Forum

Incorporating resilience into adaptation planning

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Maul's (2015) report on Florida's rising seas is admirable in its emphasis on making tough choices in the face of uncertain future sea level rise projections in order to bolster progress on climate adaptation planning. Because of uncertain sea level projections, Maul is careful to point out that there is no simple solution for coastal managers to choose a value for local relative sea level (RSL) rise for coastal infrastructure planning. Yet, his bold conclusions emphasize the urgent need to move forward with planning in vulnerable coastal regions like southeast Florida, where cities and infrastructure are already within just a few feet of mean sea level. The purpose of this commentary is not to evaluate the scientific rigor of Maul's paper; rather, to analyze the implications of his conclusion that the path forward for climate adaptation is to begin by using linear projections of sea level rise plus a safety factor of at least 2X for decadal scale projects in order to reduce costs. I would like to elaborate on Maul's conclusion by highlighting two key issues that merit greater attention: First, the importance of resilient, flexible planning, and second, the exacerbation of coastal flooding and storm surge due to sea level rise.

Focusing on Flexibility

In the past, the term 'resilience' was typically used to refer to a system's ability to bounce back to some ideal equilibrium state after a disturbance. This view of nature as balanced and stable often led to environmental management decisions which reinforced the dangerous myth that environmental variability could be controlled, and its consequences predicted (Gunderson and Holling 2002). Resilience, in this more outdated sense, promoted adaptation planning that enhanced resistance to change and prioritized becoming more *adapted* to deal with risks like sea level rise by using mostly hard engineering solutions like dikes, dams or sea walls. If or when these engineering solutions were overcome by unanticipated or unlikely disturbance events, the highly adapted system would likely be unprepared to deal with the unexpected consequences. To cite a quote from Harvard Environmental Science and Engineering Professor Daniel Schrag on the topic, "investment in engineering solutions will help, but only for a period of time" (Ireland 2014).

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More recent conceptualizations of resilience, however, embrace the inherent complexity and uncertainty involved in managing social-ecological systems like South Florida, and consider longer-term sustainability. This more appropriate approach to resilience (in the context of climate change) is based on an understanding that nature is dynamic and ever-changing rather than stable. In this sense, resilience refers to "the amount of change a system can undergo and still retain the same controls on function and structure while maintaining options to develop" (Nelson et al. 2007: 398). Hence, more modern planning approaches incorporate resilience by stressing the need to become more *adaptive*, instead of adapted, managing for flexibility, not stability. This means developing a range of possible responses to sea level rise and combining the most appropriate, looking not only at hard engineering solutions, but also at soft engineering solutions (like wetland or beach restoration) and even in some more extreme cases, managed retreat from coasts (Ireland 2014).

Maul's conclusion does, in some ways, promote the more modern, flexible view of resilience. For instance, he notes that choosing a modest linear RSL rise projection with a safety factor of at least 2X should only be done for infrastructure projects that have a relatively short service life. He also acknowledges that even though the rate of sea level rise has been rather steady for over 150 years, these trends could change. However, a problem with this conclusion is that temporary or short-term solutions have a tendency to become permanent ones. For instance, after a structure has outlived its service-life it may be less costly in the short-term to simply renovate that structure rather than demolish or relocate it, even if RSL is found to be increasing more rapidly than predicted. Using the lowest value in the range of RSL projections could also unintentionally set an inappropriate precedent for longer-term planning projects or for projects in other regions where acceleration is occurring at a greater rate.

Storm Surge and Coastal Flooding

When Hurricane Sandy grazed the Atlantic Coast of Florida in 2012, the storm surge combined with a near full moon and seasonal high tides resulted in severe erosion of Fort Lauderdale's State Road A1A. A few weeks later, when strong storms blew in, parts of the road and sidewalk collapsed due to the erosion. In fact, even after the state spent $8.3 million in repairs, the road still had to be permanently reduced from four to two lanes in some places (Turnbell 2014).

While Maul points out in his closing that coastal flooding from tropical storms will be exacerbated by sea level rise, this variable does not appear to explicitly factor into his recommendation for planners. It is unclear whether storm-related coastal flooding is a component of the safety factor of 2X the linear projection, however doubling the linear projection would not seem to account for the potential storm surge and coastal flooding that could occur. In any case, more explicit attention needs to be given to the issues of storm surge and coastal flooding, particularly in Florida, where hurricanes are a relatively common occurrence.

To sum up, Maul's article stresses the importance of moving forward with adaptation planning and action in South Florida which is, indeed, vitally important. However, instead of focusing only on choosing an RSL value to pave the way forward, a greater emphasis should be placed on finding ways to encourage innovation and flexibility in planning. Selecting a value for projected RSL will inevitably be a controversial task, and communities cannot wait for policymakers to agree on a projection before taking adaptive action. Using an adaptive resilience framework will allow planning to begin even in the face of uncertainty, focusing on innovation and experiential learning in addition to engineering solutions. Furthermore, when planning for infrastructure in South Florida, planners need to consider RSL rise in the context of already existing hazards like storm surge and coastal flooding.

References

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