

## CHAPTER ONE

# INTRODUCTION

---

### *A Perspective on the Coast of California*

**GARY GRIGGS, KIKI PATSCH, AND LAURET SAVOY**

California's nearly 1,100 miles of shoreline have something to offer almost everybody: beaches to escape the heat of the city on a summer day; fertile near-shore waters that support an extensive, but threatened, sport and commercial fishing industry; private coastal property, a place to build a home for recreation or retirement; and some wild and isolated places where one can still find solitude and peace of mind. These are but a few of the shoreline's benefits. The magnetic attraction of California's shoreline is clearly seen in a single statistic: 80 percent of the state's 35 million people now live within 30 miles of the shoreline, and this number continues to increase. In the 20 years since the first edition of this book was published, the state's population has grown 40 percent, from 25 to 35 million, and many of these people have moved to coastal communities. If we divide the state's shoreline evenly among its residents, these 35 million people would each have a little less than 2 inches to enjoy. To make matters worse, only about 400 miles of the shoreline consists of beaches, so if space at the beach is what one is looking for, California residents have only about three-quarters of an inch of shoreline apiece. Unfortunately, the state's residents must share the beaches with 100 million visitors each year, which further reduces their space. California is now the nation's most populous state and ranks as the world's fifth largest economy. The coast has become increasingly popular for homes, condominiums, hotels, and restaurants.

Coastal conflicts, however, are becoming increasingly evident. They are not unique to California, but in a state known for its excesses they tend to be more widely publicized. The newspaper headline *MOVIE STARS' OCEAN FRONT HOMES BATTERED BY WAVES IN MALIBU* is a good illustration. Whereas the early residents of the California coast usually set their homes back a reasonable distance from bluffs or the approach of storm waves and high tides,

the desire today is often to encroach as close as permits or engineering will allow, with homes even built on the beach or cantilevered out over the water (Figure 1.1) or on the side of a cliff or bluff (Figure 1.2).

The continuing growth of California's coastal population, the desirability of living on the shoreline, and the resulting astronomical prices of oceanfront property have led to political pressure and economic motivation to develop much of the state's privately held coastal land. Because of its inherent geological instability, however, the coastline is not the safest place to build. Many diverse forces and processes interact on the coast, making the coastline one of the world's most dynamic environments. Waves, tides, wind, storms, rain, and runoff combine to build up, wear down, and continually reshape the interface of land and sea. Many of California's coastal cliffs are eroding relatively quickly (a foot or so a year), but the entire 1,100 miles of shoreline is actually undergoing erosion.

If we could look back in time about 18,000 years, we would find that the climate was considerably cooler and the Earth was in the waning stages of a period of extensive glaciation. Nearly 11 million cubic miles of seawater was bound up on the continents in the form of ice caps and glaciers that covered a large portion of the Earth's surface. The removal of this seawater from the oceans led to a worldwide drop in sea level of about 350 feet. The shoreline along the coast of California at that time was 10 to 20 miles offshore to the west of its present location. As the climate warmed, the ice caps began to melt and the glaciers retreated. The meltwater flowed into the ocean, and sea level rose globally at an average rate of nearly half an inch a year, flooding all that offshore real estate, until about 5,000 years ago. From that time until the present, the rate of sea level rise has slowed, although it has continued at about a tenth of an inch annually for the past century.

Herein lies the dilemma: Much of California's and the world's people choose to build right up to the edge, even though the location of the edge constantly changes. The dimensions of oceanfront parcels have been surveyed down to a hundredth of a foot, but the Pacific Ocean is 10,000 miles wide and doesn't care much about a few feet either way at the margins.

In the not-too-distant past, the ongoing natural processes of cliff erosion and shoreline retreat either were not recognized, were not completely understood, or were ignored by most coastal builders, developers, and home buyers. Within the past 25 years, however, this problem has come into clear focus along virtually the entire coastline of California. Public and private losses during the 1978 El Niño event, the first serious coastal storms in several decades, amounted to over \$50 million in 2003 dollars (for consistency, all damage or cost values will be reported in 2003 dollars). Five years later, the high tides and storm waves during the El Niño winter of 1983 inflicted over



Figure 1.1 Houses in Malibu built overhanging the beach and on an alluvial fan at the mouth of a coastal stream. Photo by Gary Griggs and Kiki Patsch.

\$184 million in damage to oceanfront property. Damage was not restricted to broken windows and flooding of low-lying areas—33 oceanfront homes were totally destroyed, and dozens of businesses, park improvements, roads, and other public infrastructure were heavily damaged (Figure 1.3). In mid-January 1988 very large waves struck the southern California coastline suddenly and left \$43 million in property damage. In 1997–98, another major El Niño winter seriously impacted the state’s coastline; more property was lost, and more houses were damaged or destroyed (Figure 1.4).

California is not the only state with coastline erosion problems. Much of the shoreline of each coastal state erodes, and the low, sandy coastlines common along the East and Gulf coasts often erode more rapidly than California’s coastline. Atlantic and Gulf coast residents also live under the threat of hurricanes and of nor’easters, which can be more damaging than hurricanes.

The conflict between coastline development and the hazards associated with it is becoming more evident for several reasons: (1) an increased migration to coastal communities and the desirability of owning oceanfront property; (2) the progressive erosion of oceanfront yards and vacant property, causing structures and utilities to be undercut or threatened; (3) the human-induced acceleration of seacliff erosion due to cliff-top construction with its associated roof, patio, driveway, and street runoff and its landscape watering;



Figure 1.2 House on the side of a bluff at Bolinas undermined by erosion during the 1983 winter. Photo by Gary Griggs and Kiki Patsch.

and (4) an era of more frequent and severe El Niño events beginning in 1978, bringing heavy rainfall, elevated sea level, and larger waves. In addition, coastal engineering projects such as groins, jetties, and breakwaters have directly or indirectly accelerated erosion rates in adjacent areas, principally by trapping sand and starving down-coast beaches.

The climate in southern California has drawn more people to this portion of the coastline than elsewhere in the state. The warm days and wide



Figure 1.3 Logs and debris carried into Rio Del Mar by high tides and storm waves during 1983 El Niño storms. Photo by Gary Griggs and Kiki Patsch.



Figure 1.4 Bluff erosion led to the collapse of portions of homes in Pacifica during the 1998 El Niño winter. Photo by Monty Hampton, U.S. Geological Survey.

summer beaches can be deceiving, however, as cliff-top and beachfront dwellers in places like Malibu, Solana Beach, and Cardiff discover during the winter months. Beach sand moves offshore, leaving the decks and plate glass windows of homes and restaurants to absorb the full force of the destructive storm waves.

The construction of seawalls and riprap is the most common response to coastline erosion in California, and a survey completed in 2001 indicates that 107 miles, or 10 percent of the entire California coast, have now been armored. At present-day costs of \$1,000 to \$7,500 per front-foot of armor, or \$5 to \$40 million per mile, protection is getting very costly, and concerns continue to be raised about spending public funds to protect private property as well as building seawalls or revetments on public beaches. These complex issues, discussed in Chapter 7, will plague California residents for years to come.

For many, living on the ocean is a dream come true. For others it has become a nightmare and an expensive lifestyle to maintain. Joe Maschutes, for example, moved into a \$350,000 beachfront house in Santa Cruz in early January 1983 (at today's prices this house would probably be valued at \$3.5 million); 10 days later, after a severe storm, his house slid into Monterey Bay, leaving nothing but a small pile of wreckage. An indication that we do not always learn from the past is evident in the fact that a permit was recently issued to allow construction of a new beachfront house at this same location. Events of this sort are tragic, but we can learn something from them. The Pacific Ocean is a very powerful force to reckon with, as is global sea level rise. Nearly all of our protection efforts are, in the long run, temporary, and they simply buy a little more time at great expense. Unless we are wealthy or have recourse to some government subsidy or aid, we cannot long afford to protect an oceanfront home in an area of active coastal retreat. Yet there are literally thousands of homes in such hazardous locations, and in many other oceanfront areas development continues to be planned or proposed.

Before we invest in oceanfront land, purchase a home along the shoreline, or approve new construction in a coastal area, we should have a clear sense of the history of the site, paying particular attention to what has happened there over the past 50 or 100 years. Where was the historic shoreline at this location and how fast is the shoreline retreating? It's critical to find the answers to these questions before going any further. What can we learn from California's past history of coastline development and construction, especially during the severe winters of the past 25 years? What options exist for protecting our valuable coastal property, and how effective and costly are the different methods? Is it likely that either the California Coastal Commission or the local government permitting agency will approve a proposal for a seawall? In areas not yet intensively developed, what "nonstructural" solutions, such as setbacks or buffer zones based on long-term retreat rates, can be utilized? And finally, what types of land-use planning regulations do we need to consider, and what agencies can or must we work with in our efforts to build, plan, buy, or protect our beach houses?

This book discusses the processes, problems, and issues that anyone living or planning to live directly on the coastline must understand. This book should allow readers to make well-informed decisions about the future of their particular homes or home sites and to learn something of the past, present, and future of the individual geographic areas along the state's 1,100-mile coastline. Although the shoreline may appear stable and solid, a look at the historic photographs we have assembled in this book will provide a different perspective on the permanence of the California coastline.