MARINE SCIENCES RESEARCH CENTER
STATE UNIVERSITY of NEW YORK
STONY BROOK, N.Y

# THE DUNES OF EAST HAMPTON

Henry Bokuniewicz
and
The Shore Processes Group

Marine Sciences Research Center
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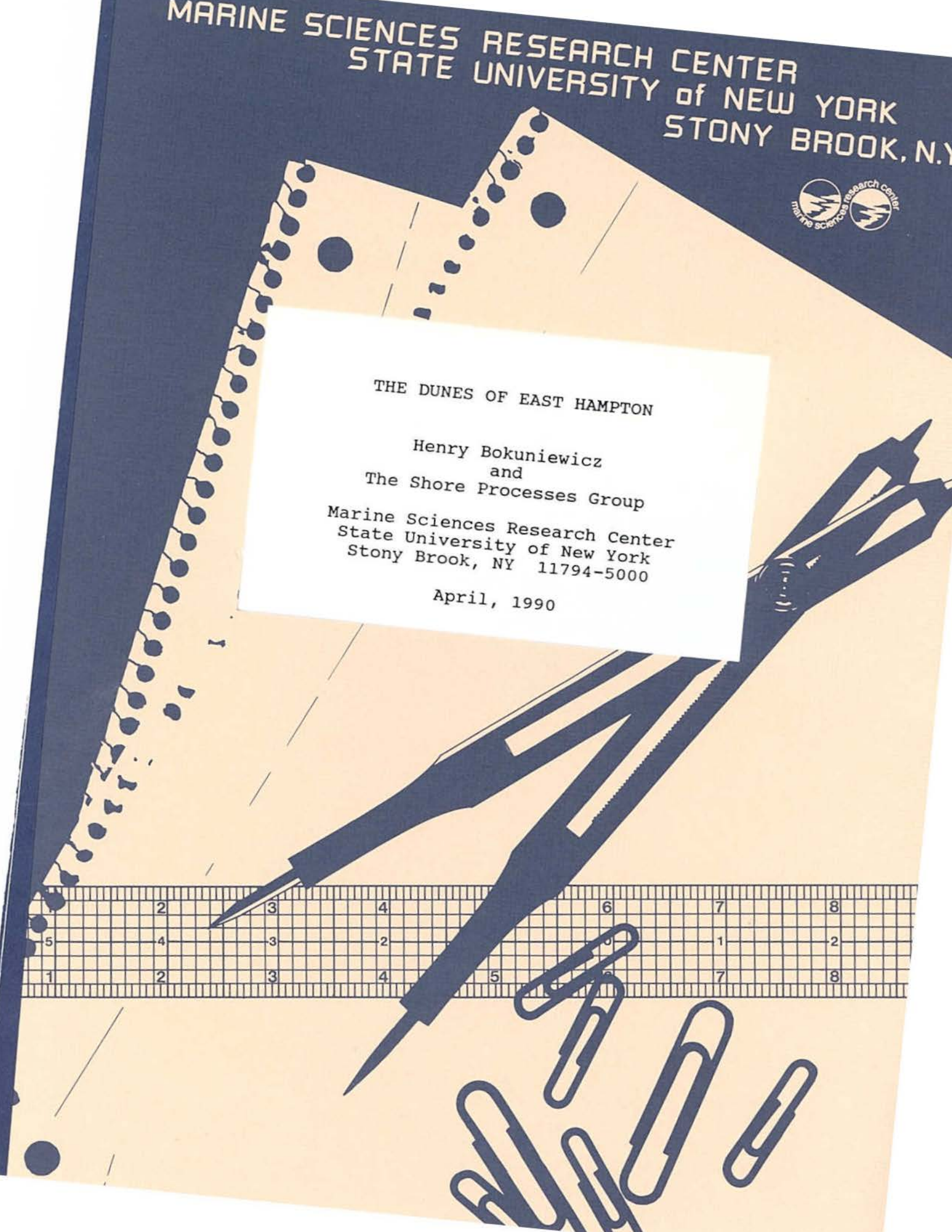

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## Introduction

Coastal specialists at the Marine Sciences Research Center (MSRC) of the State University of New York have compiled this assessment of the dunes of the East Hampton Village Ocean beaches as part of its analysis of monthly surveys of the beach that has been underway since 1979. This is the first study specifically focused on the East Hampton dunes.



## Geological History

The Ronkonkoma Moraine forms the backbone of the south fork of Long Island. This ridge of sediment was formed at the edge of the continental glacier during the last ice age. When the ice began to recede about 18,000 years ago, sand carried by the melt water was deposited in a thick blanket south of the moraine. Waves have carved the East Hampton beach from this sand deposit and coastal dunes probably began to form on its surface about 6000 years ago as the rate of post-glacial sea level rise slowed.

The dunes have been pushing northward with the beach for thousands of years. There is no direct indication on how the dunes reached their present position but, most likely, their migration has not been gradual and continuous. Geological evidence suggests that periods of shoreline recession have alternated with periods of stability over many hundreds of years. Dunes might have formed and grown during prolonged periods of relative stability, eroded during periods of intense erosion, only to reform when the next favorable conditions recurred.

## The Character of the Dunes in East Hampton Village

The dunes at East Hampton are some of the most substantial in the chain of dunes that stretches for nearly 100 miles along the Long Island shoreline. A primary line of dunes in the East Hampton Village extends from West End Avenue to the Main Beach with crests attaining heights in excess of 40 feet above sea level. This line of dunes is typically confined to a zone about 200 feet wide. Multiple dunes are found between the Main Beach and Hook Pond spread across a zone about 700 feet wide. Among the multiple dunes there are crests about 20 feet above sea level.

## The East Hampton Dunes over the last 152 Years

The shoreline at East Hampton Village has been relatively stable over the past 152 years. It is reasonable to assume, therefore, that the dune position behind the beach has also been stable. The shoreline position goes through a cycle of seasonal shifts but the duneline position is much less variable. Nevertheless, the dune is a dynamic feature whose volume and integrity changes.

Aerial photographs taken between 1938 and 1975 show that the dunes at East Hampton Village have accreted during this period. Both the base of the dune and the grass line have grown seaward. Likewise, monthly measurements of the beach conditions, done by the MSRC since 1979, show measurable accumulations at the base of the dune and the spread of beach grasses. The dune volume increased at all locations where the dune formed a part of the

measured profile. Figure 1 shows the volume of sand contained in these dune sections.

Despite variability, the dune volume persistently increased between 1980 and 1987, the last year for which this calculation was done. On the average, about 2 cubic yards of sand were added annually along each foot of the dune. Along the entire three-mile section of beach in East Hampton Village, this would correspond to an accumulation of 27,600 cubic yards of sand. The accretionary trend, however, is superimposed on an irregular cycle of erosion and accretion. In some months, parts of the dune may lose as much as 16 cubic yards of sand per foot of duneline, while in other months, sections gained over 20 cubic yards per foot of duneline.

The beach has been persistently providing sand to the dunes rather than the other way around; the dunes have not been providing sand for building the beach. During storms sand can be eroded from the dunes and widely dispersed but, over time, sand that is eroded from the dunes during storms has been restored to the dune by the wind or replaced from the beach by special conditions of waves and tides. Changes in the dune do not follow a strong seasonal pattern but the dunes do appear to be more stable in the winter and more changeable in the summer.

## Storm Damage and Shore Protection

The East Hampton dunes are not under continual attack by the ocean as part of a continually worsening erosion process; there has been no such progressive erosion in this area for at least the past 152 years. The dunes, however, are subject to

occasional storm damage which can be severe. Neither the present condition of the dunes nor the historical documents give evidence that the dunes have ever been demolished or overwashed during storms or hurricanes. Severe storms, however, have excavated the toe of the dunes which gradually reform during subsequent calm weather.

In response to storm damage, some homeowners have constructed revetments or bulkheads to protect the dunes and the property behind them even during severe storms. Most of these structures have been constructed after the mid-1960's although wooden bulkheads from 1932 were unearthed during storms after being completely buried for nearly 50 years. The revetments and bulkheads have been successful in preventing the erosion of the dunes behind them.

These structures have been closely observed during the MSRC study over the last ten years. During most of this time, they have been nearly completely buried by sand. They do reduce the magnitude of beach changes during severe storms. Under storm attack, they are exposed and prevent the beach form from migrating as far inland as it does along unprotected stretches of the beach. The loses of beach sand are, therefore, slightly less in front of the structures than they are along unprotected sections. The beach rebuilds everywhere during the subsequent calm-weather periods and covers the revetments again.

As a result, the structures do not influence the accretion of the beach so that as the beach rebuilds, the shoreline becomes relatively straight. Slightly less sand is taken from the base

of the dunes in front of revetments and bulkheads throughout the year, and a correspondingly smaller amount of sand is restored, than in unprotected areas, but this cycle occurs without an apparent net loss or gain of sand in the littoral sand budget. There has not been any meaningful diminution of the sand reserves in the East Hampton beaches due to the revetments during the study period.

Since the sand volume has increased substantially over the last ten year period, the MSRC monitoring program has not detected any narrowing of the beach either directly in front of the structures or downdrift. Nor has it been possible to detect any exceptional erosion at the edges of revetments or bulkheads.

The Role of the Dunes as Protection against Inland Flooding

There is no physical evidence or historical record that the Village dunes between the Georgica Pond parking lot and the Main Beach have been topped or breached by the ocean. Even in the 1938 hurricane, the most damaging on record on Long Island, dunes at elevations greater than 18 feet were left intact on the exposed barrier island - Fire Island. Since the elevations of the East Hampton Village dunes are considerably above 18 feet, even such an extreme storm would not top the dunes at these heights.

The dangers of coastal storm flooding at East Hampton do not seem to arise from the danger of breaching these dunes. Rather, the dangers come from specific locations where the integrity of the dune has been interrupted. There are four such locations in East Hampton Village. These are:

1. at the Hook Pond groin where vehicular traffic has reduced the elevation to about 15 feet

2. at the end of Ocean Avenue in the Main Beach parking lot where the elevation is 13 feet
3. at the Georgica Beach parking lot where the elevation is also 13 feet
4. at the Georgica Gut where the elevation can be less that 5 feet.

Storm tides have passed the dune line through these low spots to flood the inland area. According to reports, this has occurred in the major storms of 1933 and 1938, for example.

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Figure 1. These graphs show the accumulation of sand at the toe of the dune at three stations in East Hampton Village. The station locations are described in the report by Bokuniewicz, Zimmerman, Pavlik and Zimmer. Each dot on the graph is the volume of sand at the toe of the dune measured on various dates between 1980 and 1987. In each case, there has been a gradual increase in the amount of sand on the toe of the dune as indicated by the upward sloping, straight lines.

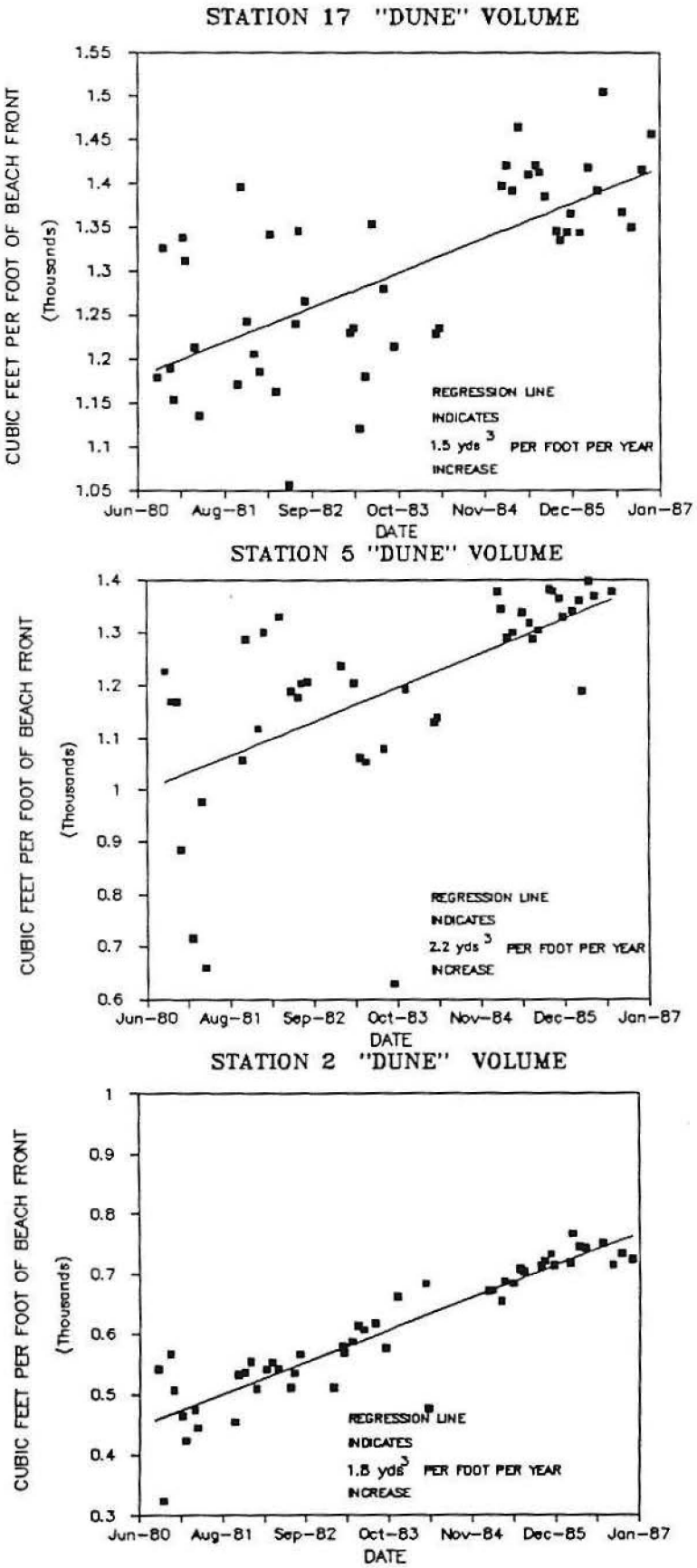
STATION 17 "DUNE" VOLUME
CUBIC FEET PER FOOT OF BEACH FRONT
(Thousands)
1.55
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
REGRESSION LINE
INDICATES
1.5 yds 3 PER FOOT PER YEAR
INCREASE
Jun-80 Aug-81 Sep-82 Oct-83 Nov-84 Dec-85 Jan-87
DATE
STATION 5 "DUNE" VOLUME
CUBIC FEET PER FOOT OF BEACH FRONT
(Thousands)
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
REGRESSION LINE
INDICATES
2.2 yds 3 PER FOOT PER YEAR
INCREASE
Jun-80 Aug-81 Sep-82 Oct-83 Nov-84 Dec-85 Jan-87
DATE
STATION 2 "DUNE" VOLUME
CUBIC FEET PER FOOT OF BEACH FRONT
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
REGRESSION LINE
INDICATES
1.8 yds 3 PER FOOT PER YEAR
INCREASE
Jun-80 Aug-81 Sep-82 Oct-83 Nov-84 Dec-85 Jan-87
DATE

Figure 1