BOOKS: EARTH SCIENCES

A Line in the Sand

Tom Drake

After a hurricane swept across Galveston, Texas, in the fall of 1900, killing 20 percent of the population, the city's citizens constructed a gigantic concrete barrier and raised their entire city nearly ten feet. Over 2150 buildings were laboriously hoisted on screwjacks. Less affluent residents merely opened first-floor doors and windows to admit the slurry of sand and moved family life to upper floors. Just 15 years later the new seawall prevented a repeat disaster when another hurricane rolled directly across the city. But the inexorable landward migration of the shoreline continued unabated, leaving the city without its calling card: a wide, sandy beach.

Against the Tide
The Battle for America's Beaches
by Cornelia Dean
Columbia University Press, New York, 1999. 295 pp. $24.95. ISBN 0-231-08418-8.

Over the years, essentially similar but less dramatic beach-loss scenarios have played out on both sides of the North American continent (some 70 to 90 percent of the coastlines of the lower 48 states are eroding). In *Against the Tide* Cornelia Dean, science editor of the *New York Times*, ably describes a number of specific cases and navigates the controversies surrounding the available options for curating the shoreline. The choices are hard: Wholesale stabilization of the shoreline with rock or concrete is often associated with loss of a useable beach. Replenishing beach sand is expensive, even if a supply can be found nearby. And leaving nature to take its course is complete anathema to developers. Each option enjoys much vocal support. The fundamental problem is our collective desire to not only visit the beach but, increasingly, to live on or close to it.

The interplay between acknowledged uncertainty in science and tacit uncertainties in economics and politics forms the bulk of this well-annotated volume. Conducting surf zone science is notoriously difficult. Despite its apparent accessibility, the seafloor beneath the crashing surf is one of the least known parts of Earth's surface. Its shape is often inaccessible to the usual optical and acoustical tools used on land or in the deep ocean. The macroscopic physics of sandy, bubble-filled seawater, the material of fundamental interest, is difficult to study even in the laboratory, due to lack of a suitable small-scale substitute for sand. Solid particles finer than sand stick together and otherwise hinder scale-modeling efforts; thus, understanding of nearshore processes requires going to the beach.

Waves and currents and their propensities to move tremendous amounts of sand have been studied extensively in a series of nearshore experiments over nearly two decades at an otherwise nondescript, straight stretch of beach on the Outer Banks of North Carolina. Dean's coverage of work at "the Duck pier" offers a peek into the nitty-gritty world of beach science. There the U.S. Army Corps of Engineers uses an ungainly, three-story–high wheeled tripod to methodically map the underwater evolution of the beach after each storm, and these findings are often dovetailed with concurrent studies by researchers from around the world. Perhaps ironically, despite clear advances in nearshore science at this unique field facility, the Corps has been vociferously attacked by some for its role in defining the nation's shoreline.

If no retreat, surrender. As recommended in a study by the National Academy of Sciences, early this summer the 1870 Cape Hatteras Lighthouse was relocated 2900 feet southwest from its original site. (Information on the move is available at www.nps.gov/caha/lrp.htm).

Curiously, Dean omits discussion of an ongoing scientific controversy over the origin of beach cusps (regular scalloping of the shoreline that occurs under certain conditions) despite her interesting 1994 *New York Times* article on such cusps and the scientists studying them. The cusps may be self-organized patterns or may be generated by edge waves: invisible-to-the-eye, ankle- to calf-high waves that extend from intermediate depths on the continental shelf to the shoreline (where they are highest) and travel along the coast. Nor does Dean mention chaos theory or complex systems (subjects presented to the public by another *New York Times* science writer, James Gleick); the application of such ideas to beach processes is an active area of research.

Leaving the turbulent world of surf zone physics for the equally chaotic jumble of coastal regulation, it is easy to see why many scientists shun public discussion of beach processes. The chapter "Constituency of Ignorance" outlines the bewildering morass of rules that apparently safeguard short-term economic and political coastal interests at the long-term expense of the general public. Such issues are general ones and are increasingly common in science concerned with processes at Earth's surface. Modification of rivers, creeks, and urban landscapes as well as beaches has become big business. Research-oriented scientists, largely free in the past to pursue scientific goals without public fetters, are increasingly asked to educate the policy-making constituency and to justify their science. Dean plucks important grains of truth from numerous interviews; for example, Douglas Inman, a patriarch of nearshore science, pragmatically advises young scientists that involvement in public policy counts against them in tenure decisions. Such worldly advice might surprise legislators charged with funding state universities.

Drawing a line between land and sea is an abstract intellectual exercise, as any beach lover can attest—nature's notion of a well-defined line between surf and turf is a foamy uprush of sandy seawater far removed from any cartographic ideal. *Against the Tide* straddles, somewhat uncomfortably, the line between beach science and beach policy. Declared to be "a journalist's book, not a scientist's or scholar's," its many minor scientific mistakes unwittingly underscore Dean's plea for increased public input by research scientists. At the same time, it flashes like a metaphorical lighthouse to warn scientists, policymakers, and the public about the state of the shoreline.

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