane Sandy, residents in a defined enhanced buyout area received a 10 per cent incentive above pre-storm fair market value and an additional 5 per cent if they relocated within the

³ In this assessment of buyout, we focus on already developed property as opposed to open space acquisition, which is discussed further below.

⁴ While it proved effective, there were mixed opinions on whether this was appropriate or morally correct.

same five boroughs of New York City or county to maintain the local tax bases (Georgetown Climate Center, 2020).⁵

Benefits of buyout scale with the size of the programme, but buyout is costly

The benefits of buyout (e.g. the avoided future losses due to natural disaster or climate change impacts) scale with the size of the buyout, and therefore benefits are maximised when purchasers are able to buyout larger areas such as whole neighbourhoods (Georgetown Climate Center, 2022a). However, property acquisitions at a fair value are likely too expensive to deploy at the massive scales that may be required to fully address the impacts of climate change on vulnerable communities (Siders et al., 2019).

For example, coastal properties often have the highest values (Georgetown Climate Center, 2022a; Spiegel, 2021) and in New Zealand are increasing (C. Smith, 2019), but also have the highest vulnerability to climate change impacts such as rising sea levels and eroding coastlines (i.e. are most at risk). Land, infrastructure, and property values in intensively urbanised coastal zones may render retreat especially expensive and therefore unviable (Braamskamp & Penning-Rowsell, 2018).

A further cost of buyout for state governments in the US is forgone tax revenues if there is a reduction in the number of properties within an area and those who received a buyout move outside of the tax zone (BenDor et al., 2020; Shi & Varuzzo, 2020). In New Zealand, this could be similar to a reduction in the rate base for local councils if property owners decide to move to another district.

A study of Staten Island post-Hurricane Sandy found the fair value of the property plus a premium for removal and relocation costs would be essential to get property owner buy-in and successful retreat (Braamskamp & Penning-Rowsell, 2018). This, alongside the other literature on property owner attitudes pre-climate event, suggests the conditions for successful buy-in to pre-emptive retreat would be even more demanding.

As an examples of the order of magnitude of costs depending on scale, the Charlotte-Mecklenburg Storm Water Services purchased more than 400 homes and businesses and invested more than USD \$67 million in the acquisitions.

Buyout programmes may create a moral hazard problem

Providing buyout options alone (without leaseback; more on this later) may also set a precedent and lead to property owners assuming the government will offer to buy property on generous terms after coastal hazards inevitably force relocation (Young, 2018). Not only is this unaffordable, it creates a

⁵ In the case of Matatā, New Zealand, financial settlement for buyout of property consists of a baseline and discretionary factor (Whakatāne District Council, 2020). The baseline consists of an assessed base property value at fair market value, an allowance for the owner's legal fees for the sale of their existing property and purchase of a replacement property (if applicable), and a relocation allowance if the property is the owner's primary place of residence. The discretionary component consists of mortgage break fees and for deferred settlement options, considered on a case-by-case basis.

moral hazard⁶ problem and provides incentives to developers to intensify vulnerable land that distorts the market (Young, 2018).

Without clearly distinguished land acquisition processes and requirements, there is a risk property owners assume there will be compensation for all and therefore the potential for a moral hazard problem to eventuate (Hanna et al., 2018). A possibility is to have prerequisites in place for qualification for the buyout programme, such as whether the property owner knew of risks associated with location before purchasing (Hanna et al., 2018). Other things like historic date cut-offs and announcing no future development will qualify may help.

Multiple pressures, like risk and speed of finance, affect the acceptance of a buyout offer

Buyout can occur before (i.e. pre-emptive), during, or after an event. Particularly in the case of buyout in response to a disaster or event, speed of buyout offer is critical – there is a significant drop in willingness of homeowners to participate in buyout programmes as time goes on (Purdy, 2019).

The perception of risk is hugely important to property owners when choosing to participate in a buyout programme, and there is often a difference in views of the risks from the perspective of the buyer and the property owner (Freudenberg et al., 2016). It is therefore important to be able to adequately communicate risk to homeowners through insurance rates and policies, while also refraining from placing undue financial burdens on homeowners (Freudenberg et al., 2016).

Freudenberg et al. (2016) propose four important considerations for successful buyout:

- **Timing:** the timing of information provided to property owners is critical in determining whether they decide to participate in a buyout. In the context of floods (which is likely applicable to a wider range of disasters and climate change impacts), those who have experienced more floods are more likely to participate than those who have only experienced one flood or none. In post-event settings, the buyout programme must be communicated effectively and offered as soon as possible so that people have the capital to purchase new property and relocate quickly.
- **Community organising:** many of the most successful buyouts in the US began as community-driven efforts. Stakeholders are generally more satisfied with the outcome of the buyout if the information is clearly presented and they feel engaged and consulted with regularly through the programme.
- **Costs:** in the post-event setting, only people owning property beforehand should qualify, otherwise there may be incentives for speculators to invest in property and make money off the buyout, reducing its effectiveness and wasting precious funds. Relocation programmes are most successful when relocation costs and housing counselling are provided, and when pre-event housing values are more competitive.

⁶ Moral hazard refers to the case when someone is protected from the consequences of their actions and therefore are incentivised to engage in risky behaviour as they do not feel the repercussions. In the case of buyout, if a property owner in an at-risk area knows at some point inevitably their property will be bought out, they then have no incentives until the point of buyout to avoid risk-taking behaviour (such as developing further on their at-risk properties).

- **Disposition of land:** knowing properties bought will remain undeveloped can reassure some property owners that others will not profit from the sale of their property. Additionally, strong plans for reuse of the land (such as for recreational purposes) can encourage buy-in from other parties. Plans that add value to the area will lessen the financial burden of the acquired properties.

Post-Christchurch earthquake buyout participation preferences (Nguyen, 2020)

Nguyen's analysis of homeowner's choice of participating in government buyout post-Christchurch earthquakes showed choices were substantially driven by things like choice of neighbours and value of properties, rather than purely from profit-maximising assessment of the two choices they were given (participating in government buyout, or going through private insurance).

Homeowners were more likely to choose the insurance option if their properties had high earthquake damage, or government buyout if there was a high improvement value. Areas with high full-time employment were more likely to choose the government option, suggesting a higher opportunity cost of time. Low-income households and elderly homeowners were more likely to take the government offer.

While this is in the post-disaster context, it may still reveal some useful principles for consideration in the instance of any sort of retreat (such as income factor on choice).

In the case of buyout in Staten Island, New York, assuring property owners land bought out would not be developed again, as well as providing quick finance, helped to get more buy-in for the programme (Georgetown Climate Center, 2020).

Use of buyout programmes elsewhere point to major equity issues – necessary for consideration in design

The impacts of buyout are not distributed equally among society and some groups come off worse than others as a result (Keeler et al., 2022; Siders et al., 2019). Compensation at market value results in greatest transfer of resources to the richest people, referring to those with the highest value homes (Marino, 2018; Tubridy et al., 2022).⁷

Involuntary immobility can arise when households would like to access buyouts but are not able to participate (Elliott et al., 2020; Kraan et al., 2021).⁸ Those who remain in an area after a buyout (for

⁷ There is an adapted buyout programme being trialled in Canada whereby the compensation provided to homeowners is capped at maximum threshold to try and combat this (Flavelle, 2019).

⁸ For example, if one neighbourhood is targeted for the buyout scheme, but not another.

whatever reason) may experience loss of community, sense of place, and social capital (Binder et al., 2015, 2019, 2020).⁹

Indigenous communities may also experience extra difficulties during buyout and/or managed retreat more generally because of cultural differences and the nature of managed retreat being market-based with individualism and private property rights at its core (Ajibade, 2019; Marino, 2018; Sipe & Vella, 2014).

In US examples, jurisdictions that implemented buyouts tended to be more urban and wealthier (Elliott et al., 2020; Mach et al., 2019). However, at a county level of buyouts, bought-out properties were located in relatively poorer, less densely populated areas, and also with relatively lower education levels (Mach et al., 2019; K. S. Nelson & Molloy, 2021). Black and minority populations in the US are also likely to be compensated relatively poorly and increasingly less likely to receive a buyout offer (K. S. Nelson & Molloy, 2021).

Lawrence et al. (2020) found that low-income households are particularly disproportionately affected because they cannot afford to relocate and have limited coverage of private insurance.

Kraan et al. (2021) makes some suggestions to promote equity in buyout programmes:

- Fund investment in administration capacity and programme evaluation to reflect on access to buyout programmes and adjust them for more equitable access.
- Increase community engagement and support, including transparency and involvement in decision-making and relocation services.
- Accelerate the process of buyout, but only once homeowners have accepted the buyout offer.
- Expand compensation for buyout-related costs (i.e. more funding to expand the choice set for affected households, providing more options for relocation to ideal locations).
- Budget and plan for open space use (i.e. make it productive) within the buyout programme to positively impact neighbourhoods and sense of community and place.
- Prepare destination communities to receive relocating households to make the transition and integration as smooth as possible.

Countering the costs of buyout

Some of the costs of buyout can be mitigated (Georgetown Climate Center, 2022a):

- If households are incentivised or forced to relocate within the same jurisdiction, the government does not forfeit tax revenues. For New Zealand, this might be about moving within the same regions so local governments maintain their rates base, or offering adjustments to counter the impacts across councils.
- Phasing out infrastructure and services for the buyout areas over time will result in future cost savings.

⁹ These issues may apply to managed retreat more generally, rather than just in the instance where properties are bought out.

- Incorporating trails and other recreational amenities within the bought-out areas for nearby homes and communities can generate additional tax revenues.
- Leaseback arrangements can generate revenue for longer (more on this below).

4.2.2 Buyouts with leasebacks

Buyouts with leasebacks (or just leasebacks) are a variant of a buyout where the property is bought out by the government; however, the owners are allowed to lease the property back off the government up to a certain point in time decided by the purchaser (Georgetown Climate Center, 2022a; Keeler et al., 2022). After this point in time the purchaser can then demolish structures and restrict development on the property to mitigate future economic losses due to climate change impacts.

The study of leaseback arrangements is typically in the context of coastal erosion and retreat (Fenn et al., 2015; Keeler, 2019; Keeler et al., 2022; Revell et al., 2021), and in some instances post-flood (Adaptation Clearinghouse, 2020; Georgetown Climate Center, 2020). Young (2018) suggests the default position of a party looking to implement a buyout programme should be to rent land rather than acquire it once assets are abandoned by private landowners to protect the public interest, provide financial assistance to the relocating landowner, and also allow markets to properly reflect risk.

Two types of leasebacks are described in (Georgetown Climate Center, 2020) and were used in the example of Charlotte-Mecklenburg County, North Carolina: triple net leaseback and orphan parcel leaseback.

- Triple net leaseback is where the tenant/lessee pays all the expenses of the property including real estate taxes, insurance, and maintenance, in addition to the rental and utility costs. The lessor's limited legal obligations are reflected in a reduced rental price for the lessee. Triple net leaseback has the advantage of limiting the fiscal exposure and administration burden of the lessor/buyer by avoiding maintenance costs and processes.
- Orphan parcel leaseback is where a nearby property owner agrees to maintain a bought-out property in exchange for exclusive and free (i.e. no rental charge) use of it. Orphan parcel leaseback may also reduce the fiscal exposure and administration burden of the lessor/buyer by avoiding maintenance costs and processes.

There are multiple benefits of leaseback arrangements over a typical buyout:

- They allow the purchaser to recover some of their expenditure on the property buyout by collecting rent up until the point of demolition of structures, and also means the purchaser can avoid some property maintenance costs up to that point (Georgetown Climate Center, 2020, 2022a). Property can also be leased for other uses too (aside from residential) such as commercial recreational activities, which can recover some of the expenditure on property buyout too (Turbott, 2006). This makes the case for buyout and the benefit-cost ratio more attractive.
- Buyout with leaseback does not encourage investments that bias residents toward remaining in the at-risk area in the long run, but it also does not require immediate relocation, which could therefore be more attractive for property owners (Keeler et al.,

2022). It allows property owners to delineate the decision of selling at-risk property from the decision to relocate, which allows flexibility in timing of relocation, greater mobility, and potentially reduces associated stresses (Keeler, 2019; Keeler et al., 2022; Revell et al., 2021). In the case of Charlotte-Mecklenburg County, North Carolina, post-floods, leasebacks were used on a case-by-case basis with elderly homeowners or people who needed additional time to purchase new homes (Georgetown Climate Center, 2020, 2022a).

Fenn et al. (2015) reviewed the decisions of local authorities in the UK to implement leaseback arrangements for coastal retreat. Some of the main reasons for not implementing the leaseback arrangements (or potential negatives of leasebacks) included:

- Residents, particularly retired, struggle financially and emotionally with transition from homeowner to tenant.
- There may be substantial breaks in tenancies once people leave their homes, and therefore substantial periodic loss in income for purchaser.
- The purchase price able to be offered may be too low to be acceptable (leaving homeowners in net zero position after end of lease).
- Costs may be incurred (and ongoing) to get the property to a sufficient standard (to meet legal requirements) for lease.
- Even though money can be recouped, a large capital outlay is still needed upfront to buy property like in a regular buyout. Without initial funding, the money either must be borrowed or taken from existing resources.

In a study of stated preference for buyout and leaseback in coastal US contexts, Perry (2022) showed that the willingness to accept an offer of buyout is motivated by income, wealth, perception of expected acute property damage from a disaster, and geographic location. The willingness to pay to rent back their home from the government is motivated by more psychological factors, including relative risk aversion, worrying tendencies, and risk perceptions. The findings also suggest that property owners in the studied areas require a considerable premium (37 per cent) to accept a buyout, and a significant discount (62 per cent) to be willing to rent back their property (Perry, 2022).

4.2.3 Life estates and future interests

Life estates and future interests are another way of implementing managed retreat. Typically, it is a legal agreement between parties that means the property owner owns the property until death, upon which ownership of the property may pass on to another owner through a simple buyout. This can be used to grant the property to a third party, such as government, in the event of the property owner's death (Georgetown Climate Center, 2022a). Life estates have been used in the likes of Florida and Norfolk, Virginia as part of managed retreat programmes (Georgetown Climate Center, 2022a).

The main benefit of life estate and future interest arrangements is that these can encourage property owners in areas vulnerable to climate change impacts to take part in managed retreat programmes while not requiring them to make any short-term commitment to relocation and upholding their autonomy over the management of the property while they possess it (Georgetown Climate Center, 2022a). This therefore may also avoid some of the negative impacts associated with relocation, like

people's sense of permanence, identity, place attachment, and community (Ajibade et al., 2020; Binder et al., 2019; Bukvic et al., 2018; Charan et al., 2017; Huang, 2018; Jessee, 2020; See & Wilmsen, 2020).

In the longer-term, however, life estate and future interest arrangements still let the purchaser have control of the property to advance its climate change mitigation objectives (Georgetown Climate Center, 2022a). These arrangements can also reduce the government's costs of property purchase, demolition, restoration, and management in the short term (Georgetown Climate Center, 2022a).

Life estates and future interests in the context of managed retreat only really make sense when (Georgetown Climate Center, 2022a):

- The expected lifetime of the property holder is shorter than the likely time horizon for climate change impacts (such as sea level rise and erosion) to start occurring.
- There is not strong long-standing or significant economic, cultural, historical, or sentimental ties to the property and a desire or expectation to pass the property to new generations.

4.3 Offer of new land

New land may be offered to property owners for use in the short term (as well as longer term by way of an exchange) to implement managed retreat and move activities and people away from at-risk areas.

4.3.1 Land swaps

Land swaps refer to the exchange of title to land in perpetuity between two or more property owners (where one is typically government, either local or central, or a land trust), with the intent of moving property owners away from areas vulnerable to climate change impacts (Georgetown Climate Center, 2022a). Typically, land swaps happen when the property owner does not want to sell their site but is open to receiving something of negotiated fair value in return, or the government or land trust cannot afford or is legislatively unable to pay for the property (World Bank, 2015). Land swaps may be less costly for the purchaser if they already hold suitable land because they do not then have to come up with capital for purchase (Georgetown Climate Center, 2020; World Bank, 2015).

Once the land is swapped, the purchaser can then take similar actions as in a buyout or open space acquisition to repurpose the land. These land swap arrangements can be complex, but also an effective means of implementing retreat on a larger scale (Georgetown Climate Center, 2022a).

Globally there are examples of land swap as part of disaster recovery (Hong & Brain, 2012; M. Nelson, 2014; Olshansky & Johnson, 2010):

- Edgemere neighbourhood, Queens, New York City, US. After Hurricane Sandy, a land swap pilot programme was launched that offered Edgemere residents (within a designated zone) a newly built, elevated home on safer ground in exchange for the title of their damaged original homes. The damaged homes were to be demolished and the property maintained as open space in the interest of future flood resilience. The process was notable for having an 18-month public engagement process that had residents at the centre of an open and

transparent neighbourhood planning process. The programme was successful in rehoming people within an existing neighbourhood, rather than moving them further away, which helps minimise the economic, social, psychological, and other costs of retreat (Georgetown Climate Center, 2020).

- Gently District, New Orleans, US. A land swap programme called PHA was established after Hurricane Katrina and swapped land for 100 working-class households (considered large-scale) into three other New Orleans neighbourhoods. Qualification for PHA land swap required homeowners to own their home outright, earn less than 120 per cent of area median income, be employed, have completed homeownership training, and have no liens on their storm-damaged home. PHA had the advantage of having land on hand to swap, and focused on concentrating resettlement and redevelopment to select neighbourhoods to increase density, encourage continued development and repopulation, and make residents feel safe and connected to their community (M. Nelson, 2014). This concentration of redevelopment has also been shown to spur localised improvements, increase property values in and around targeted areas, and alter trajectories of distressed neighbourhoods (Galster et al., 2006).
- Land swap is being investigated and advocated for by the Lismore City Council as a mechanism of managed retreat in Lismore, NSW, Australia, to allow for residents to move to higher and less flood-prone ground while still keeping them connected to existing social networks and jobs (Lismore City Council, 2022).

4.4 Funds and/or insurance

There are a few different types of funds and/or insurance schemes discussed in the literature. They differ by main contributors as well as the time period for use. The contributors and the time period are not mutually exclusive. Our assessment and view of these mechanisms is limited by the number of sources we have been able to draw from. There may be more examples of funds and/or insurance systems used to implement managed retreat both conceptually and in practice.

4.4.1 Pre-paid fund for relocation (both within, and to new property) / levy model

A pre-paid relocation fund is a potential mechanism for funding managed retreat proposed by (Turbott, 2006). This would operate where property owners in at-risk areas pay a contribution (likely annual) to a fund so that once the impacts of climate change are no longer bearable and climate risks are too high, the contributing property owners can withdraw the funds to pay for relocation. The analysis from (Turbott, 2006) suggests a fund like this would come with complications, including:

- A low likelihood of a fund of this nature to be set up and run purely on private and voluntary terms. Further, if there is some government involvement, it may also inherit some or all liability from losses because of the fund.
- Accumulated contributions potentially not being enough to cover the required pay-outs, therefore requiring external investment – particularly if aimed to relocate to new property and not just within existing property.

- If within property relocation focus only, those who are unable to relocate within their property due to climate change impacts will face losses that the fund may not cover.
- Rights to pay-out would have to transfer with sale of property.
- Cumulative individual contributions may have to be capped at the estimated eventual cost of relocation so that property owners are not exposed to more financial burden than they would qualify for.
- This suggests a form of compulsory saving, which if it is not invested, represents a potentially large opportunity cost lost from having money in a relocation fund. Property owners may be incentivised to invest their money elsewhere and self-insure for future relocation requirements.

A similar concept has been reported elsewhere as a levy model (Surminski et al., 2022), where a mandatory levy (payment) is imposed on the population in an at-risk area to subsidise losses incurred to residential homeowners due to climate change impacts (Surminski et al., 2022). The money raised through the model would be allocated for pay-out once coastal properties become uninhabitable and may be used for a range of managed retreat mechanisms. The levy could be raised in multiple ways – as a general taxation pool or climate change levy, or via participating insurance carriers or government insurance schemes where policyholders, as part of their premium, contribute to the levy. This has been done in the UK with Flood Re.

4.4.2 Coastal accumulator fund to offset property value losses

A coastal accumulator fund has been proposed by Surminski et al. (2022), which is comparable to a life insurance scheme. Individual property owners would pay an annual contribution into a fund over the property's "predicted life expectancy", accumulating over time and pooled with other property owner's accumulations. The accumulated funds would be invested by some underwriting body. As the at-risk property's value depreciates (due to increasing climate risk and decreasing desirability of the property), the fund size would grow (through investment returns) to allow participating properties to maintain their value, such that the gains from the fund's earnings offset the losses due to climate change.

Property owners would receive a pay-out following the loss of property that would allow them to relocate and purchase another property in a lower-risk area. One way of working out the required contributions of the property owners would be to base it upon the price of each property and its relative life expectancy. To incentivise uptake, Surminski et al. (2022) propose the funds could be eligible for tax subsidies.

Like the pre-paid relocation fund, the use case for a coastal accumulator fund would be when there is a relatively long time period between current date and when the effects of climate change become unmanageable, to allow for enough time for contributions to accumulate and for investments to make significant enough returns to offset property value losses.

4.4.3 Coastal rehousing pool

A coastal rehousing pool, as described in Surminski et al. (2022) is effectively ring-fenced funding to be used in immediate relocation where there is current intolerable climate risk, or the effects of

climate change are already unmanageable in the coastal setting. Properties deemed at risk would be provided support via a local government pooled housing fund, allowing them to be compensated for the unavoidable risk and to relocate to a lower-risk area.

To do this, participating authorities would contribute a pre-determined annual premium into a pooled fund to be administered at the local government level. This fund would be pooled to create a larger, more viable coastal rehousing fund that would be invested to accelerate the pool growth. The money that would be contributed to this fund would come from local and/or central government directly.

This is clearly thinking about the financing of managed retreat with a much more immediate focus than the likes of the pre-paid relocation or coastal accumulation funds.

4.4.4 Rollback model

In a rollback model, property owners are provided the opportunity by local authorities to relocate and develop a new plot of land in addition to assisting with the demolition of at-risk properties (Surminski et al., 2022). To take up the opportunity, property owners are required to raise funds to use the development rights and build a new property – otherwise, the property owner could sell their development rights to a third party and use the funds for another property. The model includes support via government grants.

This has been used in the UK and could be used in conjunction with something like a coastal rehousing pool (Surminski et al., 2022). Surminski et al. (2022) suggest this model could be used in situations of imminent climate change effects, and then in due course for properties that will become more exposed to climate change effects.

5. Other mechanisms to avoid future managed retreat needs

There are multiple mechanisms we have identified that could be implemented currently with the effect of avoiding the requirement of managed retreat programmes in the future (or reduce its scope). These mechanisms focus on blocking future development or sending appropriate signals such that medium- to long-term investment decisions are more attractive in areas of lower risk (and with less exposure to climate change impacts).

5.1 Financial incentives

We came across one financial incentive mechanism in our review of the literature which could be implemented currently to minimise the need for future managed retreat in at-risk areas.

5.1.1 Taxation of risk or adverse effects

Taxation of risk or adverse effects is a financial incentive that can be used in a managed retreat setting to internalise the adverse effects of activities within market values, and disincentivise development in areas vulnerable to climate change impacts (Turbott, 2006). It also raises money that can be used to implement managed retreat programmes.

The argument for having such a tax is that property owners who develop land in hazardous areas impose costs on their communities for emergency planning and disaster recovery and therefore should pay a fair share of these costs (Deyle & Smith, 2000; Henstra, 2016; Mori & Perrings, 2012). In other words, implementing higher tax rates for development in areas exposed to greater climate change impact and disaster risk stimulates development in safer areas (Filatova, 2014). There are not many examples of this risk-based taxation in the context of climate adaptation (Henstra, 2016).

A benefit of taxation of risk is that it is relatively non-intensive in terms of the resources and administration required to operate, given it is largely the market that therefore decides whether development goes ahead (Henstra, 2016). The negative of this, however, is that governments often lack sufficient information to be able to determine the optimal tax rate to fully offset the marginal cost of harmful activities like development on vulnerable land (Faure & Weishaar, 2012). Therefore, the costs to the government of establishing the optimal tax rate could be high (and comprised of research as well as inefficiencies if the tax rate is set wrong initially).

Of particular importance for consideration is how palatable an environmental risk-based tax would be within New Zealand's more holistically relatively pure tax system, as well as how implementation of a tax like this would impact the population affected by managed retreat. The likes of carbon taxes (and other environmental or risk-based taxes) may point toward issues of acceptability, efficiency, and distributional effects and provide some insights for implementation of a risk-based tax for developing in at-risk areas.

5.2 Property purchase

There are two property purchase mechanisms that could be implemented to avoid/reduce the need for future managed retreat in at-risk areas: open space acquisition, and conservation land trusts and easements. Both essentially rely on the purchase of undeveloped land for protection purposes to then prevent future development/undesirable activities (such as residential living) and therefore avoid future exposure of property and people to climate change impacts.

5.2.1 Open space acquisition

Open space acquisition is another type of property purchase that is focused more specifically on the buyout of undeveloped, open space and working lands for conservation purposes (Georgetown Climate Center, 2022a). The focus of acquiring parcels of land before they are built up has the benefits of preventing development in areas vulnerable to climate change impacts, while also avoiding the social and institutional problems associated with traditional buyout programmes (discussed above) (Atoba et al., 2021; Naturally Resilient Communities, 2022). So, while there is no managed retreat as such of built infrastructure during open space acquisition, it serves a climate adaptation purpose of preventing further development of infrastructure in at-risk areas and forces future development to move to safer areas.

For example, when vacant lands in flood-prone areas remain vacant, there are automatically no direct economic losses from flooding, and there may even be reduced flood losses to surrounding development since the flood-prone areas can act as stores for the floodwater (Atoba et al., 2021; Brody et al., 2014, 2017; Highfield et al., 2018). The counterfactual to this would be development in flood-prone areas, which then records direct economic losses as a result from flooding. Other benefits from open space acquisition include native vegetation restoration, protection of wetlands and floodplains, biodiversity conservation, and opportunities for recreation (Atoba et al., 2021; Brody et al., 2014, 2017; Highfield et al., 2018).

Multiple cost-benefit analyses have shown strongly positive net benefits of floodplain land acquisition in the US for future flood damage reduction (Atoba et al., 2021; Johnson et al., 2020; Kousky & Walls, 2014). Curran-Groome et al. (2021) look deeper at the costs of floodplain buyouts.

5.2.2 Conservation land trusts and easements

Conservation land trusts act as a buyer, and acquire and hold land for public benefit with a focus on preservation and restoration of undeveloped lands for their natural resource values and to advance natural infrastructure for climate change resilience (Georgetown Climate Center, 2022a; Grannis, 2019). In the US land trusts also help to facilitate buyouts of structures in flood-prone areas to help residents relocate and restore natural floodplains (Grannis, 2019). Conservation easements are voluntary legal agreements that permanently limit the use of land to protect its conservation values.

Land trusts can be considered as an alternative funding model for buyout programmes (i.e. acting as the buyer, instead of government or others), creating regulatory mechanisms that give the state the right to refuse sale of at-risk properties (Freudenberg et al., 2016).

At their core, land trusts are community-oriented organisations that involve and engage a diverse range of stakeholders and therefore can address many failings of past climate debates (Campbell & Salus, 2003; Grannis, 2019). Land trusts lend themselves to community empowerment and control through their unique governance models that can build political will and resident support for climate change action (Grannis, 2019).

The benefit of land trusts is that they remove some of the direct responsibility for conservation and mitigation of climate change out of the hands of government, although still allow its involvement. There are opportunities for land trusts to work with government to share information with stakeholders, align objectives, and bring additional financial resources to the programme (Grannis, 2019).

Land trusts typically receive funds from a range of public and private sources and acquire less than full title by purchasing or accepting donations of conservation easements (Merenlender et al., 2004). In New Zealand, private (or independent from the government) conservation land trusts such as the Banks Peninsula Conservation Trust (Banks Peninsula Conservation Trust, 2022) and QEII National Trust (QEII National Trust, 2022) rely on donations, grants (from local and central government), membership fees, and sponsorships from businesses to be able to operate. The division of costs among the public, landowner, and non-profit sector in a land trust arrangement can be incredibly complex (Merenlender et al., 2004).

There is increasing appeal of conservation land trusts to the conservation community and the public because of increasing land values, the high cost of government management of land, disenchantment with public land management and resource agencies, and attitudes of central governments toward local communities (Merenlender et al., 2004).

A key criticism of land trusts and the use of perpetual easements is they can be too rigid in their function and objective (Owley et al., 2017). While in place to conserve, they do not always explicitly recognise climate change and its evolving nature within their formation (Owley et al., 2017). Owley et al. (2017) suggest that land trusts can better target the impacts of climate change by:

- Shifting land acquisition priorities to account for potential climate change impacts.
- Considering conservation tools other than perpetual easements that provide greater flexibility in time and space. For example: fee ownership; option agreements; contractual payments; term, moving, and tradeable conservation easements; and flexible reserves.
- Ensuring terms of conservation easements permit the holder to adapt to climate change successfully. For example, inclusion of climate change in the purpose of the easement; provision for biophysical monitoring; allowance for adequate authority and management of climate risks and stresses; consideration of proper responses to changed conditions; and the power to potentially amend easements where necessary.
- Provision for more active stewardship of conservation assets.

Rolling easements recognise that eventually some low-lying coastal land (such as wetlands and beaches) must give way to rising sea levels and this needs to be incorporated into development planning (Abel et al., 2011; London et al., 2009; Titus, 2011; Titus et al., 2009). Rolling easements are usually either regulations that prohibit shore protection or a property right to ensure wetlands, beaches, barrier islands, or access along the shore moves inland with the nature retreat of the shore

(Titus, 2011). In other words, a rolling easement could mean retreat is triggered by a certain sea level threshold (Abel et al., 2011).

5.3 Offer of new land

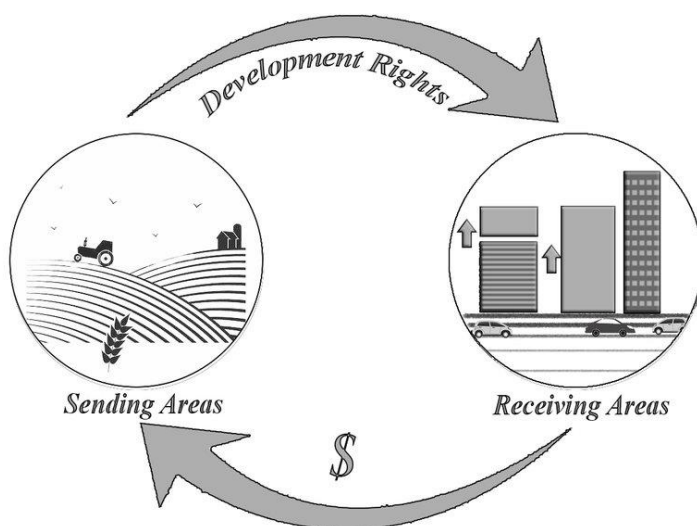
Transferrable development rights (TDRs) are one mechanism of offering new land which could be used to avoid the future need for managed retreat. This is done by preventing development in at-risk areas to limit the potential for future exposure of property to climate change impacts in at-risk areas.

5.3.1 Transferrable development rights (TDRs)

Transferrable development rights (TDRs)¹⁰ are rights to transfer a residential development or subdivision right from one property to another. TDR programmes create market-based incentives to shift development away from areas where it is discouraged (i.e. areas vulnerable to climate change impacts) to areas where development is preferred (Georgetown Climate Center, 2022c; Turbott, 2006). Most existing TDR programmes in the US focus on redirecting future development (M. H. Smith, 2020).

Effectively, landowners who hold development rights for a property in an area the government does not want further development in (designated as a “sending” area), such as an area exposed to climate risks, can choose to sever and sell some or all their unused development rights as TDR credits. Sale of these credits forgoes the ability to develop the land in the “sending” area in the future (Georgetown Climate Center, 2022c). TDR credits can be bought and sold as a tradeable commodity separate from the land itself (i.e. in their own market).

Figure 3: Transferrable development rights (TDRs)



Source: (Shahab et al., 2018)

¹⁰ Also known as transferrable title rights (TTRs) and/or transferrable titles.

Developers in designated “receiving areas” (i.e. areas safe from climate risks where development is preferred by government) can purchase TDR credits to develop their land further than otherwise able to, over and above restrictions (Georgetown Climate Center, 2022c). This means there is a financial gain to be made for those in “sending areas” from forfeiting future development rights in at-risk areas, and incentives for developers in “receiving areas” to be able to undertake development they otherwise would not have been able to.

The financial incentives from selling TDR credits can help to get property owners in areas vulnerable to climate change impacts engaged in managed retreat, and may also make them dedicate parts or all of their land to conservation uses (Georgetown Climate Center, 2022c).

There are numerous examples in the US for hazard mitigation and coastal flooding (Gruss, 2016; Schechtman et al., 2013; M. H. Smith, 2020; Stroud, 1994; Turbott, 2006). Use of TDRs in New Zealand is uncommon in the context of managed retreat (Turbott, 2006), but appears to be used in Auckland and Waikato in the context of controlling rural subdivision (The Land Vault, 2022; The Surveying Company, 2022). Turbott (2006) also pointed to the example of Rodney District Council (before Auckland City Council formation), which proposed in its 2000 district plan for subdivision rights to be transferred by linking amalgamation of property titles in a rural or conservation donor area (Muriwai) to additional subdivision rights in countryside living, town receiving area (Kumeū), with the objective of controlling the pattern of subdivision. While these examples point to a TDR system’s feasibility, it does not appear implementing a TDR system would come without challenge.

5.4 Regulation

There are many different regulatory avenues that could be taken to avoid the need for future managed retreat, some of which we are able to support with literature. For simplicity, we have reduced these to three broad groups:

- not funding further infrastructure provision in at-risk areas
- zoning restrictions
- compulsory insurance.

5.4.1 Not funding further infrastructure provision in at-risk areas

The purpose of adopting a policy of not funding further infrastructure provision in at-risk areas is to avoid future losses to the government from climate risk-related damage to future infrastructure, activities, properties, and lives by disincentivise at-risk areas from further development and therefore increased climate risk. This does not fully restrict development on the at-risk land, it just means the costs of exposure to climate risks are shifted to the property owner.

This policy would disincentivise at-risk areas from further development by signalling to property owners and insurers that the at-risk land should not be developed. For most property owners wanting to develop land this may act as a deterrent.

The Federal Coastal Barrier Resources System (CBRS) in the US (explored in Kousky, 2014; Platt et al., 2002) is an example of this type of restriction on coastal (i.e. high climate risk) development. US Federal funds are not available for coastal barrier lands designated by Congress and therefore the

burden of climate risk does not fall on the rest of the country's taxpayers (Kousky, 2014). However, the CBRS does not restrict state funding for development in these areas and therefore these areas could still be developed, either with or without (i.e. private development) state backing (Kousky, 2014). Other areas in the US such as Maine, Florida, and Massachusetts have similar policies that limit public expenditure in certain coastal areas or barrier islands (Godschalk et al., 2000).

A few key considerations of such a policy are:

- the differences in regulation, governance, and private property rights between the US and New Zealand
- the timing and cut-off point of further infrastructure provision
- whether the government would still support the targeted areas in the event of natural disasters
- how this impacts property owners with existing properties in the targeted area
- legal and planning requirements at a local government level.

5.4.2 Zoning restrictions

There is the potential to use local government's powers to place zoning restrictions on areas at risk of climate change impacts, such as coastlines. This would be done by updating and implementing plans to change the land uses allowed within at-risk areas as well as restrict further development (Kousky, 2014; Lawrence et al., 2020). Zoning can also be used in conjunction with TDRs and, more generally, to increase the allowed density and development rights in areas that are not at risk (or at lower risk) to incentivise redirection of development (Georgetown Climate Center, 2022d).

Important considerations include:

- equity implications of rezoning areas and changing allowed land uses (i.e. this might drive property values down significantly)
- the timeframes in which zoning would be implemented, as well as the timeline of the climate risks
- the ability to coordinate consistent zoning and rezoning practice across all local government plans.

5.4.3 Compulsory insurance

The government could introduce regulation that requires property owners in at-risk areas to have their property insured for loss in the case of a climate disaster. This is akin to car insurance requirements in the UK and Germany. Compulsory insurance preserves market incentives and signals to property owners that the area is risky and therefore more expensive to develop, which will hopefully drive the property owners to develop elsewhere away from climate risks.

To consider:

- Is this actually possible, given some areas are already not insurable? If it is possible, does it affect other support, such as buyout price or zoning restrictions? If not possible in the market, would the government play the role instead (then it looks like the levy option)?

- Equity versus efficiency: are you wanting to force this upon property owners with existing property in at-risk areas? By doing so it may be inequitable, but by only applying it to new development, it may be inefficient.
- The political acceptability of a compulsory scheme – voluntary options could be explored.
- Monitoring and implementation requirements of compulsory insurance schemes.

5.4.4 Other regulatory measures

Other measures that could be considered, for use alone or in conjunction with other mechanisms, include:

- requiring that property owners get financial advice alongside any buyout offers to support property owners to make well-informed decisions
- increasing land acquisition powers of the government to aide buyout (akin to the Public Works Act)
- reducing Local Government Act service requirements under particular circumstances (and possibly similar service requirements of central government, and other providers of regulated services/infrastructure)
- leading infrastructure investment in other areas if undertaking greenfield development (i.e. a planned community, such as the case of Pegasus in Canterbury)
- setbacks, which is the required distance a structure must be located behind a baseline (like a tidal line, for example), to keep development away from portions of a property subject to climate risks such as flooding or erosion (Georgetown Climate Center, 2022b).

6. Analysis of mechanisms

Below we analyse the mechanisms we have identified relative to the objectives and principles from the draft NAP (Table 2). We consider how, if at all, each mechanism could be designed to meet each of the objectives and principles. Further considerations have also been listed in Appendix A. This allows the pros and cons of options of each mechanism as well as trade-offs in how they could be applied to be considered in the context of the considerations highlighted in the draft national adaptation plan.

Consideration of a package of mechanisms is out of the scope of this work, so we only briefly comment on the use of combinations where relevant to whether a particular mechanism could be designed to meet the objectives and principles from Table 2.

The following are our conclusions from that analysis:

- Managed retreat is a problem the world over, and there appears no one way of approaching it. There are many mechanisms both conceptually and in use that each have differing pros and cons, as well as trade-offs in fairness and effectiveness based on design and eligibility.
- There are few funding sources for managed retreat, and in historical cases local and central government have had key roles.
- The New Zealand context varies greatly from other countries, particularly when considering Te Tiriti o Waitangi and legal settings. Overseas experiences and learnings must be taken with caution and interrogated before being applied domestically.
- Some mechanisms may be easier to implement in the New Zealand context than others.
- A suite of mechanisms is likely required to effectively implement a managed retreat programme. To meet the draft NAP funding objectives and principles, we believe most mechanisms require proactive engagement and signalling to property owners and the market.
- As such, attention should be turned to how these mechanisms can and will work in combination and how best to sequence them.

6.1 Considerations that apply to most mechanisms

There are some considerations that apply to most mechanisms we have looked at.

6.1.1 Choice and enforcement of eligibility criteria

The choice and enforcement of eligibility criteria have a trade-off with the effectiveness and efficiency of the system. For example, choice and enforcement potentially impact the:

- Fairness and equity of a managed retreat programme and the mechanisms used. If too rigid, eligibility criteria may exclude certain parts of communities and cause disproportionate hardships. Discretion to employ a case-by-case assessment of eligibility may be a useful tool in avoiding inequities (however, it comes at a cost of administrative burden and potential additional property purchase).

- Problem of moral hazard. Loose eligibility criteria around property ownership (such as second homes or investment properties, purchase after knowledge of risks, purchase after defined cut-off point, etc.) may encourage risk-taking behaviour with the expectation the government will bail property owners out.

6.1.2 Early planning and signalling of intentions

For most of these mechanisms to be effective and to minimise costs, early planning and signalling of intentions from the Government is needed. This is to ensure markets have time to respond to new information, property owners become aware (and are warned) of risks in their areas plus can start to plan longer-term, to allow fund-type mechanisms to have greatest exposure to investment opportunities, and in general to encourage greater uptake of the managed retreat programme.

6.2 Analysis of mechanisms for implementing managed retreat

The mechanisms for implementing managed retreat are assessed in the following A3.

6.3 Analysis of mechanisms that avoid the need for future managed retreat

The mechanisms for avoiding/reducing the need for future managed retreat are assessed in the following A3.

References

- Abel, N., Gorddard, R., Harman, B., Leitch, A., Langridge, J., Ryan, A., & Heyenga, S. (2011). Sea level rise, coastal development and planned retreat: Analytical framework, governance principles and an Australian case study. *Environmental Science & Policy*, *14*(3), 279–288. <https://doi.org/10.1016/j.envsci.2010.12.002>
- Adaptation Clearinghouse. (2020, July 15). *Managing the Retreat from Rising Seas—Charlotte-Mecklenburg County, North Carolina: Floodplain Buyout Program*. <https://www.adaptationclearinghouse.org/resources/managing-the-retreat-from-rising-seas-eo-charlotte-mecklenburg-county-north-carolina-floodplain-buyout-program.html>
- Ajibade, I. (2019). Planned retreat in Global South megacities: Disentangling policy, practice, and environmental justice. *Climatic Change*, *157*(2), 299–317. <https://doi.org/10.1007/s10584-019-02535-1>
- Ajibade, I., Sullivan, M., & Haeffner, M. (2020). Why climate migration is not managed retreat: Six justifications. *Global Environmental Change*, *65*, 102187. <https://doi.org/10.1016/j.gloenvcha.2020.102187>
- Atoba, K., Newman, G., Brody, S., Highfield, W., Kim, Y., & Juan, A. (2021). Buy them out before they are built: Evaluating the proactive acquisition of vacant land in flood-prone areas. *Environmental Conservation*, *48*(2), 118–126. <https://doi.org/10.1017/S0376892921000059>
- Banks Peninsula Conservation Trust. (2022). *BPCT.org.nz-About Us*. Banks Peninsula Conservation Trust. <https://www.bpct.org.nz/about-us/us>
- Bell, R., Lawrence, J., Allan, S., Blackett, P., & Stephens, S. (2017). *Coastal hazards and climate change: Guidance for local government*. Ministry for the Environment. <https://environment.govt.nz/assets/Publications/Files/coastal-hazards-guide-final.pdf>
- BenDor, T. K., Salvesen, D., Kamrath, C., & Ganser, B. (2020). Floodplain Buyouts and Municipal Finance. *Natural Hazards Review*, *21*(3), 04020020. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000380](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000380)
- Binder, S. B., Baker, C. K., & Barile, J. P. (2015). Rebuild or Relocate? Resilience and Postdisaster Decision-Making After Hurricane Sandy. *American Journal of Community Psychology*, *56*(1–2), 180–196. <https://doi.org/10.1007/s10464-015-9727-x>
- Binder, S. B., Barile, J. P., Baker, C. K., & Kulp, B. (2019). Home buyouts and household recovery: Neighborhood differences three years after Hurricane Sandy. *Environmental Hazards*, *18*(2), 127–145. <https://doi.org/10.1080/17477891.2018.1511404>
- Binder, S. B., & Greer, A. (2016). The Devil Is in the Details: Linking Home Buyout Policy, Practice, and Experience After Hurricane Sandy. *Politics and Governance*, *4*(4), 97–106. <https://doi.org/10.17645/pag.v4i4.738>
- Binder, S. B., Ritchie, L. A., Bender, R., Thiel, A., Baker, C. K., Badillo, E., Goodfellow, S., Kulp, B., & Weir, P. (2020). Limbo: The unintended consequences of home buyout programmes on peripheral communities. *Environmental Hazards*, *19*(5), 488–507. <https://doi.org/10.1080/17477891.2020.1714537>

- Blunkell, C. T. (2017). Local participation in coastal adaptation decisions in the UK: Between promise and reality. *Local Environment*, 22(4), 492–507.
<https://doi.org/10.1080/13549839.2016.1233525>
- Boston, J. (2017a). *Governing for the Future: Designing Democratic Institutions for a Better Tomorrow*. Emerald Publishing Limited.
- Boston, J. (2017b). *Safeguarding the Future: Governing in an Uncertain World* (1st edition). Bridget Williams Books.
- Boston, J. (2019). *Funding Climate Change Adaptation: The Case for Public Compensation in the Context of Pre-emptive Managed Retreat*. School of Government, Victoria University of Wellington.
<https://knowledgeauckland.org.nz/media/1681/funding-climate-change-adaptation-public-compensation-boston-j-oct-2019.pdf>
- Boston, J., & Lawrence, J. (2017). *The case for new climate change adaptation funding instruments*. Institute for Governance and Policy Studies, School of Government, University of Wellington Victoria. https://www.treasury.govt.nz/sites/default/files/2018-03/tgls-boston-lawrence-paper_1.pdf
- Boston, J., Panda, A., & Surminski, S. (2020). *Designing a funding framework for the slow-onset impacts of climate change: Insights from recent experiences with coastal retreat* [Policy Working Paper 373]. Centre for Climate Change Economics and Policy, London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2020/08/working_paper_343_Boston_et_al-1-1.pdf
- Braamskamp, A., & Penning-Rowsell, E. C. (2018). Managed Retreat: A Rare and Paradoxical Success, but Yielding a Dismal Prognosis. *Environmental Management and Sustainable Development*, 7(2), 108–136. <https://doi.org/10.5296/emsd.v7i2.12851>
- Brody, S., Blessing, R., Sebastian, A., & Bedient, P. (2014). Examining the impact of land use/land cover characteristics on flood losses. *Journal of Environmental Planning and Management*, 57(8), 1252–1265. <https://doi.org/10.1080/09640568.2013.802228>
- Brody, S., Highfield, W. E., Blessing, R., Makino, T., & Shepard, C. C. (2017). Evaluating the effects of open space configurations in reducing flood damage along the Gulf of Mexico coast. *Landscape and Urban Planning*, 167, 225–231.
<https://doi.org/10.1016/j.landurbplan.2017.07.003>
- Bronen, R. (2015). Climate-induced community relocations: Using integrated social-ecological assessments to foster adaptation and resilience. *Ecology and Society*, 20(3).
<https://www.jstor.org/stable/26270247>
- Bukvic, A., Zhu, H., Lavoie, R., & Becker, A. (2018). The role of proximity to waterfront in residents' relocation decision-making post-Hurricane Sandy. *Ocean & Coastal Management*, 154, 8–19.
<https://doi.org/10.1016/j.ocecoaman.2018.01.002>
- Campbell, M. C., & Salus, D. A. (2003). Community and conservation land trusts as unlikely partners? The case of Troy Gardens, Madison, Wisconsin. *Land Use Policy*, 20(2), 169–180.
[https://doi.org/10.1016/S0264-8377\(03\)00002-4](https://doi.org/10.1016/S0264-8377(03)00002-4)

- Charan, D., Kaur, M., & Singh, P. (2017). Customary Land and Climate Change Induced Relocation—A Case Study of Vunidogoloa Village, Vanua Levu, Fiji. In W. Leal Filho (Ed.), *Climate Change Adaptation in Pacific Countries: Fostering Resilience and Improving the Quality of Life* (pp. 19–33). Springer International Publishing. https://doi.org/10.1007/978-3-319-50094-2_2
- Cummins, J. D., Suher, M., & Zanjani, G. (2010). Federal Financial Exposure to Natural Catastrophe Risk. In *Measuring and Managing Federal Financial Risk* (pp. 61–92). University of Chicago Press. <https://www.nber.org/books-and-chapters/measuring-and-managing-federal-financial-risk/federal-financial-exposure-natural-catastrophe-risk>
- Curran-Groome, W., Haygood, H., Hino, M., BenDor, T. K., & Salvesen, D. (2021). Assessing the full costs of floodplain buyouts. *Climatic Change*, 168(1), 3. <https://doi.org/10.1007/s10584-021-03178-x>
- Dachary-Bernard, J., Rey-Valette, H., & Rulleau, et B. (2019). Preferences among coastal and inland residents relating to managed retreat: Influence of risk perception in acceptability of relocation strategies. *Journal of Environmental Management*, 232, 772–780. <https://doi.org/10.1016/j.jenvman.2018.11.104>
- Danda, A. A., Ghosh, N., Bandyopadhyay, J., & Hazra, S. (2019). Managed retreat: Adaptation to climate change in the Sundarbans ecoregion in the Bengal Delta. *Journal of the Indian Ocean Region*, 15(3), 317–335. <https://doi.org/10.1080/19480881.2019.1652974>
- de Vries, D. H., & Fraser, J. C. (2012). Citizenship rights and voluntary decision making in post-disaster U.S. floodplain buyout mitigation programs. *International Journal of Mass Emergencies and Disasters*, 30. <https://dare.uva.nl/search?identifier=aafa3ebb-287f-41a1-a75e-8fe0554254d3>
- de Vries, D. H., & Fraser, J. C. (2017). Historical waterscape trajectories that need care: The unwanted refurbished flood homes of Kinston’s devolved disaster mitigation program. *Journal of Political Ecology*, 24(1), 931–950. <https://doi.org/10.2458/v24i1.20976>
- Deyle, R., & Smith, R. (2000). Risk-Based Taxation of Hazardous Land Development. *Journal of The American Planning Association - J AMER PLANN ASSN*, 66, 421–434. <https://doi.org/10.1080/01944360008976125>
- Dobes, L., & Chapman, B. (2011). *Financing adaptation to climate-induced retreat from coastal inundation and erosion* [CCEP Working Paper 1113]. Centre for Climate Economics & Policy, Crawford School of Economics and Government, The Australian National University. <https://core.ac.uk/download/pdf/30680568.pdf>
- Elliott, J. R., Brown, P. L., & Loughran, K. (2020). Racial Inequities in the Federal Buyout of Flood-Prone Homes: A Nationwide Assessment of Environmental Adaptation. *Socius*, 6, 2378023120905439. <https://doi.org/10.1177/2378023120905439>
- Esteves, L. S. (2014). What is Managed Realignment? In L. S. Esteves (Ed.), *Managed Realignment: A Viable Long-Term Coastal Management Strategy?* (pp. 19–31). Springer Netherlands. https://doi.org/10.1007/978-94-017-9029-1_2
- Faure, M. G., & Weishaar, S. E. (2012). *The Role of Environmental Taxation: Economics and the Law* (SSRN Scholarly Paper No. 2370360). <https://papers.ssrn.com/abstract=2370360>

- Fenn, T., Daly, E., Miller, J., Elding, C., Clarke, C., Guthrie, G., Hick, E., Silson, R., & Hickling, D. (2015). *Adapting to coastal erosion: Evaluation of rollback and leaseback schemes in Coastal Change Pathfinder projects*. Department for Environment, Food, and Rural Affairs.
https://www.researchgate.net/publication/310604965_Adapting_to_coastal_erosion_evaluation_of_rollback_and_leaseback_schemes_in_Coastal_Change_Pathfinder_projects
- Filatova, T. (2014). Market-based instruments for flood risk management: A review of theory, practice and perspectives for climate adaptation policy. *Environmental Science & Policy*, 37, 227–242.
<https://doi.org/10.1016/j.envsci.2013.09.005>
- Flavelle, C. (2019, September 10). Canada Tries a Forceful Message for Flood Victims: Live Somewhere Else. *The New York Times*. <https://www.nytimes.com/2019/09/10/climate/canada-flood-homes-buyout.html>
- Fletcher, C., Taylor, B., Rambaldi, A., Harman, B., Heyenga, S., Ganegodage, K., Lipkin, F., & Mcallister, R. (2013). *Costs and coasts: An empirical assessment of physical and institutional climate adaptation pathways*.
https://www.researchgate.net/publication/260602341_Costs_and_coasts_an_empirical_assessment_of_physical_and_institutional_climate_adaptation_pathways
- Freudenberg, R., Calvin, E., Tolkoff, L., & Brawley, D. (2016). *Buy-in for Buyouts: The Case for Managed Retreat from Flood Zones*. Lincoln Institute of Land Policy.
<https://www.lincolninstitute.edu/sites/default/files/pubfiles/buy-in-for-buyouts-full.pdf>
- Galster, G., Tatian, P., & Accordino, J. (2006). Targeting Investments for Neighborhood Revitalization. *Journal of the American Planning Association*, 72(4), 457–474.
<https://doi.org/10.1080/01944360608976766>
- Georgetown Climate Center. (2020). *Managing the Retreat from Rising Seas: Lessons and Tools from 17 Case Studies*. Georgetown Climate Center.
https://www.georgetownclimate.org/files/MRT/GCC_20_FULL-3web.pdf
- Georgetown Climate Center. (2022a). *Managed Retreat Toolkit » Acquisition Tools*. Georgetownclimatecenter.Org.
<https://www.georgetownclimate.org/adaptation/toolkits/managed-retreat-toolkit/acquisition-tools.html>
- Georgetown Climate Center. (2022b). *Managed Retreat Toolkit » Regulatory Tools*. Georgetownclimatecenter.Org.
<https://www.georgetownclimate.org/adaptation/toolkits/managed-retreat-toolkit/regulatory-tools.html>
- Georgetown Climate Center. (2022c). *Managed Retreat Toolkit » Transfer of Development Rights*. Georgetownclimatecenter.Org.
<https://www.georgetownclimate.org/adaptation/toolkits/managed-retreat-toolkit/transfer-of-development-rights.html>
- Georgetown Climate Center. (2022d). *Managed Retreat Toolkit » Zoning and Overlay Zones*. Georgetownclimatecenter.Org.
<https://www.georgetownclimate.org/adaptation/toolkits/managed-retreat-toolkit/zoning-and-overlay-zones.html>

- Godschalk, D., Norton, R., Richardson, C., & Salvesen, D. (2000). Avoiding Coastal Hazard Areas: Best State Mitigation Practices. *Environmental Geosciences*, 7, 13–22. <https://doi.org/10.1046/j.1526-0984.2000.71002.x>
- Göransson, G., Van Well, L., Bendz, D., Danielsson, P., & Hedfors, J. (2021). Territorial governance of managed retreat in Sweden: Addressing challenges. *Journal of Environmental Studies and Sciences*, 11(3), 376–391. <https://doi.org/10.1007/s13412-021-00696-z>
- Grannis, J. (2019). Community-Driven Climate Solutions: How Public-Private Partnerships with Land Trusts Can Advance Climate Action. *William & Mary Environmental Law and Policy Review*, 44, 701.
- Green, T. F., & Olshansky, R. B. (2012). Rebuilding housing in New Orleans: The Road Home Program after the Hurricane Katrina disaster. *Housing Policy Debate*, 22(1), 75–99. <https://doi.org/10.1080/10511482.2011.624530>
- Greer, A., & Binder, S. B. (2017). A Historical Assessment of Home Buyout Policy: Are We Learning or Just Failing? *Housing Policy Debate*, 27(3), 372–392. <https://doi.org/10.1080/10511482.2016.1245209>
- Gruss, J. (2016, July 29). *Take credit* | *Business Observer*. Business Observer. <https://www.businessobserverfl.com/article/take-credit>
- Hanna, C., White, I., & Glavovic, B. (2017). *Managed retreat in New Zealand: Revealing the terminology, approaches and direction of local planning instruments*. [Report]. Resilience to Nature's Challenges. <https://researchcommons.waikato.ac.nz/handle/10289/14288>
- Hanna, C., White, I., & Glavovic, B. (2018). *Managed retreat governance: Insights from Matatā, New Zealand* [Report for the National Science Challenge: Resilience to Nature's Challenges]. University of Waikato. <https://researchcommons.waikato.ac.nz/bitstream/handle/10289/14523/Hanna-White-Glavovic.-2018.-Managed-retreat-governance.pdf?sequence=2&isAllowed=y>
- Hanna, C., White, I., & Glavovic, B. (2019). *Managed Retreat in Practice: Mechanisms and Challenges for Implementation*. <https://doi.org/10.1093/acrefore/9780199389407.013.350>
- Hanna, C., White, I., & Glavovic, B. C. (2021). Managed retreats by whom and how? Identifying and delineating governance modalities. *Climate Risk Management*, 31, 100278. <https://doi.org/10.1016/j.crm.2021.100278>
- Healy, A., & Malhotra, N. (2009). Myopic Voters and Natural Disaster Policy. *American Political Science Review*, 103(3), 387–406. <https://doi.org/10.1017/S0003055409990104>
- Henstra, D. (2016). The tools of climate adaptation policy: Analysing instruments and instrument selection. *Climate Policy*, 16(4), 496–521. <https://doi.org/10.1080/14693062.2015.1015946>
- Highfield, W. E., Brody, S. D., & Shepard, C. (2018). The effects of estuarine wetlands on flood losses associated with storm surge. *Ocean & Coastal Management*, 157, 50–55. <https://doi.org/10.1016/j.ocecoaman.2018.02.017>
- Hino, M., Field, C. B., & Mach, K. J. (2017). Managed retreat as a response to natural hazard risk. *Nature Climate Change*, 7(5), 364–370. <https://doi.org/10.1038/nclimate3252>

- Hong, Y.-H., & Brain, I. (2012). *Land Readjustment for Urban Development and Post-Disaster Reconstruction*. Lincoln Institute of Land Policy.
<https://www.lincolninst.edu/publications/articles/land-readjustment-urban-development-post-disaster-reconstruction>
- Huang, S.-M. (2018). Heritage and Postdisaster Recovery: Indigenous Community Resilience. *Natural Hazards Review*, 19(4), 05018008. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000308](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000308)
- Jessee, N. (2020). Community Resettlement in Louisiana: Learning from Histories of Horror and Hope. In S. Laska (Ed.), *Louisiana's Response to Extreme Weather: A Coastal State's Adaptation Challenges and Successes* (pp. 147–184). Springer International Publishing.
https://doi.org/10.1007/978-3-030-27205-0_6
- Johnson, K. A., Wing, O. E. J., Bates, P. D., Fargione, J., Kroeger, T., Larson, W. D., Sampson, C. C., & Smith, A. M. (2020). A benefit–cost analysis of floodplain land acquisition for US flood damage reduction. *Nature Sustainability*, 3(1), 56–62. <https://doi.org/10.1038/s41893-019-0437-5>
- Keeler, A. G. (2019). *Long-Term Considerations; the Role of Finance in Discontinuous Responses; Approaches to Relocation*.
<https://scholarship.law.wm.edu/vcpconference/2019forum/resiliencefunding/8>
- Keeler, A. G., Mullin, M., McNamara, D. E., & Smith, M. D. (2022). Buyouts with rentbacks: A policy proposal for managing coastal retreat. *Journal of Environmental Studies and Sciences*.
<https://doi.org/10.1007/s13412-022-00762-0>
- Kim, H., & Karp, C. A. (2012). When Retreat is the Better Part of Valor: A Legal Analysis of Strategies to Motivate Retreat from the Shore. *Sea Grant Law and Policy Journal*, 5, 169.
- Koslov, L. (2016). The Case for Retreat. *Public Culture*, 28(2 (79)), 359–387.
<https://doi.org/10.1215/08992363-3427487>
- Kousky, C. (2014). Managing shoreline retreat: A US perspective. *Climatic Change*, 124(1), 9–20.
<https://doi.org/10.1007/s10584-014-1106-3>
- Kousky, C., & Walls, M. (2014). Floodplain conservation as a flood mitigation strategy: Examining costs and benefits. *Ecological Economics*, 104, 119–128.
<https://doi.org/10.1016/j.ecolecon.2014.05.001>
- Kraan, C. M., Hino, M., Niemann, J., Siders, A. R., & Mach, K. J. (2021). Promoting equity in retreat through voluntary property buyout programs. *Journal of Environmental Studies and Sciences*, 11(3), 481–492. <https://doi.org/10.1007/s13412-021-00688-z>
- Lawrence, J., Boston, J., Bell, R., Olufson, S., Kool, R., Hardcastle, M., & Stroombergen, A. (2020). Implementing Pre-Emptive Managed Retreat: Constraints and Novel Insights. *Current Climate Change Reports*, 6(3), 66–80. <https://doi.org/10.1007/s40641-020-00161-z>
- Lismore City Council. (2022). *Starting the Discussion: Building Back Better*. Your Say Lismore.
<https://yoursay.lismore.nsw.gov.au/growth-management-strategy>
- Local Government New Zealand. (2016). *Risk financing in local government*. Local Government New Zealand. <https://www.lgnz.co.nz/assets/9190f8591f/42600-LGNZ-Risk-Financing-Guide-Final-WEB.pdf>

- London, J., Dyckman, C., Allen, J., John, C. S., & Jackson, S. (2009). An assessment of shoreline management options along the South Carolina coast, 2009 August. *Publications*.
https://tigerprints.clemson.edu/sti_pubs/188
- Lynn, K. A. (2017). Who defines 'whole': An urban political ecology of flood control and community relocation in Houston, Texas. *Journal of Political Ecology*, 24(1), 951–967.
<https://doi.org/10.2458/v24i1.20977>
- Macdonald, N. (2022, March 30). *Sad final farewells for Matatā managed retreat fighters*. Stuff.
<https://www.stuff.co.nz/national/128203042/sad-final-farewells-for-matat-managed-retreat-fighters>
- Mach, K. J., Kraan, C. M., Hino, M., Siders, A. R., Johnston, E. M., & Field, C. B. (2019). Managed retreat through voluntary buyouts of flood-prone properties. *Science Advances*, 5(10), eaax8995.
<https://doi.org/10.1126/sciadv.aax8995>
- Marino, E. (2018). Adaptation privilege and Voluntary Buyouts: Perspectives on ethnocentrism in sea level rise relocation and retreat policies in the US. *Global Environmental Change*, 49, 10–13.
<https://doi.org/10.1016/j.gloenvcha.2018.01.002>
- McClure, T. (2021, October 29). Forced retreat: One New Zealand town's fate highlights coming fight over climate adaptation. *The Guardian*.
<https://www.theguardian.com/world/2021/oct/30/forced-retreat-one-new-zealand-towns-fate-highlights-coming-fight-over-climate-adaptation>
- Merenlender, A. M., Huntsinger, L., Guthey, G., & Fairfax, S. K. (2004). Land Trusts and Conservation Easements: Who Is Conserving What for Whom? *Conservation Biology*, 18(1), 65–76.
<https://doi.org/10.1111/j.1523-1739.2004.00401.x>
- Ministry for the Environment. (2022). *Adapt and thrive: Building a climate-resilient New Zealand*. Ministry for the Environment. <https://environment.govt.nz/assets/publications/Adapt-and-Thrive-consultation-document.pdf>
- Mori, K., & Perrings, C. (2012). Optimal management of the flood risks of floodplain development. *Science of The Total Environment*, 431, 109–121.
<https://doi.org/10.1016/j.scitotenv.2012.04.076>
- Naturally Resilient Communities. (2022). *Open Space Preservation through Land Acquisition*. Naturally Resilient Communities. <https://nrnsolutions.org/open-space-preservation-through-land-acquisition/>
- Nelson, K. S., & Molloy, M. (2021). Differential disadvantages in the distribution of federal aid across three decades of voluntary buyouts in the United States. *Global Environmental Change*, 68, 102278. <https://doi.org/10.1016/j.gloenvcha.2021.102278>
- Nelson, M. (2014). Using Land Swaps to Concentrate Redevelopment and Expand Resettlement Options in Post-Hurricane Katrina New Orleans. *Journal of the American Planning Association*, 80(4), 426–437. <https://doi.org/10.1080/01944363.2014.988167>
- Nguyen, C. N. (2020). Homeowners' choice when the government proposes a managed retreat. *International Journal of Disaster Risk Reduction*, 47, 101543.
<https://doi.org/10.1016/j.ijdr.2020.101543>

- Noy, I. (2020). Paying a Price of Climate Change: Who Pays for Managed Retreats? *Current Climate Change Reports*, 6(1), 17–23. <https://doi.org/10.1007/s40641-020-00155-x>
- Olshansky, R. B., & Johnson, L. A. (2010). *Clear As Mud: Planning for the Rebuilding of New Orleans*. Routledge. <https://doi.org/10.4324/9781351179713>
- Owen, S., Lawrence, J., Ryan, E., Kench, P., Bell, R., Rennie, H., Blackett, P., & Schneider, P. (2018). Coastal management: Anticipating staged managed retreat. *Planning Quarterly*, 209, 8–11.
- Owley, J., Cheever, F., Rissman, A. R., Shaw, M. R., Thompson, B. H. J., & Weeks, W. W. (2017). Climate Change Challenges for Land Conservation: Rethinking Conservation Easements, Strategies, and Tools. *Denver Law Review*, 95, 727.
- Perry, A. (2022). *Perceptions toward Coastal Retreat: Evidence of Buyout and Rent back preferences across the U.S. East Coast* [Master's, University of Virginia]. https://s3.amazonaws.com/na-st01.ext.exlibrisgroup.com/01GALI_UGA/storage/alma/0B/D9/10/D4/8A/0B/5D/5C/EC/0B/CC/45/A4/FE/18/09/perry_anna_j_202205_ms.pdf?response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Date=20220622T231215Z&X-Amz-SignedHeaders=host&X-Amz-Expires=119&X-Amz-Credential=AKIAJN6NPMNGJALPPWAQ%2F20220622%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Signature=c846ec8013cd0b2afc884dfb1227029be4afef33d570eb785feb835a39b9303e
- Platt, R. H., Salvesen, D., & Il, G. H. B. (2002). Rebuilding the North Carolina Coast after Hurricane Fran: Did Public Regulations Matter? *Coastal Management*, 30(3), 249–269. <https://doi.org/10.1080/08920750290042192>
- Purdy, B. (2019). *Planning and design scenarios for equitable outcomes in managed retreat* [Thesis, Massachusetts Institute of Technology]. <https://dspace.mit.edu/handle/1721.1/123932>
- QEII National Trust. (2022). About Us | QEII National Trust. *QEII*. <https://qeiiationaltrust.org.nz/about-us/>
- Reisinger, A., Lawrence, J., Hart, Georgina, & Chapman, R. (2014). *From coping to resilience: The role of managed retreat in highly developed coastal regions*. <https://doi.org/10.1201/b18053-18>
- Revell, D., King, P., Giliam, J., Calil, J., Jenkins, S., Helmer, C., Nakagawa, J., Snyder, A., Ellis, J., & Jamieson, M. (2021). A Holistic Framework for Evaluating Adaptation Approaches to Coastal Hazards and Sea Level Rise: A Case Study from Imperial Beach, California. *Water*, 13(9), 1324. <https://doi.org/10.3390/w13091324>
- Rulleau, B., Rey-Valette, H., & Clément, V. (2017). Impact of justice and solidarity variables on the acceptability of managed realignment. *Climate Policy*, 17(3), 361–377. <https://doi.org/10.1080/14693062.2015.1119097>
- Schechtman, J., Brady, M., & Administration, (NOAA) National Oceanic and Atmospheric. (2013). *Cost-efficient climate change adaptation in the North Atlantic*. United States of America - gov. <http://www.regions.noaa.gov/north-atlantic/wp-content/uploads/2013/07/CEANA-Final-V11.pdf>

- See, J., & Wilmsen, B. (2020). Just adaptation? Generating new vulnerabilities and shaping adaptive capacities through the politics of climate-related resettlement in a Philippine coastal city. *Global Environmental Change*, 65, 102188. <https://doi.org/10.1016/j.gloenvcha.2020.102188>
- Shahab, S., Clinch, J. P., & O'Neill, E. (2018). Estimates of Transaction Costs in Transfer of Development Rights Programs. *Journal of the American Planning Association*, 84, 61–75. <https://doi.org/10.1080/01944363.2017.1406816>
- Shi, L., & Varuzzo, A. M. (2020). Surging seas, rising fiscal stress: Exploring municipal fiscal vulnerability to climate change. *Cities*, 100, 102658. <https://doi.org/10.1016/j.cities.2020.102658>
- Siders, A. R. (2019). Managed Retreat in the United States. *One Earth*, 1(2), 216–225. <https://doi.org/10.1016/j.oneear.2019.09.008>
- Siders, A. R., Hino, M., & Mach, K. J. (2019). The case for strategic and managed climate retreat. *Science*, 365(6455), 761–763. <https://doi.org/10.1126/science.aax8346>
- Sipe, N., & Vella, K. (2014). Relocating a Flood-Affected Community: Good Planning or Good Politics? *Journal of the American Planning Association*, 80(4), 400–412. <https://doi.org/10.1080/01944363.2014.976586>
- Smith, C. (2019, February 27). *Kiwi beach properties rising in value—And defying climate change fears*. Onerooof.Co.Nz. <https://www.oneroof.co.nz/news/35981>
- Smith, M. H. (2020). *Creating a market for retreat: Transfer of development rights as a climate adaptation tool in coastal Massachusetts* [Thesis, Massachusetts Institute of Technology]. <https://dspace.mit.edu/handle/1721.1/127623>
- Spiegel, M. (2021, April 20). *Study: Rising Seas Aren't Causing Coastal Property Values to Decline*. Yale Insights. <https://insights.som.yale.edu/insights/study-rising-seas-arent-causing-coastal-property-values-to-decline>
- Storey, B., Owen, S., Noy, I., & Zammit, C. (2020). *Insurance Retreat: Sea level rise and the withdrawal of residential insurance in Aotearoa New Zealand* [Report for the Deep South Science Challenge]. Deep South National Science Challenge. <https://deepsouthchallenge.co.nz/wp-content/uploads/2021/01/Insurance-Retreat-December-2020-Final-Report.pdf>
- Stroud, H. B. (1994). Controlling growth and development in Monroe County, Florida. *Land Use Policy*, 11(1), 17–30. [https://doi.org/10.1016/0264-8377\(94\)90040-X](https://doi.org/10.1016/0264-8377(94)90040-X)
- Surminski, S., Panda, A., & Boston, J. (2022). *Forthcoming chapter on managed retreat*.
- The Land Vault. (2022). TTR's explained. *Land Vault*. <https://www.thelandvault.co.nz/transferable-ttrs-explained/>
- The Surveying Company. (2022, March 4). *Transferable Development Rights*. <https://www.thesurveyingcompany.nz/articles/transferable-development-rights>
- Titus, J. G. (2011). *Rolling easements* [Climate Ready Estuaries Program]. United States Environmental Protection Agency. <https://www.epa.gov/sites/default/files/documents/rollingeasementsprimer.pdf>
- Titus, J. G., Hudgens, D. E., Trescott, D. L., Craghan, M., Nuckols, W. H., Hershner, C. H., Kassakian, J. M., Linn, C. J., Merritt, P. G., McCue, T. M., O'Connell, J. F., Tanski, J., & Wang, J. (2009). State and

- local governments plan for development of most land vulnerable to rising sea level along the US Atlantic coast. *Environmental Research Letters*, 4(4), 044008. <https://doi.org/10.1088/1748-9326/4/4/044008>
- Tobin, G. A. (1995). The Levee Love Affair: A Stormy Relationship? *JAWRA Journal of the American Water Resources Association*, 31(3), 359–367. <https://doi.org/10.1111/j.1752-1688.1995.tb04025.x>
- Tubridy, F., Lennon, M., & Scott, M. (2022). Managed retreat and coastal climate change adaptation: The environmental justice implications and value of a coproduction approach. *Land Use Policy*, 114, 105960. <https://doi.org/10.1016/j.landusepol.2021.105960>
- Turbott, C. (2006). *Managed Retreat from Coastal Hazards: Options for Implementation*. Environment Waikato. <https://www.waikatoregion.govt.nz/assets/WRC/WRC-2019/tr06-48.pdf>
- Waikato Region Emergency Management Group. (2011). *Port Waikato 'managed retreat' a success*. Waikato Region Emergency Management Group. <https://www.waikatoregioncdemg.govt.nz/assets/PageFiles/898-beachcare/magazines/2011-Port-Waikato.pdf>
- Wall, T. (2019, May 18). 'This is a wake-up call': The villagers who could be Britain's first climate refugees. *The Guardian*. <https://www.theguardian.com/environment/2019/may/18/this-is-a-wake-up-call-the-villagers-who-could-be-britains-first-climate-refugees>
- Whakatāne District Council. (2019, September 6). *Awatarariki Managed Retreat Programme*. Whakatāne District Council. <https://www.whakatane.govt.nz/residents/awatarariki-managed-retreat-programme>
- Whakatāne District Council. (2020). *Statement of evidence of Greg Ball on behalf of Whakatāne District Council*. https://www.whakatane.govt.nz/sites/www.whakatane.govt.nz/files/documents/greg_ball_property_acquisition.pdf
- White, I., & Haughton, G. (2017). Risky times: Hazard management and the tyranny of the present. *International Journal of Disaster Risk Reduction*, 22, 412–419. <https://doi.org/10.1016/j.ijdr.2017.01.018>
- World Bank. (2015). *Land Swaps | Urban Regeneration*. World Bank. <https://urban-regeneration.worldbank.org/node/27>
- Young, A. W. (2018). How to Retreat: The Necessary Transition from Buyouts to Leasing. *Coastal Management*, 46(5), 527–535. <https://doi.org/10.1080/08920753.2018.1498716>

Appendix A Further considerations for each of the mechanisms

Mechanisms to implement managed retreat

Subsidies

- A subsidy for moving buildings within property may be effective in isolation (though difficult to achieve managed retreat) but subsidy for moving away from a property entirely are unlikely to be effective in isolation given the high purchase cost of property (i.e. other support may be needed for property if subsidy limited to moving buildings).
- There needs to be transparency about who and what qualifies for subsidy, as well as aware it could set precedent for other at-risk areas.

Property buyout

- This is likely to result in a significant cost when scaled. Is this something that an existing entity would be tasked with coordinating (such as Kāinga Ora, Ōtākaro, EQC, HUD), or would an entirely new entity have to be created? Where would the funding for this come from? Where does it sit? Does it then become a community-by-community arrangements and what is the role of local government?
- What is the role of local government in this situation, if any? Can it be orchestrated at a national level, or does it need to be a joint effort between local and central government?

Leasebacks

- Leasebacks have most of the same considerations as buyout since it is an extension to a buyout.
- Conceptually these sound good, but there are likely large barriers and challenges in practice. Contending with the Tenancy and Land Acts. Leaseback would be different from lease (no obligations on landlord, but there is for a lease). If this was then a lease arrangement, this has consequences that could mean creating new kind of tenure.

Life estates and future interests

- All the same considerations of a buyout.
- Plus, political acceptability of approaching pre-emptively. Potential for perceived coercion or issues with perceived level of "choice" in participation?

Land swaps

- Lead investments in infrastructure in proposed land swap areas may be necessary to encourage uptake.
- Zoning requirements.
- Legislative requirements to be able to swap land.
- Treaty considerations.

Pre-paid fund for relocation / Levy model, and Coastal accumulator fund

- Acceptability of mandatory fund contributions.
- Eligibility for the mandate; at what level does the risk become sufficient that property owners must start contributing?
- Fairness and equity – how do you deal with those who cannot afford to contribute?
- Potential for accumulated funds to be insufficient to cover eventual pay-outs. How will it be adjusted in the case of underperformance (particularly if the fund is invested – how do you get a standard return)?
 - Conversely, what if the fund overperforms? Where does the excess money go?
- Rights to pay-out and transfer of rights when there is transfer of property.
- If to be invested, how? What is the administration burden of doing so?
- Incentivise uptake through tax subsidies? Trade-off then with uptake and fiscal exposure.
- Time period – when do you start to collect?

Coastal rehousing pool

- Acceptability of publicly funding buyout (onus falling on group wider than just those affected).
- How to determine the agreed contribution from each party?
- What investment opportunities are there? How does this impact contribution period and amount?

Rollback model

- Similar to TDRs (within the section below).

Mechanisms that may avoid/reduce the need for retreat

Taxation

- Political acceptability of taxes.
- Legislative requirements to implement a new tax.
- Knowable risk and when eligibility kicks in – at what point does a tax apply? Can it be retrospective when it can be argued the property owner should have known about a risk?

Open space acquisition

- The form of ownership of the land that is acquired – who owns it, how is it split, who determines what it is used for? Who then maintains the land? Administration burden likely and potential property upkeep requirements.
- How do you determine what land is eligible for such an acquisition programme? Is it restricted to undeveloped land, or can greenspace already owned by some party be acquired too?

Conservation land trusts

- Can this method be expanded past typical use to include the purchase of houses?
- Is this possible to be used secondarily in cases where other mechanisms may not work, i.e. buyout where people are ineligible because of income levels being too high, or houses not being primary residencies?
- Designing the Trust to have iterative land use criteria based on evolving nature of climate change – different to the more typical conservation goal.
- Unclear about the scalability, or level to which Trusts will be able to make a difference – what can be done to make this applicable at a larger scale? Scaling will require more resources and potentially central government backing to get something up and running.
- Considerable legal complexity when dealing with multi-party ownership and land use covenants, requirements for well-defined purposes of land use and so on.
- Already experience with Trusts in New Zealand like QEII which could easily do something like this. Financing becomes an issue though; how do you get a group of private interests to invest in this at a significant scale?

Transferrable Development Rights (TDRs)

- How are the sending and receiving areas selected? What sort of consultation requirements would there be? Likely large for receiving areas given you will be closing out some of the amenities etc. (e.g. if you are allowed to build an extra storey on a building, people may oppose due to issues such as blocking natural light but this may still be allowed under receiving rules). What sort of legislative changes are required to make this possible in a retreat setting? Potential learnings from the other uses in New Zealand?

Not funding further infrastructure

- Political acceptability- can the government actually leave people stranded, even if they tell them they will no longer support them through infrastructure?
- What are the legislative, zoning, and planning requirements to be able to do this?
- How do you get this to be a politically neutral policy that is consistent over time.
- Implications this has for legislative responsibilities – e.g. if you are no longer funding wastewater services to an at-risk area, how is the environmental impact dealt with?

Zoning restrictions

- Ability for consistency across plans and the principles used for implementing zoning restrictions – can this be done across all councils? Needs collaborative approach.
- This will diminish the value of existing properties within the area – how do you compensate for that? Fair market value before the zoning change to pay out?

Compulsory insurance

- Only ever going to be useful as a transitory measure, since there is already some areas that cannot be insured given the risk is too high for the tolerance/threshold of insurance companies. If government were to step into that role, it is like a levy/targeted rate.

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