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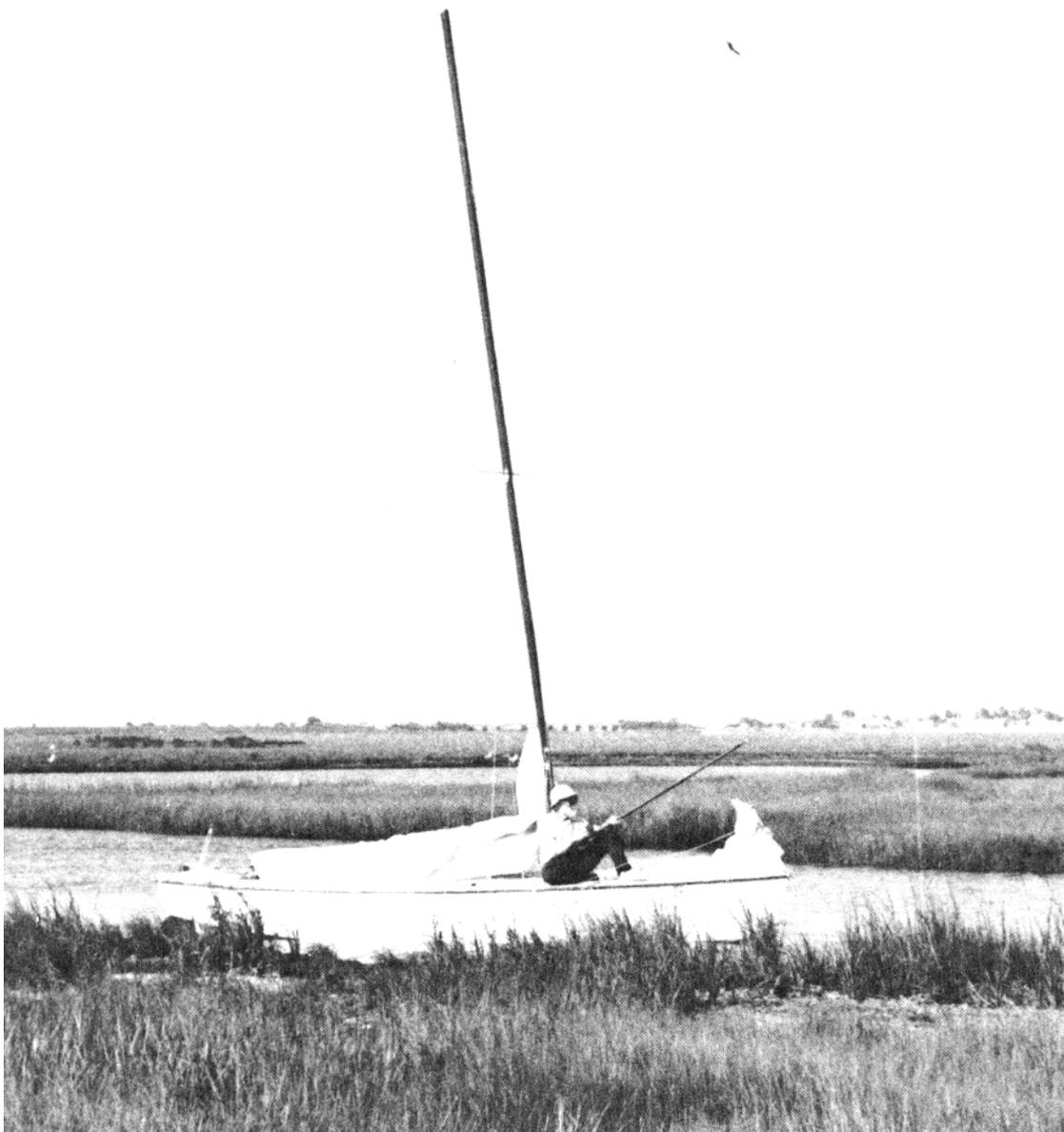
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# Greenhouse Effect Sea Level Rise and Coastal Wetlands



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# **GREENHOUSE EFFECT, SEA LEVEL RISE AND COASTAL WETLANDS**

**Edited by**

**James G. Titus  
U.S. Environmental Protection Agency**

**Other Contributors-**

**Timothy W. Kana Bart J. Baca  
William C. Eiser Mark L. Williams Coastal Scientists**

**Thomas V. Armentano  
Richard A. Park  
C. Leslie Cloonan  
Holcomb Research Institute  
Butler University**

**Office of Wetland Protection  
U.S. Environmental Protection Agency**

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## SUMMARY

Increasing atmospheric concentrations of carbon dioxide and other gases released by human activities are generally expected to warm the earth a few degrees (C) in the next century by a mechanism commonly known as the "greenhouse effect." Such a warming could raise sea level by expanding ocean water, melting mountain glaciers, and eventually causing polar ice sheets to slide into the oceans. Unfortunately, it is not yet possible to accurately predict future sea level. Estimates for the year 2025 range from five to fifteen inches above current sea level, while estimates of the rise by 2100 range from two to seven feet. Although the timing and magnitude of future sea level rise is uncertain, there is an emerging scientific consensus that a significant rise is likely.

To further society's understanding of how to rationally respond to the possibility of a substantial rise in sea level, EPA has undertaken assessments of the impacts of sea level rise on economic development, beach erosion control strategies, salinity of estuaries and aquifers, and coastal drainage and sewage systems. Those studies have generally found that even a one-foot rise in sea level has important implications for the planning and design of coastal facilities.

This report examines the potential impacts of sea level rise on coastal wetlands in the United States. Coastal marshes and swamps are generally within a few feet of sea level, and hence could be lost if sea level rises significantly. Although new wetlands could form where new areas are flooded, this cannot happen where the land adjacent to today's wetlands is developed and protected from the rising sea. Once built, neighborhoods can be expected to last a century or longer. Therefore, today's coastal development could limit the ability of coastal wetlands to survive sea level rise in the next century.

Chapter I provides an overview of the greenhouse effect, projections of future sea level rise, the basis for expecting significant impacts on coastal wetlands, and possible responses. Chapters 2 and 3 present case studies of the potential impacts on wetlands around Charleston, South Carolina, and Long Beach Island, New Jersey, based on field surveys. Chapter 4 presents a first attempt to estimate the nationwide impact, based on topographic maps. Finally, Chapter 5 describes measures that wetland protection officials can take today. This report neither examines the impact of sea level rise on specific federal programs nor recommends specific policy changes.

## CONCLUSIONS

1. *Along undeveloped coasts, a rise in sea level drowns the seaward wetlands and allows new wetlands to be created inland as formerly dry land is flooded.* However, for the rise in sea level expected in the next century, the area just above sea level available for wetland creation is generally far smaller than the area of wetlands that would be lost. Along developed coasts, there may not be any land available for wetland creation.
2. *Sea level rise could become a major cause of wetland loss throughout the coastal zone of the United States.* Assuming that current rates of vertical wetland growth continue and that economic development does not prevent the formation of new wetlands, a five-foot rise would result in 80 percent losses of wetlands in both the South Carolina and New Jersey case studies. In the preliminary nationwide analysis, a five- to seven-foot rise would result in a 30 to 80 percent loss of coastal wetlands.
3. *The coastal wetlands of Louisiana appear to be the most vulnerable to a rise in sea level.* The coastal wetlands of the Mississippi River delta are already converting to open water at a rate of 50 square miles per year because of the interaction between human activities, such as construction of levees and navigation channels, and current relative sea level trends caused by land subsidence. Future sea level rise could substantially accelerate the rate of wetland loss and alter the relative advantages of various options to solve the problem.
4. *The impact of sea level rise on coastal wetlands will depend in large measure on whether developed areas immediately inland of the marsh are protected from rising sea level by levees and bulkheads.* In the Charleston case study, protecting developed areas would increase the 80 percent wetland loss to 90 percent for a five-foot rise. In the nationwide analysis, structural protection would increase the 30-80 percent loss to 50-90 percent.
5. *Factors not considered in this report could increase or decrease the vulnerability of wetlands to a rise in sea level.* This report does not attempt to estimate the change in rates of vertical marsh growth that might accompany a global warming and rise in sea level.
6. *Federal and state agencies responsible for wetland protection should now begin to determine how to mitigate the loss of wetlands from sea level rise.* Outside of Louisiana, the most substantial losses are at least 50 years away. However, today's coastal development may largely determine the success with which wetlands adjust to rising sea level in the future.
7. *The prospect of accelerated sea level rise does not decrease the need to implement existing wetland protection policies.* Numerous federal, state, and local programs are being implemented to curtail the destruction of the nation's dwindling coastal wetlands. Some people have suggested that because these policies protect wetlands that will eventually be inundated, the prospect of sea level rise is a justification for relaxing wetland protection requirements. However, even from the narrow perspective of a particular parcel of land, this justification ignores the biological productivity that these wetlands can provide until they are inundated, as well as the value of submerged aquatic vegetation that could develop after they are inundated. Moreover, from the broader perspective, even if particular parcels are flooded, society has options for ensuring the continued survival of wetland communities as sea level rises, such as allowing them to migrate inland or promoting their vertical accretion. By protecting today's wetlands, existing programs are helping to keep those options open.

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