

relative sea-level rise are proposed, and attention is paid to remedial procedures in diverse geographic sectors of southeast and eastern Asia, the Mediterranean, west Africa, and the U.S. Gulf Coast.

Although this volume appeared almost eight years after the workshop, it is worth noting that about ¼ of the references cited in the 19 chapters date from the 1990's. As a whole, the references provide a useful current bibliographic compilation, particularly for Asian case studies. Most valuable are chapters focusing on less commonly discussed regions: Gulf of Thailand, Indian coast, and mouths of Ganges-Brahmaputra and Yangtze rivers.

The summary chapter by R.H. Meade on river sediment input to major deltas is of note, as are syntheses presenting new data on the Ganges, Yangtze, Nile, Po, Niger, Rhine-Netherlands, and Mississippi deltas. These low-elevation coastal settings, serving as much needed agricultural breadbaskets for their rapidly growing populations, are vulnerable to the combined effects of subsidence and relative sea-level rise.

Although causal effects and exact amount of sea-level rise remain indeterminate, it appears that there has been an average rate of rise of about 1.0–2.0 mm/year during the past 100 years. Interestingly, there seems to be no sound evidence for an acceleration in this rate during this same period. Moreover, authors recognize that eustatic rise, compared to land subsidence, has been small in some of the discussed coastal areas. Only limited information is provided on long-term rates of Holocene land lowering and processes influencing natural isostatic depression, tectonic subsidence and sediment compaction. More information is presented on short-term subsidence rates, particularly in human impacted sectors affected by groundwater extraction such as Bangkok, Shanghai, and the Venice-Po delta. Tide-gauge information is all the more valuable for evaluating such recent, short-term changes.

Estimates of global (eustatic) sea-level rise range from 20 to 70 cm by the year 2065, and from 30 to 110 cm for the end of the 21st century. The Nile and Bangladesh deltas are among the most susceptible and highly populated regions affected by rising sea level and land subsidence; in a worst case scenario, a 1 m rise would negatively impact at least 8 to 15% of the arable land in these two regions. Workshop participants recognize that all hope need not be lost: countries which have adjusted to the reality of relative sea-level rise, such as The Netherlands, are now in a less precarious situation than those which have procrastinated and not taken necessary measures. Strategies include construction of sea walls, protection of dunes, stabilization of barrier islands, and increasing sediment delivery by rivers to the coast. Remedial solutions are not always possible. For example, the rate of delta deterioration can be slowed, but a dying delta lobe cannot be rejuvenated. When all else fails, a switch from agriculture to aquaculture and relocation of population may be required. Of course, the wisest course of action is to address subsidence and sea-level rise problems in timely fashion. Moreover, large-scale projects which lead to a decrease in the amount of sediment supplied to the coast (damming, chan-

nelization of rivers, construction of polders) should be implemented only after the overall fluvial-coastal system has been thoroughly evaluated.

The relevance of this technical contribution is found in some of the questions it indirectly raises as well as with the material actually presented. What explanation, for example, can be given for the reported variation of sea level at 6,000 years ago, estimated from ~2 m above present mean sea level in some areas to >10 m below msl in others? Why has there been so little use made of dated archaeological finds at coasts which would likely enhance measurement of relative sea-level changes through time and interpretation of coastal evolution? How can we use subsurface stratigraphic sections in dated cores to enhance the accuracy of longer-term (at least through the Holocene) subsidence? How will construction of dams and decrease of fluvial flow affect the flushing-out of salts and pollutants in low lying areas such as delta plains and wetlands? By tempting specialists to initiate research that should be pursued, reading this reference is a valuable exercise and a step in the right direction.

Daniel Jean Stanley
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Pilkey, O. H. and Dixon, K. L., 1998. What is a good beach? a discussion based on the review by Francis Galgano of "The Corps and the shore". *Journal of Coastal Research*, 13(3), 976–978. Royal Palm Beach (Florida), ISSN 0749-0208

In his review of [our book] *The Corps and the Shore* (Orrin Pilkey and Katharine Dixon, Island Press, 1996), Francis Galgano seems to agree with the conclusions we make in the chosen case studies (Oregon Inlet, NC, Presque Island, PA, Camp Ellis, ME, Sargent Beach, TX, and Folly Beach, SC) which illustrate the actions and interactions of the U.S. Army Corps of Engineers at the local level. Galgano, however, believes our examples to be "endpoints". He asks why we didn't consider the "many" successful Corps projects, such as the nourishment of Miami Beach. We are said to "lack even handed analysis" ignoring the success stories, particularly Miami Beach. His view of the nation's most visible nourishment project is simplistic, but popular.

Although Galgano says we ignored Miami Beach, we discuss it and its remarkable durability repeatedly in *The Corps and the Shore* (pages 40, 77–78, 85, 86, 91 and 100–101). We believe that most coastal engineers consider Miami Beach to be the premier example of a successful nourished beach and a successful Corps of Engineers project. In our book, we use Miami Beach as a prime example of the old adage that success is in the eye of the beholder. Miami Beach shows that even a "successful" project has many legitimate downsides. Miami Beach's durability is the good news. There is, however, other news that slipped by Galgano.

We believe that the "success of the Miami Beach beach

nourishment needs close examination. Certainly, it is one of the longest-lived beach nourishments in the history of the U.S. But many facets in addition to longevity determine the ultimate success of a nourishment project, including: environmental impacts; recreational value; engineering design achievement; economic viability; storm protection; and political endurance. Miami Beach fails in many of these areas. The ultimate "success" of the Corps' most successful project must be judged in its entire context.

ENVIRONMENTAL IMPACT

- We believe that the long lifespan of Miami Beach is attributable to its very hard packed, almost rock-like composition. The hardness is perhaps due to the packing of the angular calcareous grains of the beach fill. This pavement-like surface has prevented turtle nesting on the beach. Pilkey heard the Jacksonville District, Corps of Engineers colonel tout the fact that the beach would "bring back the turtles." We view the claims by the Corps that nourishment is good for turtle nesting as possibly akin to the claims by the Corps made in the 1950's and 1960's that the fish ladders on the Columbia River dams would save, the now defunct, salmon run.
- Beach fauna and flora are missing. The hard-packed sand alters the nearshore ecosystem—for the better? not likely.
- Dredging offshore resulted in the killing of large numbers of hardground organisms most notably coral heads. Destruction of hardground organisms occurred when the dredge "missed" its designated dredging zone and by the liberation of mud during the dredging processes. Pilkey observed fragments of live coral on the beach during the nourishment operation.
- Since beach emplacement, a continuous stream of calcareous fines is produced in the surf zone as waves grind up the relatively soft and fragile calcareous particles. The muddy surf zone is readily apparent on any day from the air (often on flights into and out of Miami International Airport). This suspended material has continued to contribute to the mortality of offshore hardground organisms.

RECREATIONAL VALUE

- In many places, the hard packed sand and a surf-zone shell lag greatly diminish the recreational value of the beach. The native beach of quartz sand was great for the beach towel recreationist and sand castle builders. Now, it would be easier to build a sand castle on a sidewalk than in some areas of Miami Beach's beach.

ECONOMIC AND ENGINEERING VIABILITY

- Because of the degree of the environmental damage caused by the Miami Beach project, the offshore sand source is no longer considered suitable for future nourishment projects. Thus a new and more costly sand source, not anticipated

in the original beach design, must now be found to maintain the beach.

- Hard packed sand should reduce the storm protection function of the beach. Such a beach will absorb less of the storm wave energy than a "normal" more loosely packed sand beach.
- Beach erosion was not a problem at Miami Beach before the beach was replenished. Beach loss was largely caused by placement of seawalls seaward of the high tide line. The 1960's saw a virtual race among hotel owners to have the most seaward wall, despite the direct violation of the laws of the City of Miami Beach. Why should the Corps have made the case that the federal taxpayer bail out the irresponsible hotel owners?
- All sides agree that the replenished beach has resulted in a New Miami Beach. Large numbers of beachfront buildings have been built, refurbished, or enlarged. The community is more prosperous than ever before. But much more property is now at risk, and many more people are endangered. Someday there will be a very large federal bill for storm cleanup in Miami Beach. Is the short-term increased economic prosperity worth it? Common sense dictates restrictions on new and refurbished beachfront buildings should have accompanied the project and at the very least, limiting high rise construction to the second row.

POLITICAL ENDURANCE

- In 1985 Senator William Proxmire awarded the Corps the Golden Fleece Award for its Miami Beach nourishment project, calling it a ridiculous waste of taxpayers money.
- In the same year, the Florida Shore and Beach Preservation Association bestowed their design award on the beach. They beheld a success.
- The Corps and other replenishment proponents have depicted the Miami Beach project as crown jewel of beach nourishment and promised coastal communities up and down the U.S. Atlantic and Gulf of Mexico coasts that theirs will be the next Miami Beach beach. This approach is misleading but we believe it typifies the Corps' approach to local project sponsors. The Miami Beach project is a unique and unusual project, absolutely different in its behavior compared to other East Coast nourished beaches. However, claims that the Miami Beach success is relevant to other beaches is perhaps appropriate given the Corps' design practices in which the same assumptions of beach behavior are said to work for all beaches.

Finally, we recommend to Messr. Galgano, when it comes to beach nourishment, he should look for the clouds that go with the silver linings. That's the point of *The Corps and the Shore*—all is not as it should be.

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