18. EVALUATING CLIMATE RISKS IN COASTAL ZONES

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Rising sea levels as a result of climate change pose complex risks for developed and developing nations alike. Local policies for adapting to higher sea levels need to be crafted, even if the international community is successful in controlling greenhouse gas emissions.

Coastal zones around the world have already experienced some of the most adverse consequences of climate change. Global sea-level rise over the last century has, for example, contributed to increased coastal flooding and erosion as well as widespread ecosystem loss. Extreme weather events have done much of the damage. About 120 million people were exposed to tropical cyclones between 1980 and 2000, and more than 250,000 of them died as a result. The U.S. State Department estimated that close to 100,000 people died as a direct result of the cyclone that stuck Myanmar in May 2008.

Future climate change will produce more of the same over the coming decades. We can expect increased risks from coastal storms, higher sea surface temperatures, altered precipitation and runoff patterns, and more acidic oceans. It is important to note that these impacts will vary considerably across regions—and with increasing unpredictability. Consider the plight of corals scattered around the globe. They are all vulnerable to thermal stress and most have low adaptive capacity. This is not really news, but the increased pace at which corals around the globe have been affected is surprising.

Coastal wetland ecosystems, such as salt marshes and mangroves, are especially threatened where they are sediment starved or constrained on their landward margin by development; here we are learning more about these systems' amplified vulnerabilities as they face multiple stresses from humans and other natural sources. Changes to coastal ecosystems also have serious implications for the societies whose welfare and livelihoods depend on the services that they provide. Indeed, we are only now beginning to understand the degree to which the associated socioeconomic costs will escalate as a result of climate change.

To be sure, the impact of climate change on coasts is exacerbated by elevated pressures from human activities, especially when they are concentrated in populated deltas (and even more so in Asian megadeltas), other low-lying urban areas, and narrow atolls. The enormous loss of life in Myanmar can, for example, be attributed in large measure to degraded mangroves that could have provided some protection from the enormous storm surge. While physical exposure can significantly influence vulnerability for both human populations and natural systems, diminished or nascent adaptive capacity is often the most important factor in creating a hot spot of human vulnerability.

The traditional view holds that adaptive capacity is largely dependent upon development status. However, there are many other underlying determinants of adaptive capacity that are only now being explored: the availability of social and political capital, the ability to manage risk, the ability to separate signal from noise in support of response decisions. Developing nations may have the political or societal will to protect or relocate people who live in low-lying coastal zones, for example, but their vulnerabilities could be much greater without the necessary financial and decision-support capacities, as well as widespread recognition of a causal link between human activity and climate-borne risk.

Adaptation costs for climate change are much lower than the damage costs that would result if no adaptive measures were taken for most developed coasts. Indeed,

coastline protection decisions in developed countries can, if exercised properly, reduce economic risk by as much as 75 percent. Conversely, high-end sea-level rise scenarios, combined with other climate changes (like increased storm intensity) and insufficient adaptive capacities, will make some islands and low-lying areas completely uninhabitable. Over the long term, unmitigated climate change could overwhelm the adaptive capacities of even the wealthiest coastal communities.

Coastal vulnerabilities clearly make the point that risk can increase over time for one of two reasons (or both). On the one hand, assessed risk may grow over time because evolving scientific knowledge supports increased confidence that an impact will occur. On the other, even if science has nothing new to say about relative likelihood of a particular impact or manifestation of climate change, risk can also grow because recent research and experiences have shown that consequences have heretofore been understated. Take, for example, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change on increased risk from coastal storms. The natural science community was, in 2006 (and still is, for that matter), debating whether or not a warming planet will mean an increase in the intensity and frequency of extreme storms. The social science community meanwhile learned from Hurricane Katrina (among others storms) that the assessed consequences of such storms have grown, because multiple stresses have been recognized and because even potentially strong adaptive capacity (such as that available to a big city in a wealthy country) is not always utilized to even a fraction of its full potential. Clearly, the risk of coastal storms can be assessed even higher than when the Third Assessment Report was released in 2001.

Our growing understanding of coastal vulnerabilities also supports the inclusion of "sustainability, equity, and attitudes to risk" in the iterative climate response plan described above. Development pathways matter because they dictate in large measure potential progress in building adaptive capacity and placing sustainability on par with economic growth in the calculus of development planning. But like everything else in the climate game, these connections do not work in only one direction; sustainability can affect climate impacts, and climate impacts can affect sustainability. Nor are they "linear"; these associations can have kinks and curves that cause abrupt disconnects, or at least alter the strength of the connection. And they always work together; sometimes good ideas on one side of the connection are counterproductive when their effects are evaluated on the other.

Finally, the research and policy communities are now coming to grips with the notion that increased risks associated with coastal vulnerabilities are not confined to the developing world. Even absent any change in storm frequency, sea-level rise can portend dire consequences for major cities in the developed world. For example, the likelihood that the current "every 100 years" flooding event in New York City will become the "every 25 years" event by 2035 is now assessed to be greater than 50 percent.

It is practically impossible to understate the climate risks that coastal zones will face as the future unfolds, almost irrespective of global mitigation efforts over the short to medium run. That said, the research and assessment communities continue to see them as nearly perfect laboratories within which to study the complexity of the interactions of human beings with their environments.

Further Reading

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