

The Roles of Insurance in Managed Retreats

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December 2025

Abstract: Managed retreat, a strategy where people and infrastructure are permanently moved from a disaster-prone area, may in some cases be the best strategy to protect people and reduce long-term disaster risk. Considering the increasing need for managed retreats due to sea level rise and the increasing frequency and severity of extreme weather events, traditional funding and implementation models for managed retreat, which mostly rely on government-sponsored buyouts, may not be sufficient. We review and discuss the roles of insurance in managed retreat - how insurance affects managed retreat incentives and feasibility, and how it can be designed to facilitate successful implementation and adequate funding of managed retreat programs. Insurance-related factors influence disaster exposure and relocation incentives, affecting the scale and the feasibility of managed retreats. Insurance mechanisms can be utilised for managed retreat funding, possibly covering not only damage-related compensation but also, through new insurance models, they could be used for funding managed retreat more comprehensively. In addition, insurance policies can be structured to help facilitate managed retreat. This could, for example, include designing insurance policies with buyout precommitment clauses, in which property owners pre-commit to future relocation should a damaging event occur.

Policy highlights:

1. Managed retreat, a strategy where people and infrastructure are permanently moved from a disaster-prone area, may often be the best strategy to protect people and reduce long-term disaster risk.
2. Traditional funding models for managed retreat, which mostly rely on government-sponsored buyouts, may not be sufficient.
3. Insurance can affect managed retreat incentives, feasibility and efficiency; it can be designed to facilitate successful implementation of managed retreat programs by influencing disaster exposure and relocation incentives, affecting the scale and speed of managed retreats.
4. Insurance mechanisms can be utilised for managed retreat funding, possibly covering not only damage-related compensation but also, through new insurance models, they could be used for funding managed retreat more comprehensively.

Keywords: Disaster insurance, NHC, NFIP, managed retreat, climate adaptation

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1. Managed retreat and disaster insurance

Disaster risk is increasing in many places. This increase is driven by factors such as climate change, which is altering the frequency and intensity of climate-related natural hazards, and population and economic growth, which lead to more people and assets being exposed. In many highly exposed areas, especially along coasts, recurrent disaster events keep destroying lives and infrastructure. In other areas, such as in low-lying estuaries and in riverine floodplains, the increase in disaster risk is expected to accelerate in the future as the intensity of coastal hazards increases due to rising sea levels, and episodes of extreme rainfall are expected to become more frequent. In some of these areas, *managed retreat*, a strategy where people and assets are permanently moved from a disaster-prone area, may be the best and most affordable strategy to protect people and reduce risk in the long run.

In the relatively limited number of cases where managed retreat has already been implemented (Hino et al., 2017), it typically involved the government (in some form) financially compensating property owners for the loss of their properties. Therefore, these programs are associated with very high fiscal costs per displaced person, and very high total costs for large-scale retreats. Notwithstanding the high costs, in many cases this strategy may still be the most cost-effective in the long run, as future disaster losses and defence costs in the 'retreated' area will have been avoided, and these areas can in some cases be utilized for natural defence of nearby locations.

The financial arrangements that underlie or that should underlie managed retreat have only been examined infrequently (Mach, 2019; Noy, 2020; Thaler, 2021, Thaler and Fuchs, 2020). In different locations, the mix of household, philanthropic, commercial, local government, and central government funding devoted to these programs may be very different. Even more limited focus has been paid to the role of insurance: How does the presence of insurance affect managed retreat incentives and feasibility? How can insurance be designed for efficient implementation of managed retreat programs? And how can it support funding them?

Insurance is relevant for managed retreat in multiple ways. Insurance availability and affordability influence people's decisions on where they live, thus affecting risk exposure and consequently the potential need for managed retreats and their scale. Insurance influences whether people decide to rebuild in the same place

or relocate somewhere else following a disaster event, affecting people's willingness to accept managed retreat or signalling to them that managed retreat may be necessary. Existing insurance arrangements are also relevant for the design of managed retreat compensation schemes, as insurance-related factors such as insurance cover and its level can be used to determine compensation eligibility or amounts.

Insurers can be involved in the implementation of managed retreat by conducting risk assessments or related tasks. Insurance policies can be designed so that they better accommodate the option of managed retreat, which could include designing policies with clauses for managed retreat in which property owners pre-commit to relocation should a damaging event of a given magnitude occur. Insurance can also be employed for managed retreat funding. Disaster insurance payouts for property damage can be used as part of the compensation offered to property owners for selling their properties to the government, thus lowering the fiscal burden of these programs (e.g., Noy, 2020). Furthermore, insurance schemes could be designed to enable insurance-linked managed retreat funding more comprehensively, for example through targeted levies, covering also the managed retreat costs which are not related to property damage.

In this report, we review and discuss the involvement of insurance in managed retreat. Sections 2 and 3 deal with the effects of insurance on disaster exposure, vulnerability, and relocation incentives. Section 4 reviews the ways in which insurance can be involved in managed retreat funding. Section 5 discusses the design of insurance policies which can better accommodate and enable managed retreat. Section 6 briefly discusses potential insurance considerations after a managed retreat is declared, and Section 7 concludes.

2. Insurance, moral hazard, and risk assessment

Factors related to traditional disaster indemnity insurance, such as availability, affordability and the specific contractual arrangements of insurance policies (especially exclusions) can affect the need, feasibility and scale of managed retreats through their effect on exposure and vulnerability to disasters. The availability of affordable disaster insurance in highly exposed areas may incentivise people to occupy these areas and reduce their willingness to relocate (O'Hare et al., 2016). This increases disaster risk exposure and consequently the need for and the scale and costs of eventual managed retreats.

The availability of affordable insurance in highly exposed areas is typically enabled by government subsidies or cross-subsidization from those insured households which reside in less exposed areas (Ben-Shahar and Logue, 2016). In the US, the subsidized flood insurance provided through the National Flood Insurance Program (NFIP) has incentivized the continued occupation of flood-prone areas (Bagstad et al., 2007; Craig, 2019; NASEM, 2024). For example, local NFIP availability was linked to more development and higher population growth in areas highly exposed to floods, causing a 5% increase in population per one standard deviation increase in historical flood risk, according to Peralta and Scott (2024). The participation of coastal communities in the NFIP may have increased single family housing permits in these communities by roughly 50% between 1960 and 1992 (Cordes et al., 1998). In Pittsburgh, flood insurance subsidies were estimated to have increased the housing stock by 8.1% (Colby and Zipp, 2021). Flood insurance availability has also been shown to increase population growth in flood-prone areas of Europe, especially in areas with higher degrees of flood risk cross-subsidization (Tesselaar et al., 2023). Similarly to flood insurance, cross-subsidisation of wildfire risk in the US, which partly stems from historical state insurance regulations limiting premium increases, may have contributed to the continued expansion of development in the wildland-urban interface (Walls and Wibbenmeyer, 2025).¹

On the flip side of affordable disaster insurance spurring development in highly exposed areas and exacerbating moral hazard, depending on the design of the policies, insurance can also have the opposite effect. Insurance-related disincentives to occupy these areas can be provided through higher insurance costs (Surminski, 2014), or through other insurance-related regulation, such as building code and compliance requirements. The participation requirements of the NFIP disproportionately increased construction costs in high-risk coastal areas. In Florida, this may have contributed to a shift of development away from coastal counties to inland counties (Browne et al., 2019).²

¹ A similar moral hazard can arise when the public perceives a government commitment to post-disaster buyouts of damaged property. Even in the absence of a policy guaranteeing such buyouts, repeated government interventions after past disasters can create an implicit expectation of future support, leading households to perceive buyouts as effectively guaranteed.

² Some other studies fail to find conclusive evidence regarding the effect of the NFIP on development. A review of 32 studies did not find sufficient empirical evidence to support the idea that the NFIP fosters development (Evatt, 2000), and a survey of homeowners in the coastal counties of North Carolina did not find evidence to conclude that the homeowner's failure to plan for coastal retreat is attributable to their expectation of insurance covering potential losses (Javeline et al., 2022).

Private insurers' behaviour and resources can be important for managed retreat planning. In particular, insurers' decisions about where to withdraw coverage can provide early signals of locations where managed retreat may be warranted.³ Managed retreat planning can also benefit from risk assessments conducted by the insurance sector, as insurers have developed extensive data records and sophisticated risk assessment methods that are often more advanced than what governments have easy access to. Such inputs can also be valuable in buyout eligibility determination, especially in jurisdiction where private disaster insurance is still active. Insurers, however, make different assumptions, have different risk thresholds, and typically prioritise modelling of asset risk rather than mortality/health risks associated with disasters. Additionally, their short-term horizon, as they typically only provide cover for one year ahead, is at odds with any longer-term social perspective (He and Faure, 2023). Thus, it is not clear that their considerations align well with the long-term perspective that is required for assessing the desirability of managed retreats.

3. Insurance and relocation incentives for homeowners

Insurance availability and affordability can affect people's willingness to participate in managed retreat. In the US, flood insurance take up rates were found to have a negative impact on property buyout rates in a study using nationwide data (Miao and Davlasheridze, 2022), and NFIP cover was identified as the only significant predictor of the decision not to relocate after flooding in the city of Corvallis (Gomez-Cunya et al., 2024).⁴ Consequently, some have proposed that the NFIP should be amended so that it better encourages managed retreat (e.g., Adler et al., 2019; Hayat and Moore, 2015; Pappas and Flatt, 2021).

Conversely, where disaster insurance is unavailable or unaffordable, households are disincentivised to remain in highly exposed areas where they face the possibility of uninsured losses. In County Galway, Ireland, lack of insurance access acted as the main driver of demands for relocation following the 2009 floods. After government intervention in the insurance market to improve insurance availability was rejected because of high costs, relocation emerged as an alternative strategy to resolve the expectation of

³ For example, in Aotearoa New Zealand, the information from private insurers about which areas or properties they may retreat from was used to determine buyout eligibility following the 2023 North Island Weather Events.

⁴ Interestingly, in Turkey, earthquake insurance cover was not found to influence relocation willingness (Özdemir and Mızrak, 2023).

high future uninsured losses (Tubridy and Lennon, 2021). The potential effects of disaster insurance unavailability to reduce exposure, incentivize relocation, and adjust asset prices to account for the risk they face, however, may be overshadowed by its several negative social and financial implications. These can include sharp reductions in property values, material hardship for affected households, increased fiscal costs of post-disaster retreats, and the chance of ‘unmanaged’ or ‘unplanned’ chaotic retreats (EWG, 2023; Hanna et al., 2019; Neal et al., 2005).

Peart et al. (2023) mention that insurance should ideally be maintained until managed retreat is implemented or possibly withdrawn once a buyout offer is made. The latter approach could also help incentivise retreat. In Moos, Germany, limits on insurance cover once a property owner has received a buyout offer were used to incentivise households’ participation in a retreat program. The residents that refused to participate were consequently excluded from private flood insurance cover (Walsh et al., 2023).

Ensuring that insurance is maintained until managed retreat is implemented, however, may require government intervention. Because most insurance contracts are one-year contracts, insurers can stop providing insurance cover within a year if they perceive the probability of damage to be too high, leaving households and communities uninsured when hazard frequency increases above a given threshold (He and Faure, 2023). Intervention to ensure insurance availability could take various forms, including mandating long-term contracts, temporary public insurance schemes, or reinsurance support – each of these alternatives has its own upsides and downsides (Noy and Uher, 2024). Since the liabilities of the public insurer for these properties may be quite large, it may be politically and financially wise to cap them (e.g., limit the amount insured per property).⁵ A related dilemma is how much of these insurance costs (in-between the decision to relocate and the actual relocation) should be imposed on the asset owners, especially if they are required to buy this insurance (or are heavily penalised for not doing so).

Removing premium subsidies and cross-subsidisation, and instituting risk-based insurance premiums, reduces insurance affordability in highly exposed areas. This consequently disincentivises the occupation of these areas, increases the willingness to relocate, and reduces long-term exposure by shifting behaviour and

⁵ Other limits are also possible – for example, offering this subsidized public insurance only to owner-occupied houses (EWG, 2023).

land use patterns. However, a shift to risk-based insurance pricing is technically and politically challenging, requiring sophisticated risk assessment methods, and potential regulatory support to avoid affordability crises (Kousky and Kunreuther, 2014). While the right insurance signals (e.g., risk-based insurance pricing) can be expected to provide retreat-relevant information and incentives, these alone may not be sufficient, given the short-term outlook of insurers. They may need to be coupled with other levers such as land-use change mandates (Boston and Lawrence, 2017; Peart et al., 2023).

4. Insurance Funding Retreat

Discussions on how insurance could be involved in managed retreat rarely focus on managed retreat funding (especially payments to property owners), though managed retreats often include insurance components. Most of the funding typically comes from central government, but regional and local government funds, and philanthropy or self-funding by property owners are also used (Boston et al., 2021; Ajibade et al., 2022).

The use of insurance-linked funding is less common and is usually limited to paying for damages inflicted on insured assets after a destructive event, but novel insurance arrangements could be designed to cover non-insured asset damages as well. Insurance-linked managed retreat funding is less likely to cover other types of managed retreat costs such as indirect income losses or losses to intangibles such as cultural or heritage sites. Insurance-linked funding may raise similar issues and concerns to those associated with government-linked funding, such as issues of eligibility for compensation, the amounts involved, fiscal risks, and unintended distributional and property market impacts (Boston, 2023).

4.1. Damage-related managed retreat costs

The standard way to employ insurance in managed retreat funding is to use insurance payouts for property damage as part of the compensation package offered to property owners for selling their properties to the government and relocating after a disaster. In the US, the property acquisitions which fall under the “duplication of benefits” policy of the Federal Emergency Management Agency (FEMA) require that

insurance payouts provided to property owners must be deducted from the buyout amount (FEMA, 2019).⁶ In Aotearoa New Zealand, much of the cost of the managed retreat which followed the 2010-2011 Canterbury earthquake sequence was linked to insured property damages and therefore covered by the public and private insurers (Noy, 2020). Whether insurance payouts for property damages can be utilized to co-fund post-disaster retreats can greatly affect managed retreat feasibility. In many low- and middle-income countries where insurance markets are largely underdeveloped, managed retreat may be more difficult to implement (Greiving et al., 2018).

Insurance and managed retreat schemes can be designed to better enable the use of property damage insurance payouts for managed retreat funding. This type of funding cannot be used if property owners are not covered by insurance for a given peril, i.e., when property owners choose not to purchase insurance, or when insurance is unavailable (Storey and Noy, 2017; Storey et al., 2024). To mitigate the former, EWG (2023) proposed that homeowners in areas designated for managed retreat should be required to maintain a minimum amount of disaster insurance cover from private or public insurance, where available, until a managed retreat occurs. This requirement may need to be coupled with measures to mitigate affordability, which is especially challenging for properties designated as likely candidates for managed retreat.

Insurance payouts also generally cannot be employed for post-disaster retreat compensation if they are used to rebuild the damaged properties. Property owners are more likely to use insurance payouts to rebuild their properties in areas designated for retreat if the acquisition process is slow and property owners must deal with uncertainty about whether and when they will be offered a buyout, and about the level of compensation they will be entitled to. In the US, some acquisition offers are made years after damage occurs and after many property owners have already used insurance payouts to rebuild.⁷ This is the case especially with low-income homeowners who cannot afford long periods of temporary housing (Nagra, 2024; Weber and Moore, 2019), and who may also encounter more difficulties with the post-disaster retreat process itself.

⁶ This may not always be the case and a duplicate expense of insurance payouts and a later acquisition of property at fair market value by the community can occur in some cases (GAO, 2022). Also in Aotearoa New Zealand, following the 2023 North Island Weather Events, some insurance payouts used for rebuilding were not considered when calculating the compensation offer, increasing the need for government funding (Auckland Council, n.d.).

⁷ This was the case also during a managed retreat program in Matatā, Aotearoa New Zealand (Hanna et al., 2018; Macdonald, 2019).

For example, during a post-disaster retreat following a 2008 flood event in Iowa, USA, socially vulnerable households were less likely to receive full financial compensation and experienced longer delays in obtaining funds (Muñoz and Tate, 2016). In Aotearoa New Zealand, following the 2023 North Island Weather Events, many homeowners were unable to fully cover the costs of temporary housing and incurred debt (Killick, 2025). Homeowners who have spent their insurance payouts on repairs are less likely to accept eventual acquisition offers since their total compensation amount may be lower than it would have been had they not used those payouts for rebuilding. It is therefore beneficial if acquisition offers are aligned with the insurance claims process and made soon after the disaster event, so that property owners receive an acquisition offer at the time that damage assessments are conducted and claim payments are determined.

In a post-disaster situation, the acquisition process could be sped up, for example, by implementing simpler public-insurer-funded acquisitions with fewer requirements and fewer barriers to implementation (GAO, 2022), or by having property owners pre-commit to buyouts ahead of time, as this would mean that some of the acquisition processes could take place before a relocation-triggering disaster occurs (Hayat and Moore, 2015).⁸

It may also be beneficial if insurance policies are designed so that property owners are not penalised if they elect to not use insurance payouts to rebuild. In some cases, property owners who decide to not rebuild are entitled only to a diminution in value of the insured property, rather than compensation at the cost of rebuilding/repair, which reduces their insurance payout (Hawai'i State Office of Planning, 2019). Where such differences exist, mandating insurers to provide compensation at the full value of the policy in the cases where property owners decide to relocate may (1) decrease the cost of a government buyout when it is implemented, as a higher share of the total compensation cost would be paid by the insurer; and (2) increase property owners' incentives to relocate even in the absence of a government buyout.

A more radical option could be to re-classify insurance payouts from “compensation for loss” to “payment for insured property” in the cases where government-subsidized disaster insurance is being used to repeatedly compensate high-risk properties (Craig, 2019). For example, in the cases where the property

⁸ We discuss buyout precommitments in more detail in Section 5.

owner received at least twice the property market value in insurance proceeds over a certain period (e.g., over a decade), the property would automatically be considered sold to the government.⁹

Insurance payouts for property damage cannot have a significant funding role in post-disaster retreats if only a small amount of damage occurred. These payouts also cannot be employed for anticipatory managed retreats, as no insured damages have occurred. Consequently, anticipatory managed retreats typically involve relatively higher immediate government costs compared to post-disaster retreats, which may incentivise governments to wait until an event has occurred, before offering buyouts; especially as long as private insurance remains available (Peart et al., 2023).

In order to try and incentivize homeowners to keep insurance current (thus alleviating some of the costs of a retreat program), the government can also enact rules that specify that uninsured or underinsured properties receive less compensation (a 'haircut') in the case of a post-disaster retreat decision for their property.¹⁰ The advisability of such a rule also depends, of course, on the reasons some properties do not have insurance; such a rule assumes this is not due to access or affordability challenges.

4.2. Comprehensive funding for managed retreat costs

Novel insurance scheme designs could be used to fund managed retreat costs more comprehensively, including those not related to property damages post-disaster. This would entail a shift from standard disaster insurance models of compensating damage-related property losses to those financing relocation. Various considerations would need to be considered. It would be crucial to specify who will contribute to the funding scheme and how much (i.e., what is the level of subsidization from other insured properties or from the government, and what financial burden is put on those who are relocating). It would also be necessary to ensure that the objectives of loss compensation and retreat funding do not come into conflict. For example, ensuring that post-disaster payouts do not deplete the funds that are built up to cover future

⁹ Craig (2019) argues that such a shift in legal status may be justified by the sub-actuarial nature of insurance premiums.

¹⁰ This was proposed in Aotearoa New Zealand after the 2010-2011 Canterbury earthquake sequence, but a court decision ultimately forced the government to relent and provide the same conditions to both insured and uninsured properties (Kós, 2016). Ideally, such rules should be implemented before a disaster strikes.

anticipatory managed retreat costs (and vice versa) may require setting up possibly separate stand-alone funds for post-disaster compensation and for anticipatory managed retreat.

Whether insurance-linked funding can become the primary means of post-disaster retreat funding, or whether it is complimentary to other funding sources needs to be pre-established. For example, GAO (2022) recommend that, in the US, insurance-funded acquisitions could operate in addition to the mostly government-funded acquisitions implemented using the Hazard Mitigation Assistance program (Pappas and Flatt, 2021).¹¹

Importantly, comprehensive funding of managed retreat through insurance would entail the need to secure additional funds, especially if retreats are implemented at scale. One option is to impose an insurance levy attached to policy underwriting. Such an option would need to be carefully considered due to the levy's social and economic impacts, and its political feasibility. One of the main considerations is whether the levy will apply across all insurance policies of a certain type (including policies in less exposed areas), or whether it will apply selectively to a specific group of insured properties (which will likely substantially increase their insurance premiums). A levy on all insurance policies of a certain type is used in France, where all home, business, and motor vehicle insurance premiums include an added public disaster insurance premium, part of which is a dedicated disaster prevention levy.¹²

Another consideration may be whether the levy is applied at a flat rate, or whether it is based on some metric of relative risk.¹³ Each option has its advantages and drawbacks with respect to fairness, effectiveness, equity, administrative complexity, affordability, and as a tool to incentivise risk reduction. To some degree, these implications mirror those associated with risk-based versus flat-rate disaster insurance

¹¹ FEMA's Hazard Mitigation Assistance program (HMA) includes three grant programs: Hazard Mitigation Grants, Pre-Disaster Mitigation Grants, and Flood Mitigation Assistance Grants (Peterson et al., 2020).

¹² This disaster prevention levy is used to capitalize the Barnier Fund, which was established in 1995 and is used to fund disaster prevention measures including managed retreat (Guillier, 2017; OECD, 2017, 2019). Its original purpose was to finance relocation and expropriation, but over time the range of funded activities expanded to include other prevention measures such as structural protection, vulnerability reduction studies and information campaigns (Larrue et al., 2016).

¹³ A flat-rate levy at approximately 12% of disaster insurance premiums is implemented in France. The disaster insurance premium itself is set at 12% of home and business insurance policies and at 6% of motor vehicle insurance policies (OECD, 2017; 2019).

pricing.¹⁴ Importantly, a flat rate managed retreat levy applied on a risk-based premium will already include an embedded component of relative risk by mirroring the degree to which the underlying premium is risk-adjusted.

The implications of such a levy for insurance affordability need to be carefully considered. Often, low-income homeowners already face insurance affordability challenges, and further premium increases caused by a managed retreat levy may lead them to choose not to insure their properties or to reduce the amount of cover (Boston, 2023). If the levy is risk-based, affordability impacts could be dire especially in highly exposed areas. These affordability challenges could be alleviated, for example, through subsidies, progressive levies (Owen and Noy, 2019), or voucher programs coupled with loan programs for hazard mitigation (Kousky and Kunreuther, 2014).

The disadvantage of using a levy on insurance policies to fund managed retreat is that those without insurance, many of whom may benefit from the implementation of managed retreats, would not be required to contribute (Boston, 2023). While providing compensation for uninsured property owners may lead to moral hazard and raise concerns about fairness, excluding them from being eligible for compensation may lead to checkerboarding¹⁵ and incomplete retreat, and the negative social and economic consequences associated with it. Ideally, these trade-offs need to be carefully weighed, and to the degree that it is possible, quantified.

Another related funding concern, and one which can allow for a more progressive program, is the question of the total costs of a managed retreat. Finding ways to decrease these total costs, for example by making homeowners bear some of the loss in capital value, may allow for a more equitable program, and is thus related to distributive justice concerns in multiple ways (especially if the cost sharing is progressive itself).

Comprehensive managed retreat funding through insurance could be implemented using either private or public insurance. As noted already, using a public insurer is seen in France and, to a limited extent, in the

¹⁴ Flat rates for publicly provided disaster insurance are very common (Noy and Uher, 2024).

¹⁵ Checkerboarding is a pattern of land ownership where vacated properties are interspersed with privately owned and still occupied properties. This has negative effects of community fragmentation and economic inefficiency (e.g., the inability to create continuous flood control areas or increased costs associated with maintaining the provision of local services) (Horn, 2024; Dineva et al., 2023).

US.¹⁶ An expansion of the public insurer's remit necessitates considerations such as clearly defining new responsibilities and objectives, ensuring fiscal sustainability, setting up appropriate behavioural incentives, considering the equity and distributional effects of the scheme, and aligning the new scheme with other disaster risk management policies. The delegation of new procedures and processes would likely require new skills and expertise. The distinct responsibilities of the national and local governments need to be clearly specified, making sure that various tasks are well coordinated between the different levels of the government.

An alternative to funding managed retreat through a public insurer may be the private insurance sector, but this option is even more challenging. Insuring managed retreat through a voluntary private insurance scheme is difficult, as insurers may be reluctant to provide insurance cover because of the high correlation of risk between insured properties, adverse selection, and outcome certainty (Dobes and Chapman, 2011, Kusuma et al., 2019). At some point, once the probability of damage is high enough, private insurers will retreat (Storey et al., 2024).

Another option involving higher regulation would be to provide managed retreat funding through a mandatory private disaster insurance scheme. Boston (2023) considers a scenario where insurers are obliged to provide cover (including cover for post-disaster retreat costs) regardless of the level of risk but are allowed to charge risk-based (actuarially fair) premiums. Average premiums would need to increase, and low-income homeowners may require significant subsidies for such a scheme to be equitable and affordable. The government may have to act as a reinsurer and provide guarantees to insurers to co-fund large-scale retreats, whether anticipatory or post-disaster. This is an implicit subsidy from the government, one that is less transparent and potentially quite large.¹⁷ Such an insurance scheme would likely require long-term

¹⁶ In France, the public disaster insurance scheme serves a double role of providing post-disaster compensation and disaster risk reduction funding. However, apart from a large-scale acquisition program following the 2010 Storm Xynthia, managed retreat in France has seldom been implemented. In the US, the NFIP has been used to fund property acquisitions implemented through the Flood Mitigation Assistance (FMA) and the Repetitive Flood Claims (RFC) grant programs, but these acquisitions account for a relatively small fraction of all acquisitions. The FMA funded around 2,700 property acquisitions at approximately 6% of the total cost of FEMA-funded acquisitions between 1989 and 2018 (GAO, 2020). The RFC was effective between 2004 and 2012 and was used to fund an even smaller share of acquisitions at 123 acquisitions between 2008 and 2012 (Peterson et al., 2020). Funding managed retreat through the public insurer has also been proposed for Aotearoa New Zealand by Boston and Lawrence (2017).

¹⁷ Large subsidies may be very difficult to defend politically and make little sense from a fiscal perspective, so capping these obligations may be necessary.

insurance contracts or regulation, otherwise insurance retreat would occur as soon as managed retreat became a possibility.

The private sector more generally could potentially be involved in financing post-disaster retreat through issuance of insurance-linked securities (e.g., catastrophe bonds) by local governments or insurers. The investor would receive interest payments paid out of insurance risk premiums and a money market return, with gains for the lender (the funder of the retreat) if a disaster above a pre-specified threshold occurs.¹⁸

5. Designing insurance policies to accommodate managed retreat

Other than as a funding mechanism, insurance can be designed to enable and facilitate managed retreat as an option. This can be done regardless of whether retreat is funded through insurance, the government or through other means. It may be possible to design insurance schemes which make retreat, including anticipatory managed retreat, the most appealing option. This can include designing insurance policies with managed retreat clauses, making such clauses mandatory in areas designated for retreat and other policy designs.

Managed retreat feasibility could be enhanced through the implementation of insurance policies with buyout clauses which involve property owners pre-committing to a future property sale under certain conditions, for example, when disaster-induced damage to their property reaches a certain threshold. Such insurance policies would need to be binding also for all subsequent owners of the property. Setting the damage threshold high (e.g., 60% of the dwelling's replacement value) would provide certainty to property owners that buyouts would not happen unless their property is significantly damaged.

Where disaster insurance is voluntary and property owners can choose between a policy with or without a buyout clause, the adoption of buyout precommitments may need to be incentivised. This could be done, for example, by offering premium discounts, a faster buyout process, buyout guarantees or making insurance contingent on accepting the buyout clause. In the US, Hayat and Moore (2015) suggest a system where property owners who opt for an insurance policy with a buyout precommitment receive premium

¹⁸ An alternative model to fund anticipatory retreats with CAT bonds, which involves a complex arrangement in which the cost savings from retreat are quantifiable and retrievable, is suggested by Vegh et al. (2023).

discounts and a guarantee that if their property gets substantially damaged, it will be purchased at a pre-disaster value and at a faster timeline than buyouts implemented through other means. They propose that a buyout clause should only be offered to property owners who 1) live in the most exposed areas, 2) are low- or middle-income, and 3) own properties that are estimated as cost-effective for buyouts and valued at less than the maximum allowable value.

Ando and Reeser (2022) study homeowners' interest in such a contract and find that homeowners would be willing to pay USD 600 on average for a non-insurance agreement where they pre-commit to a buyout in exchange for a faster buyout process (and reduced insurance premiums for the insured homeowners), and that 68% of the surveyed homeowners would accept the agreement if it were linked to insurance. The willingness-to-pay (WTP) for such a contract was affected by the extent of flood risk, and expectations of neighbours' responses. The acceptance of the insurance-linked agreement was higher among homeowners with a higher subjective risk and previous flood insurance claim experience, and among those who perceived the program to have environmental benefits.

A more robust method of implementing buyout precommitments is proposed by Lin (2024), who suggests that buyout precommitments could be made a mandatory feature of insurance policies offered in climate-exposed areas. They recommend that the contract could be structured so that the government, rather than providing a buyout guarantee, has a buyout option which could be realized based on considerations such as funding availability, the history of repetitive loss, the alternative land value as open space or the proximity of other buyout properties. The property owners should be informed on the buyout decision early, ideally within 2 or 3 months following a damaging disaster. Lin argues that offering 90% of the pre-disaster market value would possibly provide property owners with a more than fair return on their property, but at the same time reduce the buyout costs compared to a scenario of full compensation. Similarly to this proposal from Lin (2024), Pappas and Flatt (2021) suggest that property buyout should be a non-negotiable part of some NFIP policies, but that participation could be incentivised by offering buyouts at above market rates. The buyout would still be voluntary, but the property owners would face the choice of either securing private insurance, paying for post-disaster repairs themselves, or accepting public insurance funds for a buyout at above market rates.

Another option would be to make insurance-linked buyout precommitments mandatory only in areas designated for retreat. However, this option assumes that these areas can be defined well in advance, which is often difficult to do (EWG, 2023). In this scenario, once the damage threshold is reached, relocation would be triggered even if it was originally planned for a future date. Peart et al. (2023) mention that such a mandatory scheme could be implemented when insurance cover is provided either through private insurers (if it is still available), public insurance, or another mechanism.

Buyout precommitments may entail various benefits, such as a faster buyout process and reduced uncertainty of outcomes for both property owners and the government. Tasks such as determining buyout eligibility and property valuation could be done before property damage occurs, which may significantly speed up the buyout process and avoid many of the negative outcomes associated with extended buyout timelines (Hayat and Moore, 2015). Incentivising buyout precommitments through premium discounts would increase insurance affordability. Increased buyout participation would reduce post-disaster recovery costs as well as financial exposure to repetitive losses due to reduced disaster exposure (Hayat and Moore, 2015; Adler et al., 2019).

Buyout precommitments may also enhance the long-term planning ability of local governments, as they would be able to better plan for future scenarios of fewer people living in disaster-prone areas. Strongly incentivised or mandatory buyout precommitments would reduce the chance of checkerboarding associated with more voluntary buyout programs, as program administrators would be able to plan for and undertake buyouts in a more systematic manner (Lin, 2024). Buyout precommitments would also ensure that the property owners who agreed to a buyout remain insured and are covered for damages from less severe damage events in the time leading to the retreat itself (Ando and Reeser, 2022). Most importantly, they would help prevent an unending stream of insurance subsidies that are fiscally and socially difficult to justify.

For single-family repetitive loss properties in the US between 1978 and 2015, the average sum of insured damage payments nearly equalled the average property value. For a subset of these properties worth less than USD 250,000, the average damages amounted to 122% of the property value. Moore (2017) calculated that buying out all property owners eligible for NFIP insurance with the buyout clause proposed by Hayat and Moore (2015) may lead to annual savings of around USD 300-800 million from the avoidance of

repeated claims. Relocating the repetitive loss properties could also reduce the costs for insurers and therefore lower the costs of insurance premiums (TFFIR, 2022). Apart from avoiding these direct fiscal costs, such an approach would also provide additional benefits of avoiding other types of flood impacts (e.g., health impacts and indirect economic costs).

6. Once a Retreat has been declared

What happens to insurance once a property or community has been designated as a future target of managed retreat? Ideally, insurance should be maintained until the retreat is implemented, but it is likely that private insurance will retreat well ahead. In that case, insurance may need to be provided through a public scheme. The implementation of such a temporary scheme raises important questions including those regarding the degree to which the premiums should be risk-based, whether the scheme should be funded solely by the homeowners or through additional mechanisms, or whether limits on insurance coverage are imposed to reduce fiscal risk.

All these questions also raise equity and distributional concerns that could be exacerbated throughout the process of retreat. If only the wealthy can afford insurance after a declaration of retreat, what happens to poorer households if they are hit by an event, for example? Since often the financial incentives to pursue retreat are stronger for poorer households and poorer communities (as more wealth is more cost-effective to defend) these potential concerns can become acute.

7. Conclusion

As communities in highly exposed areas face mounting challenges due to sea level rise and increasingly frequent and severe extreme weather events and the need for managed retreat grows, traditional funding and implementation models for managed retreat which mostly rely on government-sponsored buyouts may no longer be sufficient. New and innovative ways of funding and implementing managed retreat need to be developed, and insurance-based solutions have the potential to play a constructive role.

Insurance is relevant for managed retreat at multiple stages of the retreat process. Insurance-related factors shape the pre-retreat environment in terms of disaster exposure, which affects the need for managed retreat.

Importantly, subsidized insurance, which allows property owners to avoid paying the full cost of living in highly exposed areas, incentivises people to occupy these areas, reduces their relocation willingness, and therefore reduces the feasibility of voluntary retreats. Risk modelling by insurers, however, can be instrumental in identifying properties for retreat, though their short-term horizons dis-incentivizes them from identifying future risks.

As regards managed retreat funding, traditional disaster insurance arrangements can be employed so that insurance payouts for property damage are used as part of the compensation offered for post-disaster retreats, reducing the amount of funding required from governments or other actors. Insurance schemes, managed retreat schemes, and the wider regulatory environment in which these schemes function can be crafted so that such an option is encouraged.

Importantly, novel insurance arrangements could be designed to fund managed retreat costs more comprehensively, including the costs not related to property damages. This type of comprehensive managed retreat funding through insurance represents a shift from how insurance traditionally functions and entails various complex considerations as regards the design of such a scheme. Importantly, it needs to be specified who will contribute to the funding scheme and to what degree. The option of implementing a managed retreat levy on insurance policies needs to be carefully considered. Various levy designs will have different implications and trade-offs for fairness, effectiveness, equity, administrative complexity, insurance affordability, and as a tool to incentivise risk reduction. How the levy is used (for which purposes) is also important in determining the incentives it creates. Other important considerations associated with a comprehensive managed retreat funding scheme may concern whether the scheme is operated by the public or private insurers, eligibility criteria or levels of compulsion.

In sum, the involvement of insurance mechanisms in managed retreat offers both opportunities and challenges for enhancing disaster risk reduction and climate adaptation outcomes. Insurance could provide a structured and pre-financed means of funding property acquisition, relocation, and even broader retreat-related costs, and help facilitate more predictable and timelier implementation. However, such schemes need to be crafted carefully, so that their implementation does not create affordability barriers and exacerbate existing social inequalities. Ultimately, leveraging insurance for funding and implementing

managed retreat will require the coordination between insurers, governments, and communities to align financial incentives with equitable and sustainable retreat outcomes.

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