

MARINE NOTES

SPOTLIGHT ON RESEARCH

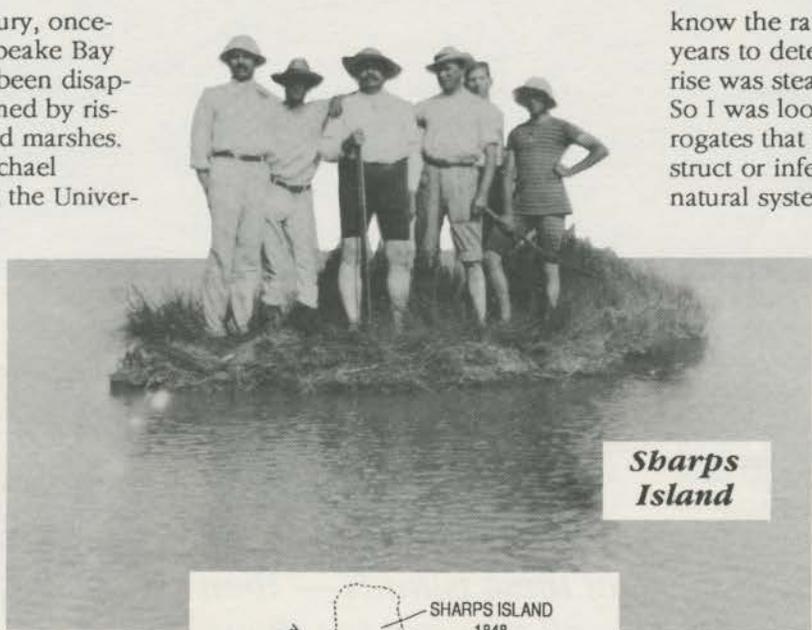
Disappearing Shores — The Bay's Rising Waters

Over this last century, once-inhabited Chesapeake Bay shorelines have been disappearing rapidly, transformed by rising waters into shoals and marshes. The loss of land, says Michael Kearney, a geographer at the University of Maryland College Park, has been accelerating much faster than sea level rise from global warming can account for.

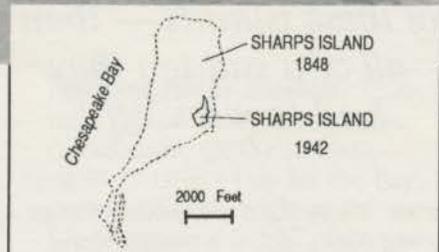
He and Court Stevenson of the University's Horn Point Environmental Laboratories believe that accelerated sea level rise is the result of massive upland and shore erosion and depletion of underground waters.

Though it has been generally accepted that water levels have risen steadily since the 1800s, Kearney and Stevenson believe the rates have increased more rapidly along the Eastern Shore since the mid-19th century. From core dating and tide gauge records which date back to the early 1800s in Baltimore, there is evidence of acceleration in rising waters," Stevenson says. "The problem is that we could not trust existing data."

"You need to be able to track sea level for at least several hundred years to see if there are any trends," Kearney says. "We couldn't use older maps," he adds, "because the Bay's coast is so complex that maps before the 19th century are too generalized: while they indicate changes over time, you cannot be sure if



Sharps Island



those changes are real or cartographic errors."

Moreover, standard radioisotope methods for dating core samples to infer sea level rise could not accurately cover the 300-year period from post-settlement through the present. Carbon dating, for example, is accurate up to the past 500, or perhaps 300 years, to 1690. Lead 210 dating, on the other hand, is accurate back to 100 to 150 years, from 1840 to 1890.

"That left a gap," Kearney says, "between 1690 and 1840 that we could not account for. We had to

know the rate of increase over those years to determine whether sea level rise was steady or was accelerating. So I was looking for proxies, surrogates that I could use to reconstruct or infer sea level rise in the natural system."

The idea for such a surrogate occurred to him when he was reading a history of Talbot County on the dramatic loss of islands in the Bay. The Chesapeake, with its large system of tributary rivers, is one of the few estuaries with a large number of islands — they form in areas where rivers

enter the Bay's mainstem. And most islands, unlike the mainland, do not have sandy beaches to buffer erosion — if water level rises, the shoreline will erode immediately

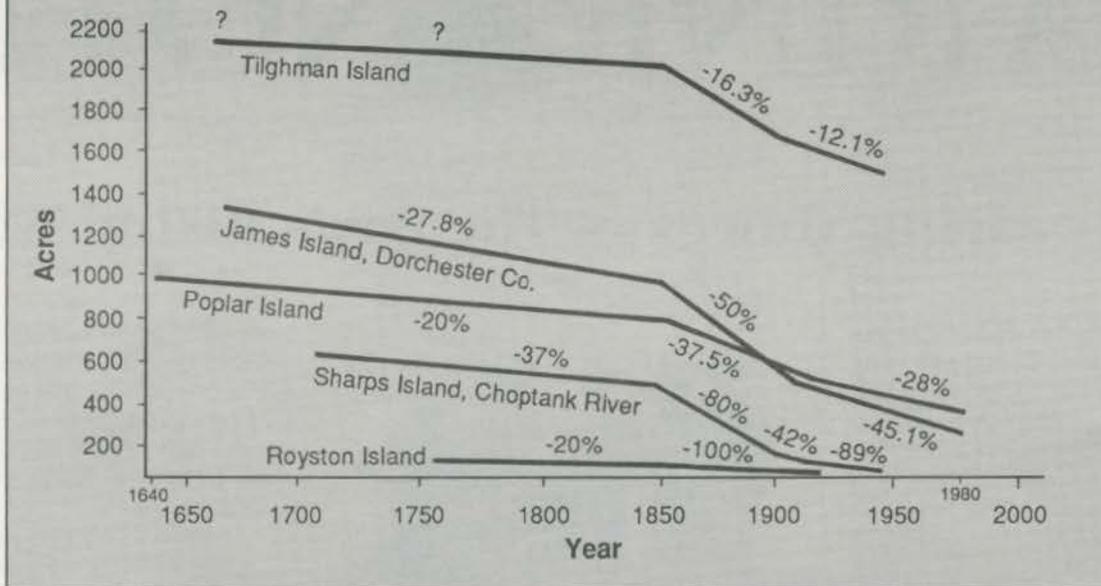
Land in Maryland was settled under separate patents, which were often resurveyed when they were sold — Kearney guessed that the records of these sales in the 17th and 18th centuries would be available in historical archives, in Annapolis and Talbot County.

Sure enough, they were.

Searching those archives, he discovered survey records for some 20 islands, though he selected for analysis only those that did not have shoreline bulkheads or other protection because those would not be subject to shoreline erosion.

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Rates of Land Loss of Maryland Eastern Shore Bay Islands



He found that the rate of change in land area loss during the 1600s and 1700s was fairly low, possibly because sea level rise is slow. "That overlaps the marsh record," Kearney says, and "it is what we would expect given the several hundred year cooling between 1450 and 1850, known as the Little Ice Age."

Between 1850 and 1900, however, he found a dramatic increase in land area lost to marsh or erosion: Sharps Island near the Choptank River, for instance, lost more than 80% of its remaining area, Poplar Island 38%, James Island 50%.

Then, between 1900 and 1950, another decline in land area occurred. "It must have been eroding very quickly and unexpectedly," Kearney says. "People were building on a lot of these islands — then all of a sudden they had to move off."

"When I saw that island data," says Stevenson, "that's when I really got excited: we knew we were seeing accelerated sea level rise in the tide gauge record, but this shoreline data just reinforced that belief."

Worldwide estimates of sea level rise due to climatic warming range between 1.2 and 2.4 millimeters per year. "The increases in sea level rise we are seeing in the Bay are some 3.4 millimeters a year," Stevenson

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says. "There have to be other things going on — global warming alone cannot account for it." Both he and Kearney believe those other things are land erosion and subsidence, or sinking, due to underground water withdrawal.

The sediment load Chesapeake Bay receives, the result of land clearance and development, is massive — some 2 million metric tons a year. Under this weight, Kearney and Stevenson argue, the Bay crust is sinking, literally "downwarping" the bottom and displacing upper mantle material. At the same time, they hypothesize, groundwater withdrawal from surficial aquifers has been increasing for more than a hundred years.

Of course these are hypotheses, Kearney says. "We haven't shown that groundwater withdrawal is the problem, but it is curious," he adds, "that the timing of initial canning operations on the Eastern Shore in the 19th century corresponds to the rapid acceleration in shore erosion of Bay islands as well as increased rates of local marsh loss."

Just what are the relative contributions of climatic warming, sediment loading and groundwater withdrawal to accelerating sea level rise? That is an unknown, Stevenson says, though he thinks warming is only a quarter of the problem. "But there's not a lot of data." The poultry industry, for instance, uses a great deal of groundwater; so do the power plants. With the prospects of increasing development throughout the Eastern Shore, the demand on underground water will continue to increase.

Can the region meet the demand without sinking even lower? Unless steps are taken to find out, Kearney and Stevenson believe, the dramatic loss of Bay islands could be a foreshadowing of the future. ■

—Merrill Leffler
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