



Managed Retreat in a Changing Climate

Climate change poses new challenges to our existing systems for natural hazard risk management. To reduce risks from floods, droughts, and hurricanes, we have built levees, imposed water efficiency regulations, and reinforced infrastructure. However, rising seas and heavier rainfall events will increase the likelihood that today's levees are overtopped. Shifting shorelines will threaten more houses and lives. Novel approaches to managing these risks may be needed to sustain safe, prosperous communities.

One means of protecting communities from natural hazards has yet to be deployed at scale: managed retreat, the strategic relocation of people or assets or abandonment of land. Managed retreat reduces risk by reducing exposure. Fewer people and assets are in the area affected by the hazard, decreasing the potential for damage. Unlike other risk reduction measures, such as elevating houses or constructing protective measures, managed retreat has been used relatively infrequently due in large part to a number of barriers.



An aerial view of Kivalina, Alaska. Kivalina is one of several Alaskan villages seeking to relocate due to repeated flooding and erosion.

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Barriers to managed retreat

Numerous political, cultural, and institutional barriers exist to retreat. These include:

1. **Attachment to place:** Loss or relocation of homes can take an immense emotional and social toll, sometimes making retreat unpalatable both personally and politically.
2. **Development incentives:** Once structural protection such as a levee is built, development tends to increase behind it, which in turn increases incentives to keep the levee in place. This cycle is known as “the levee effect,” and it makes retreat a particularly tricky option where protective measures have already been undertaken.
3. **Spatial scales:** While most risk reduction measures only protect the locations in which they are implemented, retreat in one location can significantly benefit linked areas inland or downstream. When local institutions govern natural hazard risk management, this possibility is less likely to be noticed or utilized because it requires a larger spatial scale to be considered.

4. Costs over time: Managed retreat can have high upfront costs because of the need to relocate existing assets, but once relocation occurs, there are minimal recurring financial costs. Other risk reduction measures tend to have lower upfront costs but higher recurring maintenance costs. The evaluation of managed retreat depends on the timescale and discount rates used in cost-benefit analysis.

Mapping the landscape of managed retreat

An analysis by Stanford researchers Miyuki Hino, Chris Field, and Katharine Mach synthesizes global experiences with managed retreat to date. The comprehensive examination of past experiences captures common drivers and barriers and highlights the diversity of contexts in which managed retreat has been applied.

The study evaluates 27 cases of managed retreat that each involve two or more parties (typically a government agency and the residents at risk). In these experiences from all major world regions, approximately 1.3 million people have been relocated to date. Such efforts have been initiated in response to a variety of natural hazards, ranging from tropical storms and tsunamis to riverine floods and coastal erosion. The research finds that the wide-ranging set of examples can be framed and analyzed as a series of interactions between two parties: the residents at risk, and the implementing party, often a government agency facilitating the retreat process. Examining these two parties' perspectives helps unpack observed differences in likelihood of retreat occurring and the process of implementation (see conceptual model on Page 3).

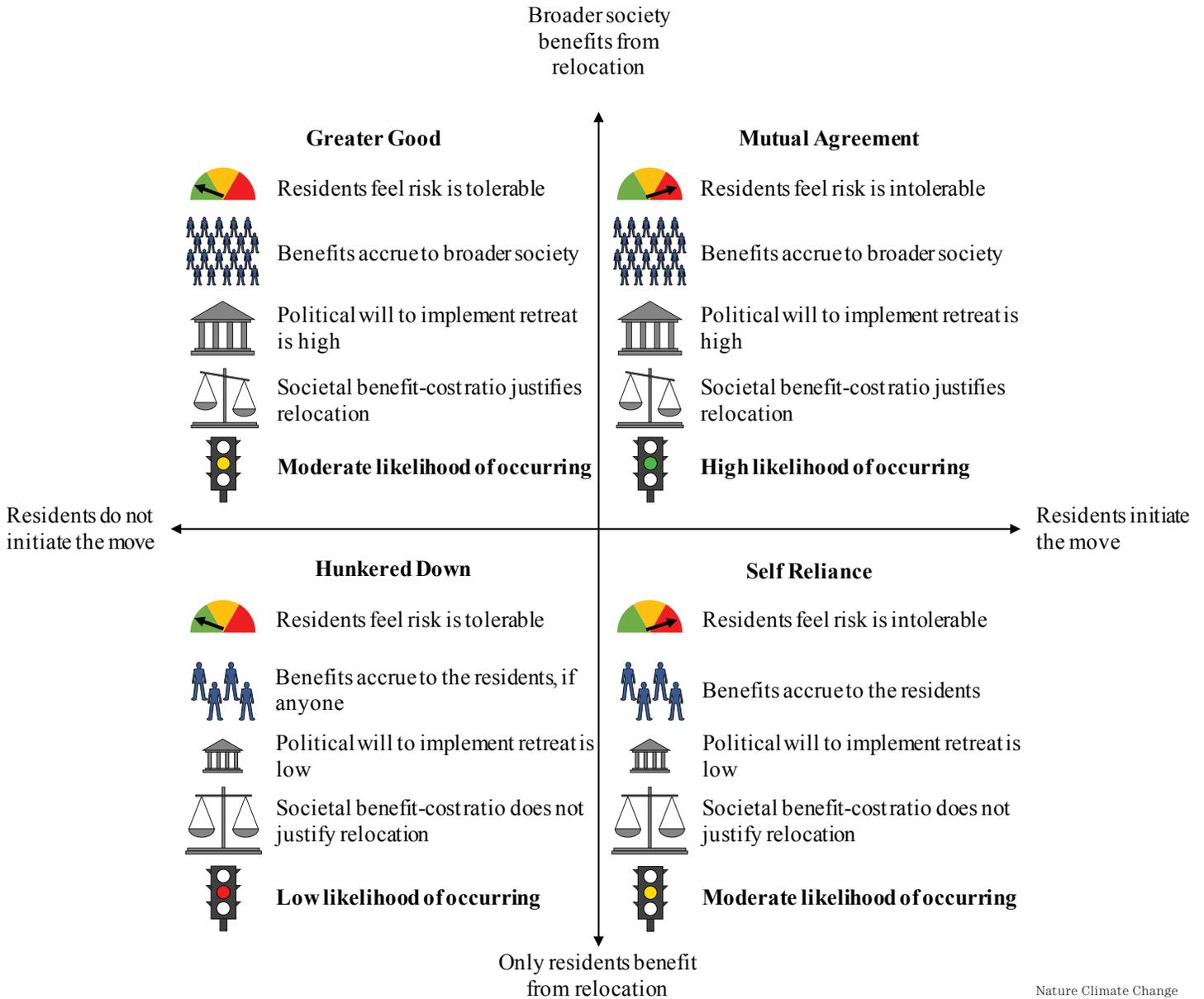
Two examples illustrate the diversity of managed retreat scenarios. In Alaska, the villages of Newtok, Shishmaref, and Kivalina have long sought to relocate away from eroding coastlines and damaging floods. Despite the residents' willingness and unity, over a decade of effort has resulted in little progress. This lack of progress can be attributed largely to the lack of financial support for this project from the implementing party. While various government agencies at state and federal levels have acknowledged the residents' desire and need

to move, the relocation has not been funded due to numerous political and institutional obstacles, such as the relocation's relatively low benefit-cost ratio. In the Netherlands, on the other hand, the community of De Noordwaard had no desire to relocate, and in fact was already protected by a dike system. However, lowering the dikes around this community so that it would serve as a floodplain during high river flows could greatly increase protection for other communities downstream. As a result, the government was highly motivated to implement the project, negotiating with each household in De Noordwaard. Ultimately, the project was completed in just a few years.

Policy considerations

Managed retreat will not be suitable for all locations, but it is a valuable risk-reduction measure to consider in conjunction with other options such as seawalls and elevated infrastructure. When under consideration, managed retreat can and should be used to yield a variety of social, economic, and environmental benefits in addition to reducing risk to communities from natural hazards. For example:

- **Retreat can lower spending on infrastructure maintenance and post-disaster rebuilding; it can also enable ecosystem restoration that protects adjacent areas from floods and erosion.** These potential benefits to broader society, in addition to the direct effects on residents relocating, should be considered when evaluating managed retreat.
- **Thoughtful pre-disaster relocation planning reduces the time pressure and emotional stress that is characteristic of post-disaster response efforts, such as the post-disaster property buyouts of FEMA's Hazard Mitigation Grant Program.** Facilitating community-scale relocations, whether before or after disasters, may make relocation more appealing to those at risk, as compared to the current practice of property-level buyouts. It may also improve relocation outcomes by preserving valuable social networks.



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Figure 3. A conceptual model of managed retreat. The two axes represent the residents' initial desire to move and the scale of beneficiaries. The scale of beneficiaries reflects the perspective of the implementing party. Each quadrant features a different set of social and political characteristics which contribute to the likelihood of retreat taking place.

- **Strategic relocation planning can acknowledge and manage intangible costs, for instance by prioritizing community input and ownership.** Different value systems are relevant to associated decision making. Managed retreat carries potential consequences that are rarely considered in project evaluations, such as cultural heritage loss. Decision-making processes that acknowledge such intangible costs are needed to avoid some of the seemingly intractable challenges that have been encountered.
- **Evaluating possible outcomes decades into the future can suggest areas that may be candidates for managed retreat.** Such foresight can incentivize development in low-risk locations and enable strategic, context-specific development in high-risk locations. For instance, governments may choose to issue temporary development permits in high-risk areas to preserve the option of managed retreat in the future, or they may monitor risk levels and gauge residents' risk perceptions in areas where retreat may become necessary or desired. The UK's Shoreline Management Plans offer one example of such forward planning.

Summary

Numerous communities around the world are already pursuing managed retreat, and it may increasingly become the preferred or necessary option as climate-related risk increases. However, current policies and decision-making processes are, in many cases, ill suited for considering managed retreat alongside other risk

management strategies. The outcomes of managed retreat depend on case-specific contexts and processes. In some cases, managed retreat can limit long-term spending on disaster risk management, preserve community networks, and restore naturally protective ecosystems. However, the potential consequences of disruption to economic activity, division of neighborhoods, and emotional distress must also be recognized and taken into consideration. Anticipatory planning and novel approaches to managed retreat may help avoid some of its potential pitfalls and enable greater community ownership of the process.

This brief is based on the paper "Managed retreat as a response to natural hazard risk," by Miyuki Hino, Christopher B. Field, and Katharine J. Mach in *Nature Climate Change*, available at: <http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3252.html>. All of the material in this brief is discussed in depth in the paper. Please also refer to the paper for citations and other helpful references.

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