



## The Rising Sea

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## BOOK REVIEWS



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### **The Rising Sea**, Orrin H. Pilkey and Rob Young, 2009

In this relatively short book written for a general audience, coastal scientists Orrin Pilkey and Rob Young warn that hazards associated with sea-level rise are not a remote possibility but are happening now. These rates of sea-level rise will continue to accelerate into the near future regardless of the success of climate change activism in motivating the reduction of global greenhouse gas emissions. In this time of easy access to disinformation on climate change–induced acceleration of the rate of sea-level rise, the authors provide an easy-to-understand review of scientifically accepted facts of the causes of sea-level rise. They expose the antiscientific “manufactured doubt” industry that distorts what otherwise should be unbiased explanations of why sea level is rising and the potential consequences of this rise. The primary messages of this book are that societies must prepare for a changing world, difficult decisions must be made when planning the development of future coastal infrastructure, and ultimately retreat from the shore will be necessary. The actions suggested in this book are consistent with previous work of Pilkey and Young that stresses the need for societies to learn to live with a dynamic coast rather than continuing to rely on engineering solutions to mitigate changes to coastal environments.

The opening chapter outlines the inevitability of sea-level rise and the corresponding increase in shoreline erosion, a process that many communities, governments, and developers continue to ignore. The authors point out that sea level has changed many times in the past; however, the impact of the present “rising sea” is unprecedented due to large human populations and associated infrastructure located in coastal areas. Although many societies will suffer the impacts from sea-level rise, in this chapter Pilkey and Young focus on a few that are most vulnerable to sea-level rise, small Arctic and Pacific island communities. They list several alternatives in dealing with this hazard that will also confront beachfront communities worldwide in the uncertain future of global change.

Chapter 2 provides a review of why sea level is rising. Here, Pilkey and Young explain the difficulties in accurately measuring global temperature. However, they stress that you do not have to accurately measure global temperature to observe that the Earth is indeed warming. The authors cleverly present the compelling cases of retreating glaciers, thinning of Arctic Ocean ice, and rising sea levels as evidence enough. They go on to review several significant factors that control the amount of water in the oceans and the level of the sea. The take-home message is that sea-level rise is not

debatable, as it has already been observed and can continue to be measured.

In chapter 3, Pilkey and Young delve into territory similar to their previous work: the difficulty of predicting nature’s response to climatic forcing, the dependence on mathematical models to predict nature, and the uncertainty of basic assumptions used in these models. This discussion also includes some perhaps excessive criticism of the U.S. Army Corps of Engineers. Among the examples used to prove their major points, Pilkey and Young stress that accurate prediction of sea-level rise and coastal response depends on accurate prediction of human behavior, for example, the reduction of greenhouse gas emission, which is extremely difficult. Thus, they suggest that we apply geologic common sense to the problem of predicting sea-level rise impact on coastal areas instead of primarily relying on the predictive capabilities of potentially inaccurate mathematical models.

In chapter 4, the reader is introduced to the “800-pound gorillas,” the Greenland and West Antarctic ice sheets, which are contributing large quantities of meltwater to the oceans and have the potential to cause catastrophic rates of sea-level rise. Here, the authors again stress the uncertainty of predicting the disintegration of the ice sheets but consider a 2-m rise in sea level for the 21st century as an appropriate planning scenario for coastal development. Although Pilkey and Young acknowledge that this 2-m rise in sea level is well above the scenarios of the Intergovernmental Panel on Climate Change (IPCC, 2007), and is indeed higher than the 1-m rise suggested by the U.S. Climate Change Science Program (Titus *et al.*, 2009), they explain that the possibility of continuing and accelerated disintegration of the ice sheets makes their 2-m planning scenario “cautious and conservative.” What sea-level rise rate should be used as a coastal-hazard planning tool is currently debated among coastal and climate scientists internationally; what is cautious to one might well be considered excessive to others. Additional research and observations may help narrow the range of possibilities in the near future (Allison *et al.*, 2009; Richardson *et al.*, 2009).

In chapter 5, the authors address climate change skeptics and rebut a “noisy minority opinion” that sea-level rise concerns have been overblown. They provide a list of suggestions for nonscientists to consider when reviewing the validity of arguments aired in the news media concerning climate change and sea-level rise. Ultimately, the authors have faith in scientists to tell the truth but stress the need to use common sense when making decisions. Unfortunately, public faith in scientists has been shaken recently by a few scientists at the Climate Research Institute at Great Britain’s University of East Anglia where e-mail communications appear to show that certain climate scientists considered

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destroying data in conflict with their predictions about global warming. The reinforcement of faith in scientists and the scientific method outlined in *The Rising Sea* is perhaps more important now than ever, as nothing in the e-mail exchanges challenge or undermine the consensus findings reached by the National Academy of Sciences, the U.S. Global Change Research Program, or the IPCC.

Pilkey and Young use chapter 6 to paint a rather bleak outlook for the impact sea-level rise will have on coastal wetlands, mangrove forests, and coral reef ecosystems. They suggest strongly that currently anthropogenic impacts may be the primary driving force destroying this “living coast.” They go on to stress that these ecosystems could disappear if we do not plan to accommodate their movement, expansion, or both as sea level rises. They ask, “Will saving these ecosystems be a high enough priority when compared to saving our cities and towns to assure their survival?” This is an important question indeed.

In chapter 7, the authors provide several examples of cities and towns that have “fallen into the sea” due to earthquakes, severe storms, and coastal erosion. They list several key nature preserves that will be seriously affected or destroyed due to sea-level rise, the huge problems faced by atoll nations; deltaic countries; countries with large, low-lying, heavily developed coastal plains; and major cities that are vulnerable to flooding. This chapter leads into chapter 8, which focuses on the Mississippi Delta, an area that has been extremely vulnerable to flooding for centuries, was devastated recently by Hurricane Katrina, and is currently experiencing relative sea-level rise rates of approximately 1 m *per* century, which may provide a view into the future for many coastal areas worldwide. Pilkey and Young go to great lengths to explain that due to the geologic setting of the Mississippi Delta region, scientists and coastal engineers need to educate the coastal communities and coastal planners, emphasize that protection to future flooding cannot be guaranteed, and strongly urge a plan to retreat from the coast.

The final chapter summarizes the overall message of the book and argues that relocation, or retreat, from the coast is likely the most economically feasible response to sea-level rise over the long term. Although scientific assessments have concluded that, regardless of potential policies to reduce emissions of greenhouse gases, rates of sea-level rise will continue to increase for at least the next few decades, if not longer, and people will have to adapt to climate change (Hoffman, Keyes, and Titus, 1983; IPCC, 1990, 1996, 2001, 2007; National Research Council, 1983). This message is successfully outlined in Pilkey and Young’s book through a series of clear, concise discussions. However, I suspect that the response to increasing rates of sea-level rise will likely be a combination of coastal engineering and retreat. Projections of sea-level rise and its effects are uncertain; thus, preparing

now involves spending today for the sake of uncertain future benefits (Titus *et al.*, 2009), never a popular political or economic strategy. Addressing what to do in the coastal zone and when to do it can be supported by providing easy access to data and resources, transferring knowledge of vulnerability and risk that affect decision making, and educating the public about the consequences and alternatives (Titus *et al.*, 2009). In this, I believe that *The Rising Sea* plays an important role in delivering this message to the nonscientist and public.

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