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Your Visit to Sandy Hook, G...

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Your Visit to Sandy Hook

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GATEWAY NATIONAL RECREATION AREA

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TO GET THE MOST FROM YOUR VISIT

The suggestions for discussion which follow are designed to complement themes and ideas that you may wish to include on your walk at Sandy Hook. The enclosed materials will give you background information and factual answers to some of the questions asked. These questions are for the teacher to use, and are subject to modification to best fit curriculum needs. Most questions are meant to provoke open-ended discussion in the classroom.

We begin with an introductory section on the concept of the National Park Service and Sandy Hook as part of Gateway National Recreation Area. This section is applicable for any activity you may be involved in during your visit. Please call the Spermaceti Cove Visitor Center at (201) 872-0115 if your group is studying a special interest for which you need more information.

GATEWAY NATIONAL RECREATION AREA SANDY HOOK UNIT

At the entrance to the great New York-New Jersey estuary, two arms of land stretch across the water toward each other, forming a natural gateway for going to and from the Nation's greatest port. This is the gateway through which millions of immigrants have entered the New World and the gateway which has given its name to a new national park site - Gateway National Recreation Area.

One of these land arms is Sandy Hook, the New Jersey unit of Gateway; the other is the Rockaway peninsula in New York, where the park's Breezy Point unit is located. The other Gateway units, Staten Island and Jamaica Bay, lie within the arms. Together the four units contain 10,600 hectares (26,000 acres) of land and water—ocean beaches, dunes, wooded uplands, bays, a holly forest, the Jamaica Bay Wildlife Refuge, three forts, two historic airfields, and the nation's oldest operating lighthouse. Besides its natural and historic features, Gateway provides tremendous opportunities for recreation. Swimming, fishing, basketball, softball, football, soccer, and jogging are just a few of the sports that you can engage in at the park. Or you may wish to do nothing but relax, and let the noise and bustle drain away as you watch birds fly by and waves roll in. Gateway is a place for both activity and relaxation.

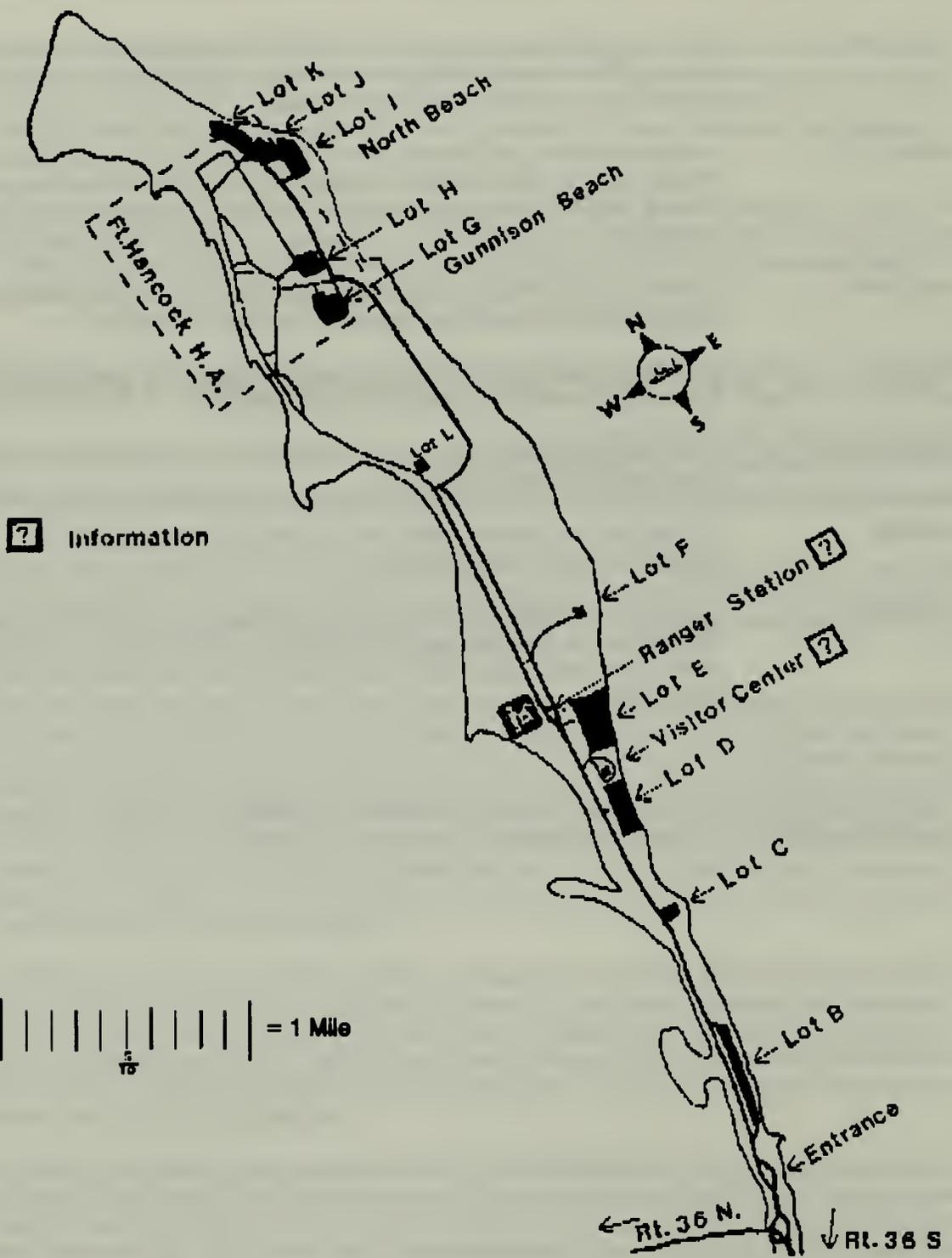
At Sandy Hook, dunes protect portions of the uplands against sea winds and enable the growth of plant life. The growth culminates in a holly forest unsurpassed on the eastern seaboard. Besides these natural aspects, Sandy Hook is also endowed with many historic sites. The lighthouse is the oldest operating one in the country. The concrete gun batteries at Fort Hancock were the last of several fortifications erected on Sandy Hook to protect the shipping channels into New York Harbor. Here also was established one of the first stations of the U.S. Life Saving Service.

That these parklands have been preserved in the midst of the largest urban area in the work is the result of both technological change and people's determination to preserve green open space. New weapons technology has made it possible for former military bases to be closed and turned into part of Gateway's parkland. Other areas that became part of the park were preserved because citizens decided they did not want scarce recreation space to be taken up by development. Large areas of the park were offered for donation by the City of New York and the states of New York and New Jersey. Responding to these facts, Congress in 1972 created Gateway as one of the first large urban parks to be managed by the National Park Service.

FACILITIES - FOR YOUR USE

*Visitor Center	The best place to start any tour of Sandy Hook is at the Spermaceti Cove Visitor Center. Rest rooms, exhibits, park information, a slide program and an orientation by a Park Ranger await you. Call for schedule.
Building 102	Located in historic Fort Hancock, this facility offers living quarters, shower facilities, meeting rooms, a large cafeteria- style kitchen and plenty of room for your group. Contact the Chief of Interpretation at (201) 872-0115 for information on building availability.
Rest Rooms	Located at the Spermaceti Cove Visitor Center, when open. Located at all major parking lots (see map) during late spring, summer and early fall.
First-Aid	Available at the Ranger Station year-round. Memorial Day weekend through Labor Day available at Parking Lots D,E,G,I. (See map)
Food Service	Available during late spring, summer, and early fall at all major parking lots. Subject to weather conditions. (see map)
Camping	Camping is for organized groups only. Contact the Ranger Station at (201) 872-0115 for more information.
Picnic Areas	Unless marked otherwise, most of Sandy Hook is open to picnicking. Please, no glass bottles on the beach and leave your picnic area as clean as you found it. A few grills are located at Guardian Park and Parking Lot I. NO other fires are permitted on Sandy Hook.

*Eastern National Park and Monument Association operates a bookstore at this location. Publications include natural history field guides, history information, coloring books and postcards.



? Information


 = 1 Mile

Directions to Sandy Hook: Garden State Parkway to Exit 117 (or U.S. 9 and N.J. 35 south) to N.J.36 to park.

Hi!..... The park rangers at Sandy Hook are happy that you are visiting us on a self guiding basis. We encourage you to make the Spermaceti Cove Visitor Center your first stop. It is the best place to understand the park as a whole. This packet has been designed to help you and your group better understand and enjoy Sandy Hook. Below we have listed some of our self guiding activities. Select a trip activity and use the key to match it with the complementary pre- and post- visit suggestions listed on the following pages. You will also find a list of other activities to supplement your trip ideas. The last pages of this packet contain background information on Sandy Hook. If you have any comments or questions, call the Spermaceti Cove Visitor Center at (201)872-0115.

KEY

- 1** **SPERMACETI COVE VISITOR CENTER** — Located two miles into the park, the Spermaceti Cove Visitor Center is a former United States Life Saving Service Station. Exhibits tell the story of Sandy Hook, and small fish tanks introduce some of the marine life. A 14-minute slide program about its cultural and natural history is shown on request. Rest rooms, water fountain, bookstore and park information are available.
- 2** **OLD DUNE TRAIL** — Begins at the Spermaceti Cove Visitor Center — an approximately one mile (1.6 km) round trip. Enjoy the aroma of bayberry, juniper and holly and perhaps catch a glimpse of the wildlife around the fresh water pond. A trail guide is available at the Spermaceti Cove Visitor Center.
- 3** **SOUTH BEACH DUNE TRAIL** — Begins at the sign on the left side of the road leading to Parking Lot F — approximately 1.1 mile (1.76 km) round trip. Walk through a maritime forest and observe plant succession from a mixed holly forest to a beach dune environment. It is an ideal place for the beach plum blossoms in the spring and the ripe fruits in the fall. It is unsigned, except at the beginning. Get more information at the Spermaceti Cove Visitor Center.
- 4** **FORT HANCOCK HISTORY TOUR** — Is located two miles (3.2 km) north of the Spermaceti Cove Visitor Center. Explore this turn- of-the-century military community and view the oldest operating lighthouse in the United States. A detailed map is available at the Spermaceti Cove Visitor Center. (Check also at the Visitor Center for the visiting hours of the Museum and History House.)
- 5** **BEACH WALKS** — All of Sandy Hook's beaches are open for exploring. To walk to the tip of Sandy Hook, park in Parking Lot J and walk out to the beach — approximately three miles (4.8 km) round trip to the tip. Walk along the beach, but please stay off the fragile dunes, and watch ships entering New York Harbor. A great place to show Sandy Hook's strategic importance to New York.

PRE-SITE DISCUSSION TOPICS

1-5

What other National Park Service sites have you visited or heard of?

1-5

The legislation for the National Park Service states that we must “conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for enjoyment of future generations”.

- a. If you ran Sandy Hook, what problems do you think you would face trying to fulfill this mission?
- b. What effect would not solving problems have on you and others?
- c. How would you try to solve these problems?

4

Why was Sandy Hook considered a strategic location by the Army?

- a. How was Sandy Hook important to people otherwise?
- b. How is Sandy Hook important today?

1-5

How has Sandy Hook physically changed over the years?

- a. Is it changing today?
- b. How do changes affect the park and people using it?

4

Fort Hancock was an Army base. What are the similarities and differences between your home community and the Fort Hancock community?

2,3,5

Why do you think the environment at Sandy Hook is similar to a desert?

How do you think the plants and animals adapt to Sandy Hook’s environment?

What is a barrier beach? Why is it important?

3

What are some of the threats to the Holly Forest?

- a. What would happen if it disappeared?

2,3

What is a dune? What are the different kinds of dunes?

How and why is poison ivy important to a dune? To Sandy Hook?

2,3,5

What happens when people build structures on the dunes or in front of the dune line?

What are some of the possible solutions to beach erosion?

1

What was the role of the United States Life Saving Service?

- a. How has technology replaced the heroic efforts of its surfman and keeper?

What were some of the difficulties faced by these men as they attempted to rescue people from ships in distress?

ON-SITE ACTIVITIES

For the Beach

- *Sand Sculptures - Make either real or fictitious animals in the sand. The group could try making a life-size whale.
- *Exploration Hike - Walk the beach looking for interesting objects and features.
- *Scavenger Hunt - List sensory objects (i.e. something smelly, something colorful) as well as objects left by the sea.
- *Relay Races - Later, discuss the difference between running on hard sand and loose sand.
- *Shipwreck - Pretend there is a shipwreck offshore and discuss what you would do. Discuss what the lifesaving service would have done one hundred years ago. Role play the different situations.
- *Animal Charades - Have someone act out an animal he has seen and have the rest of the group guess what the animal is.
- *Tides Demonstration - Explain high and low tides by using individuals to represent the earth, the moon, the sun, high tide (2 people) and low tide (2 people).
- *Sketching
- *Poetry writing
- *Story telling, particularly shipwreck stories.

DISCOVERY HUNT

Do your best to find one example of each of the objects listed below. Try to find things that you have never seen, touched, smelled, or heard before. Please do NOT collect the natural objects. Instead, bring back the idea of what you found by 1.) drawing a picture of it, or, 2.) writing a poem or short story about it.

- Something that tickles
- Something that is always breaking, but is never broken
- Something that you would like to give to a special friend
- Something cold and hard
- Something that makes a very soft sound
- Something that is older than you
- Something lighter than a feather that can move mountains
- Something you think is beautiful
- Something changing
- Something that moves
- Something that an animal lives in
- Something that makes you happy
- Something that is food for an insect
- Something that's important for your survival



Take a look around your home and school to see what surrounds you. Can you find these things at Gateway too?

WHAT DO YOU
SEE, SMELL, HEAR?

HOME

SCHOOL

GATEWAY

Any



animals

Any



plants

Anything



non-living

ACTIVITIES AFTER YOUR VISIT

Write a report on what it might be like to work as a Park Ranger at Sandy Hook.

Find out about other National Park Service areas in New Jersey. Write a letter requesting information for your report. What would it be like to work as a Park Ranger in one of these other parks?

Write a letter as if you were a soldier at Fort Hancock.

Draw a series of maps showing the interesting changes that have occurred at Sandy Hook.

Find out about some of the environmental problems that are facing New Jersey. What are some possible solutions to these problems? Write a letter to your Senator or Congressman requesting information.

Practice using all your senses - describe to the class an object using all five senses.

Write a short story - **"If you could become a creature of the beach"**

HISTORY WORD SEARCH

C I G U K G H Q U Q L A Y X Q A L R A X
W U X J N E N W Q Y Z T Q Z C G L E X N
K D B D F N Q O L S A Z Q K Q H I T L U
B S R A G B C E O U R D R B B C G T L T
Y M O A V D G M N H P I Y B F Q H O A J
W U F B U U X E T A B I R P B V T P H O
Q U F P N G X W H A L E O I L N H Y S V
R B I Q J L T P R W V W V C Q G O R S P
N N C E C S E S U O H T H G I L U E E O
P D E X Y A M N A M W Q B R X T S T M S
E H R S W T Q V Z O W I W V C J E T A T
D Q T U U W I T P Z C T U E U R K A H S
K R A P L A N O I T A N A G E D E B G T
Y H L L E H S Y R E L L I T R A E N H O
U T G N L L E Z C O L H X I L Z P N E C
Z R E S D A Q S D K M O R T A R E N A K
F A D D O F F I C E R S R O W L R K D A
W C W R I B I Y P X I I G N A G L X Q D
V H Y V M U V A B T F O V J A Z A R U E
Q C Y F C Z C S U R F M A N J A P M A E
Q A M O K C O C N A H T R O F R T E R J
Z E R F R O B R A H K R O Y W E N E T N
P B M C X W Y R E T T A B N U G Q U E W
E C I V R E S G N I V A S E F I L D R Z
T N A N E T U E I L W V G W A I M S S N

1. Fort Hancock

4. Lighthouse

7. Lieutenant

10. Headquarters

13. Whale Oil

17. Gun Battery

20. Life Saving Service

23. Coast Guard

2. National Park

5. Mortar

8. Private

11. Post Stockade

14. New York Harbor

18. Lighthouse Keeper

21. Lyle Gun

3. Battery Potter

6. Officer

9. Mess Hall

12. Officer's Row

16. Artillery Shells

19. Surfman

22. Beach Cart

NATURE WORD SEARCH

R N A T I O N A L P A R K P M N U K O G
 A M Y P N B W R U T G N L L K B R G B Y
 C U E O S E A G U L L I N L L Z C E W R
 O V B S B H R P H U V P P Q G L Y W T R
 O S G P K K V M Z J H A N L L P Q M V E
 N E F R H Z B X C N T R I L L K R Z Y B
 Y A F E S C A U P X A R T M W U C E Y Y
 V L R Y I Y O J V O B E E C Q W G Y W A
 I E S Z F G E F C M R T G N P A S A M B
 N T A P I U H J V G H D H I P P A R E G
 O T N I L C F X E O D E T R R J E J H S
 S U D W L J J Y H H U R I W O A Q F O M
 I C D S I C W G M C A P S T N P I W L X
 O E U O K O Y L M F H A K T I D E D L B
 P W N J N A U H B Y X D H E M Q S E Y A
 F W E S R U U N A Z C A N A C G Z E F R
 T I D A L M A R S H U C E K E P R W O C
 S P Y M E J R S S A R G H S R A M A R W
 W N E U Q L C N P M A R I N E E I E E A
 V Y R R E H C K C A L B D L I W O S S L
 O I P S Z E N V I R O N M E N T Q X T C
 Z S S K G L Z K O O H Y D N A S X V T E
 X U O E R V M O O N S N A I L X Z D L U
 M C O T T O N T A I L R A B B I T F U L
 A E G D O R N E D L O G E D I S A E S B

- | | | |
|--------------------|------------------------|-----------------------|
| 1. Killifish | 2. Marsh Grass | 3. Seaweed |
| 4. Tidal Marsh | 5. Snowy Egret | 6. Sandy Hook |
| 7. National Park | 8. Adapted | 9. Seagull |
| 10. Osprey | 11. Sea Lettuce | 12. Tide |
| 13. Terrapin | 14. Cottontail Rabbit | 15. Raccoon |
| 16. Tern | 17. Mussel | 18. Moon Snail |
| 19. Blue Claw Crab | 20. Seaside Golden Rod | 21. Sand Dune |
| 22. Environment | 23. Marine | 24. Wild Black Cherry |
| 25. Holly Forest | 26. Poison Ivy | 27. Bayberry |

POST-SITE DISCUSSION TOPICS

1-5 How should the National Park Service handle its dual mission (conserve and enjoy) at Sandy Hook?

Why do you think some areas are closed to the public, except with a park ranger?

Why do you think some areas are closed off completely?

How does having a National Park near your home affect you?

What would you preserve or change in your home community to make it better?

4 Why did Fort Hancock close down as an Army Base?

What changes in military philosophy and technology may have brought about the closing?

Are there any military communities in your area?

What are the similarities and/or differences between the old Fort Hancock, the Fort Hancock of today and your community?

Have members of your family worked on military bases, or have any served in branches of the military? How do they feel about their experience?

2,3,5 What did you learn about life on a beach? What shells or animals did you find?

What effects do tides, weather, wind and ocean currents have on a beach?

Where does the garbage on a beach come from? Is it all from untidy people visiting Sandy Hook? What possible solutions can you think of to solve this problems?

List some of the adaptations of plants and animals you learned about on your walk. Do people adapt to their environment or do they change the environment to suit their needs? What environmental problems arise from this approach?

How does Sandy Hook fit the description of a barrier beach? Why are barrier beaches important? What would it be like to live on a barrier beach?

How does placing Sandy Hook under the protection of the National Park safeguard environmentally fragile areas from threats to their existence? What are some of the problems and their solutions?

What type of rescue services are there in your community today?

How might today's life saving efforts by the United States Coast Guard be improved?

A MESSAGE ON SAFETY

A safe and fun visit to Sandy Hook go hand in hand. The best way to treat an injury is to avoid it all together. Dress for safety - Sandy Hook's location on the ocean makes it cooler and breezier than the mainland. If you are visiting in the fall, winter or spring, dress warmly in layers. Good shoes are a must, rubber soled sneakers will do just fine. Be aware of boards with nails and broken glass. We do our best to remove these hazards, but if you see any, please notify us as soon as you can. Bare feet and sandals are not recommended at Sandy Hook. Ticks and mosquitoes are a way of life at Sandy Hook. Check for ticks and bring insect repellent for your group. Sunburn is usually associated with the summer months, but can occur in fall and spring. Long exposure to the sun is not recommended. Like the town or city you are visiting us from, Sandy Hook is a busy place with its share of vehicular traffic. Watch out for cars, buses and bicycles. Please advise your group of the following rules here at Sandy Hook:

Stay off the dunes. Trampling dune grass and wearing paths destroys the dunes. Violators are subject to fines.

Picking plants and harming or feeding animals are prohibited.

Please do not enter or climb on buildings, gun batteries or other structures. Avoid climbing on the rock wall at any location in the park.

Any military ordnance (projectiles, bullets, etc.) found should be reported immediately to a park ranger. DO NOT HANDLE. Metal detectors are prohibited.

Swim only at guarded beaches. Lifeguard hours are posted. Lifeguards are on duty from Memorial Day Weekend through Labor Day only.

Beach parking fee: Weekdays \$4.00 per motorized vehicle; \$5.00 on weekends and holidays. The fee is in effect from the Saturday of Memorial Day Weekend through Labor Day. The fee entitles you to park in any of the beach parking lots designated with a U.S. Fee Area sign. Failure to pay the beach parking fee is subject to a fine and possible court summons. Fort Hancock parking is free.

Remember, we want you to have a safe and pleasant experience at Sandy Hook.

Poison ivy is an abundant, year-round resident of Sandy Hook.

Although poison ivy at Sandy Hook appears in all its various forms: shrub, climber and trailing vines, it is easy to recognize:

The leaves are usually green, born in clusters of three. Young leaves may be reddish in color.

From May to July, small yellowish flowers are visible.

From August through November and sometimes even longer, poison ivy bears clusters of tiny, smooth white berries.

The presence of poison ivy, although unpleasant, is essential to an area such as Sandy Hook. Poison ivy is one of the earliest plants which will grow in new sandy areas. It has an extensive root system which traps windblown particles of sand, enabling the area to build itself up. After poison ivy has established itself, other shrubs and finally trees will begin to grow in the area.

In short, without the presence of poison ivy, there would be no Sandy Hook.

In addition to holding Sandy Hook together, poison ivy provides berries which are a source of food for many migratory birds as well as some resident species such as the abundant Bob-white. These birds, while feeding on the berries, aid in the spreading of poison ivy seeds.

All parts of the poison ivy plant contain a heavy oil. The skin must come in direct contact with this oil or with the smoke from burning poison ivy plants in order to be affected.

The symptoms of ivy poisoning will often develop within a few hours of contact. Itching, the presence of blisters, redness and swelling are the most common signs of ivy poisoning.

A good scrubbing with yellow laundry soap immediately after exposure is of value in preventing the irritation. Plain water will only serve to spread the oil over a larger area.

Widespread inflammation or irritation involving the eyes should be treated by a doctor.

Learning to identify this plant and staying away from it and anything that has come in contact with it will insure your protection, and your trip to Sandy Hook will be a safe and happy one.

DANGER!!

DO NOT TOUCH THIS PLANT

SPERMACETI COVE

LIFE SAVING STATION - VISITOR CENTER

Their unofficial motto was, "You have to go out, but you don't have to come back." They were the heroic men of the U.S. Life Saving Service who would plunge into the sea during "nor'easters" to rescue victims of shipwreck. Storms blowing from the northeast could blow sailing ships into the shallow waters off Sandy Hook as the ships tried to enter New York Harbor. This 1894 lifesaving station was the rescuers' home between September 1 and May 1. A crew of eight surfmen served under the command of a "keeper." At night, in even the foulest weather, they would patrol the beaches in search of ships in distress. Upon the grim discovery of a shipwreck, a surfman would light a flare to signal "those in peril on the sea." Storm and surf conditions permitting, a surfboat would be quickly launched into the roiling sea to attempt rescue. If this were impossible, a line would be shot out to the shipwreck so that a breeches buoy could be rigged to rescue people from ship to shore. Early in 1915, the United States Life Saving Service merged with the United States Revenue Marine Service to create the U.S. Coast Guard. The present Coast Guard Station at the tip of Sandy Hook still conducts search and rescue missions to continue the tradition of lifesaving. New technology has changed the balance between humanity and the sea towards less sacrifice of lives to the sea.



FORT HANCOCK

Sandy Hook's strategic location made it an important defense site for New York Harbor. Before 1907, large ships entering the harbor had to do so by the Sandy Hook Channel, located a few hundred yards north of the tip of the Hook. A series of forts have dotted Sandy Hook since the American Revolution, each new system reflecting technological advances in weaponry, construction and tactics.

On October 30, 1895, a U.S. Army order designated the fortifications on Sandy Hook as "Fort Hancock," to honor Major General Winfield Scott Hancock, a gallant fighter for the Union during the Civil War and the unsuccessful opponent of James A. Garfield during the presidential election of 1880. Fort Hancock is not a single structure. It was a community of over one hundred buildings. It was a community with a definite purpose - to support and house the soldiers who manned the guns to defend New York Harbor. It was planned all at once and included green space, a parade ground and athletic field. Such planned communities are still too rare. Most communities grow haphazardly and have difficulty serving the needs of their residents. The open natural spaces are often sacrificed to development and lost forever.

Fort Hancock's first thirty-four buildings were built in 1898 and 1899. Captain Arthur Murray of the U. S. Artillery Corps designed the Fort buildings, and not the famous architect Stanford White, as is often claimed. Officers homes usually face parade grounds, but Fort Hancock's row of officer's quarters are lined up for a view of Sandy Hook Bay. Each of the eighteen Georgian Revival style homes housed one officer and family. The lieutenants' houses (1-8, 16-18) cost about \$8,200 each, Captains' houses (9-11, 13-15) about \$12,000 each, and the elaborate Commanding Officer's house(12), \$19,000.



Across the parade ground (named Pershing Field in honor of General John J. "Black Jack" Pershing) are the enlisted men's barracks, with a mess hall (kitchen and dining room) at the rear of each. One hundred and nine soldiers were housed in a barracks. From 1900 through World War II, additional brick and wooden buildings, as well as "tent cities," were added to accommodate more soldiers. The Fort's population peaked between the months of April and September 1945, when 18,000 men and women were stationed here.

The Sandy Hook Museum (Building 28), constructed in 1899, originally served as the post guard house/jail. Other fort buildings supplied food, clothing, protection and other support services.

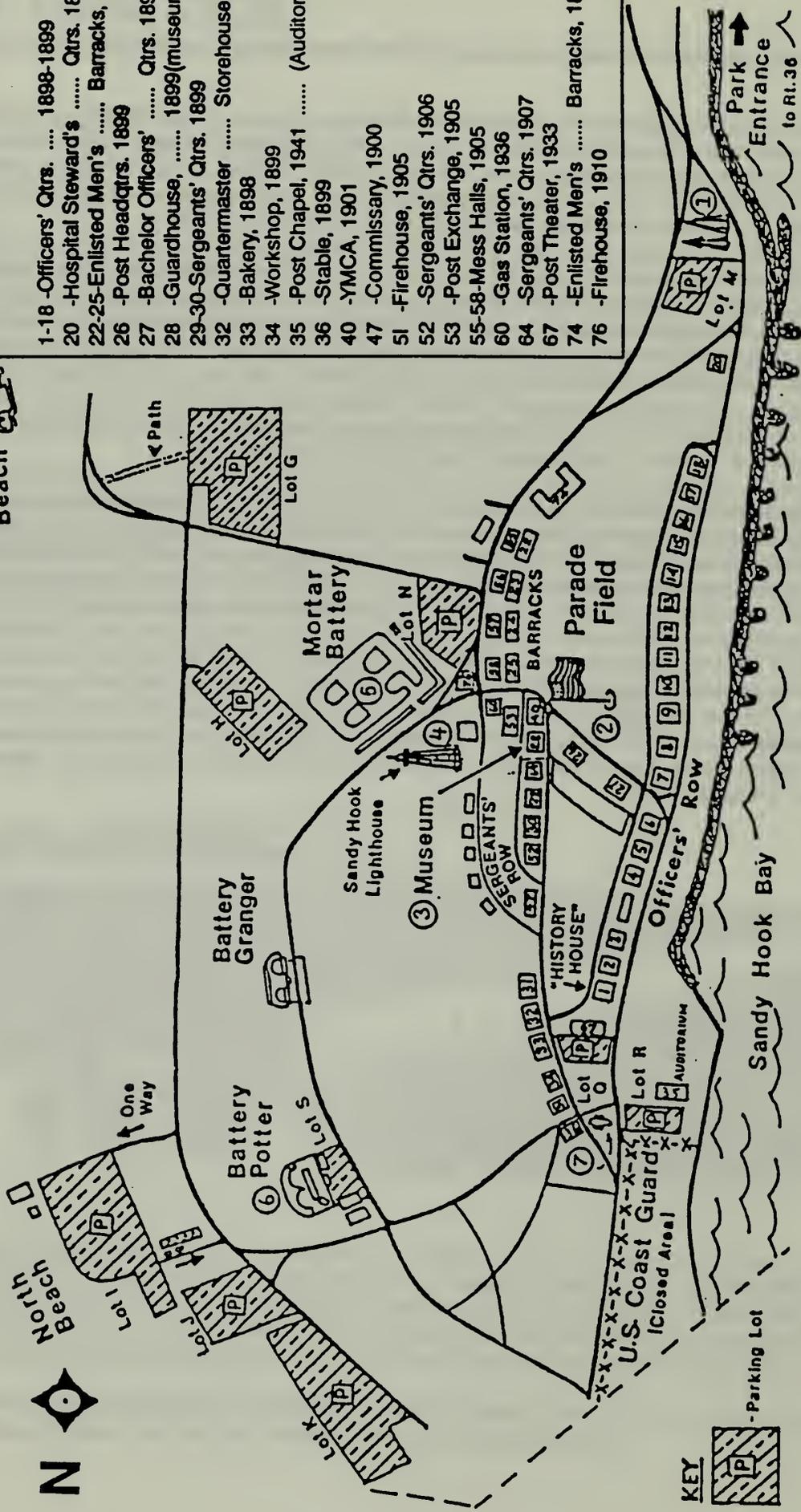
The Sandy Hook Mortar Battery (5), was the first operational concrete gun battery of its kind built for American harbor defense. Completed in 1894, this battery, along with Battery Potter, began a nationwide system of concrete coastal defense fortifications constructed between 1890 and 1910. The batteries mounted sixteen 12-inch mortars in four concrete and earth firing pits. These guns were designed to fire 700-pound armor-piercing projectiles in high arcs to drop on the decks of enemy warships.

Battery Potter (6), designated "Lift Gun Battery No. 1," was America's first and only steam-powered "disappearing" gun battery. Later named after General Joseph Potter, the battery contained two 12-inch guns, each mounted on a steam-driven elevator platform. The guns were loaded inside the battery; then each gun was lifted through a square opening in the roof. After firing at approaching enemy warships, the platforms and guns could be lowered to "disappear" from the enemy's view.

The 20-inch Rodman Gun (7), is the largest smoothbore, muzzle-loading cannon ever cast and is named for Major Thomas J. Rodman. Experimental in size, it is one of two surviving.

At Guardian Park (I), missiles memorialize six U.S. Army enlisted men and four Ordnance Corps civilian employees killed in the May 22, 1958 explosion of eight Nike missiles at Middletown, New Jersey. They are also a monument to the last descendants of America's coastal defenses. Sandy Hook's coast artillery became increasingly less effective as airpower was developed. Such imbalance led to the development of anti-aircraft guns and then missiles. Nike, Ajax and Hercules missiles were designed to intercept and destroy fast, high-flying enemy fighters or bombers before they reached a metropolitan area. The small missile, the Ajax (based at Sandy Hook from 1954 to 1959) had a range of 30 miles and a maximum altitude of 60,000 feet. The larger and more advanced Hercules (based at Sandy Hook from 1958-1974) could carry a nuclear warhead more than 100 miles at an altitude of over 150,000 feet. Another shift in balance phased out the Nike missiles in favor of the Intercontinental Ballistic Missiles (ICBM's) which are currently based in the western United States. Let us hope that they are, as were the weapons of Sandy Hook, effective deterrents that never will be launched.

Historic District



- 1-18 -Officers' Qtrs. 1898-1899
- 20 -Hospital Steward's Qtrs. 1899
- 22-25-Enlisted Men's Barracks, 1899
- 26 -Post Headqtrs. 1899
- 27 -Bachelor Officers' Qtrs. 1898
- 28 -Guardhouse, 1899(museum)
- 29-30-Sergeants' Qtrs. 1899
- 32 -Quartermaster Storehouse, 1898
- 33 -Bakery, 1898
- 34 -Workshop, 1899
- 35 -Post Chapel, 1941 (Auditorium)
- 36 -Stable, 1899
- 40 -YMCA, 1901
- 47 -Commissary, 1900
- 51 -Firehouse, 1905
- 52 -Sergeants' Qtrs. 1906
- 53 -Post Exchange, 1905
- 55-58-Mess Halls, 1905
- 60 -Gas Station, 1936
- 64 -Sergeants' Qtrs. 1907
- 67 -Post Theater, 1933
- 74 -Enlisted Men's Barracks, 1899
- 76 -Firehouse, 1910

SANDY HOOK LIGHTHOUSE



Located on a low, sandy peninsula south of New York City, the Sandy Hook Lighthouse, completed in 1764, is the oldest original "working" lighthouse in the United States. There are others which were erected earlier, but all of them have either been rebuilt or replaced at one time or another.

With a conservative estimate of some 500 shipwrecks along the Jersey Coast in the years preceding the lighthouse, the area carried the reputation of a "graveyard for ships." Edmund Andros, English Colonial Governor of New York and New Jersey during the latter part of the 17th century, was said to have suggested the idea of a beacon for the Hook as early as 1680.

However, if such a beacon existed (and no records substantiate this) it must have been claimed by the sea or outlived its usefulness by the time New York ship owners and merchants, facing financial ruin when their vessels fell victim to the deceiving and unpredictable area and weather around the Hook, began pressing for a lighthouse in the 1750's.

The Colonial Assembly of New York voted in May of 1761, to authorize a lottery to finance the building of a lighthouse. Although the lottery failed to raise an anticipated 3,000 English pounds, enough money was raised to purchase a four-acre tract of land for the site of the beacon and keeper's dwelling from the family of Richard Hartshorne, the owner of the Sandy Hook peninsula. A deed, signed in May 1762, formally transferred the property to New York representatives for somewhere between 700 and 750 pounds.

In December of 1762, the Assembly approved a second lottery for the completion of the project. At the same time, a tonnage tax was imposed on ships entering Sandy Hook channel on their way to New York. This tax was intended to help cover operating of the beacon. Funds were raised and construction started in 1763.

The octagonal building, originally called New York Lighthouse, is nine stories high, and was constructed by Isaac Conro, of New York City. The entire structure from top to bottom is 103 feet tall. The exterior walls are built of rubblestone, while the interior is lined with brick, eight feet, six-and-one-half inches thick at the base. First illuminated on June 11, 1764, the light was visible for a distance of 15 miles.

Expecting the British Naval forces arrival in New York Harbor, the New York Congress resolved in March of 1776, to darken and destroy the lighthouse in order to make it difficult for the English fleet to gain entrance through the channel.

The tower's glass lamps were dismantled and, along with the oil, removed by a group of local patriots. However, a party of British seamen landed and restored the lighthouse to service so that its glow would guide their way. But on June 1, 1776, the local militia attempted to destroy the lighthouse. Several small boats, under the command of Captain John Conover, bombarded the tower with cannon fire. The Americans lost several men in the skirmish and the small amount of damage to the tower was soon repaired.

After the Revolutionary War ended, the lighthouse became a matter of controversy between the states of New York and New Jersey. In 1787, New York passed a law which required all vessels from other states to report at the local custom house. Here they were to be entered and cleared, after paying a substantial fee for the privilege. New Jersey retaliated by levying a monthly tax of 30 pounds on the lighthouse, still owned and operated by New York.

Other lighthouses were involved in similar controversies and the federal government intervened and agreed to operate the lighthouse for the benefit of both states and commerce in general. By the Act of August 7, 1789, the Lighthouse Service was created. Sandy Hook, one of the twelve lighthouses built by the colonies and ceded to the federal government, came under the care of the Lighthouse Service in 1790.

The Sandy Hook Lighthouse was refitted in 1857, and a new iron lantern-tower was built in 1880. However, no structural changes had been made and it remains much the same as it was over two hundred years ago.

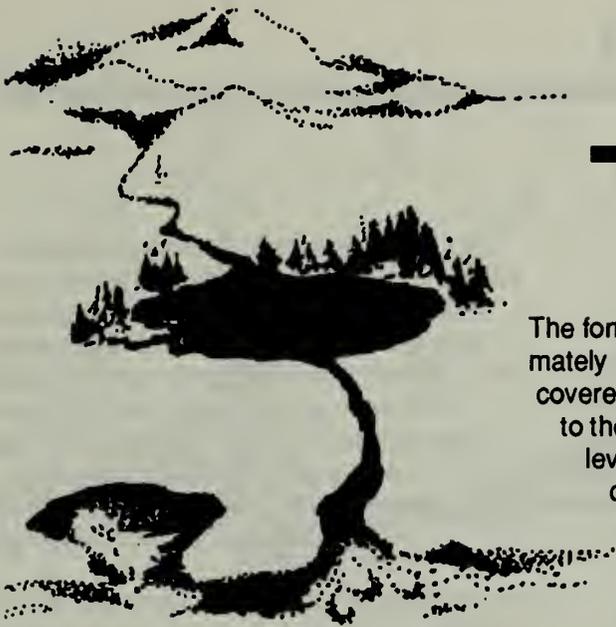
Under President Roosevelt's reorganization plan, the Sandy Hook Lighthouse was transferred to the control of the United States Coast Guard in 1939. With this plan, the Coast Guard became responsible for all lighthouse aids.

In June, 1964, the Sandy Hook Lighthouse was declared a National Historic Landmark and in 1976, a plaque was installed on the structure commemorating the famous lighthouse.

Ocean currents causing land buildup at the northern tip of the peninsula over the last two centuries has positioned the lighthouse today about one and one-half miles from the end of the Hook as opposed to its former and more prominent location some five hundred feet from the tip.

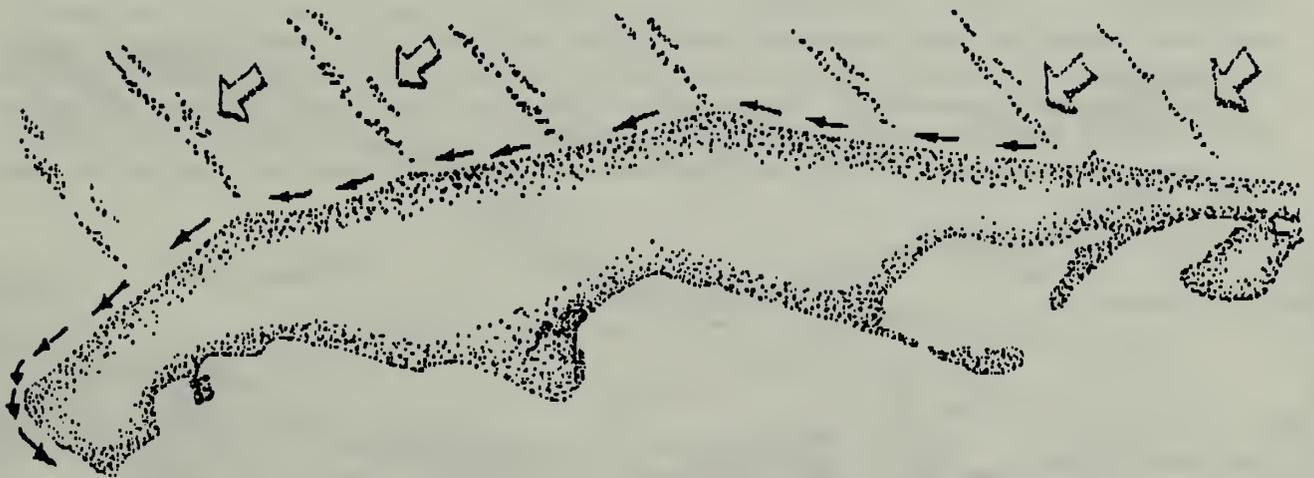
The light is currently a 45,000 candlepower, third-order electric light, fixed, white, and visible for some 19 miles. It was automated in 1962.

THE GEOLOGY OF SANDY HOOK

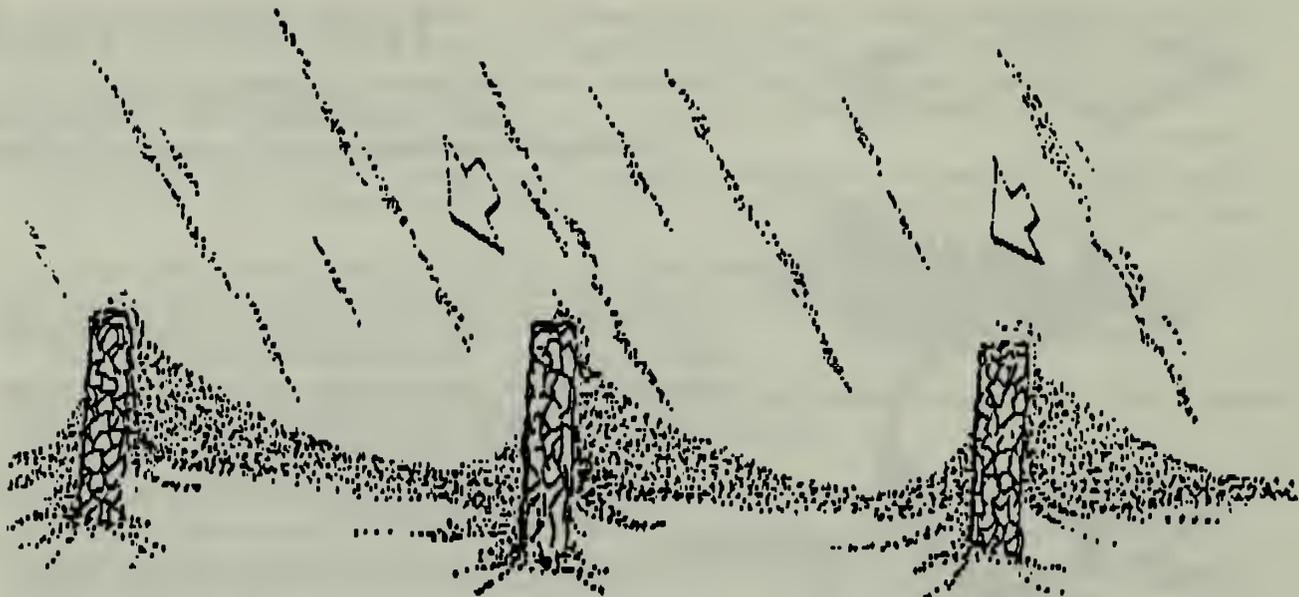


The formation of Sandy Hook is a process that began approximately 11,000 ago. The Wisconsin Ice Sheet which once covered the northern regions of this continent, receded slowly to the north, leaving behind meltwater that raised the sea level considerably. The mountains which bordered the coastline were eroded by strong winds and ocean waves crashing against the shore.

Rock fragments from the mountains were carried by streams and rivers to the ocean where waves ground them into smaller and smoother pieces. The resulting sand grains in addition to shell fragments and very fine sediment from the ocean floor, formed a sand bar. The longshore current, moving in a northerly direction along the coastline, deposited more sand on the bar until it became an island. The northern portion of the island, curved westward by currents, formed a hook. A barrier beach south of the island, presently called Sea Bright, extended to the north by the same process and eventually connected with the hook. Geologists call this finger-like projection of land a sand spit. Sandy Hook continued to grow at its northern end, forming new hooks and leaving old ones behind such as Spermaceti Cove and Horseshoe Cove as evidence of its past shape. Periodic dredging has prevented the growth of Sandy Hook into the shipping channel leading to New York City.

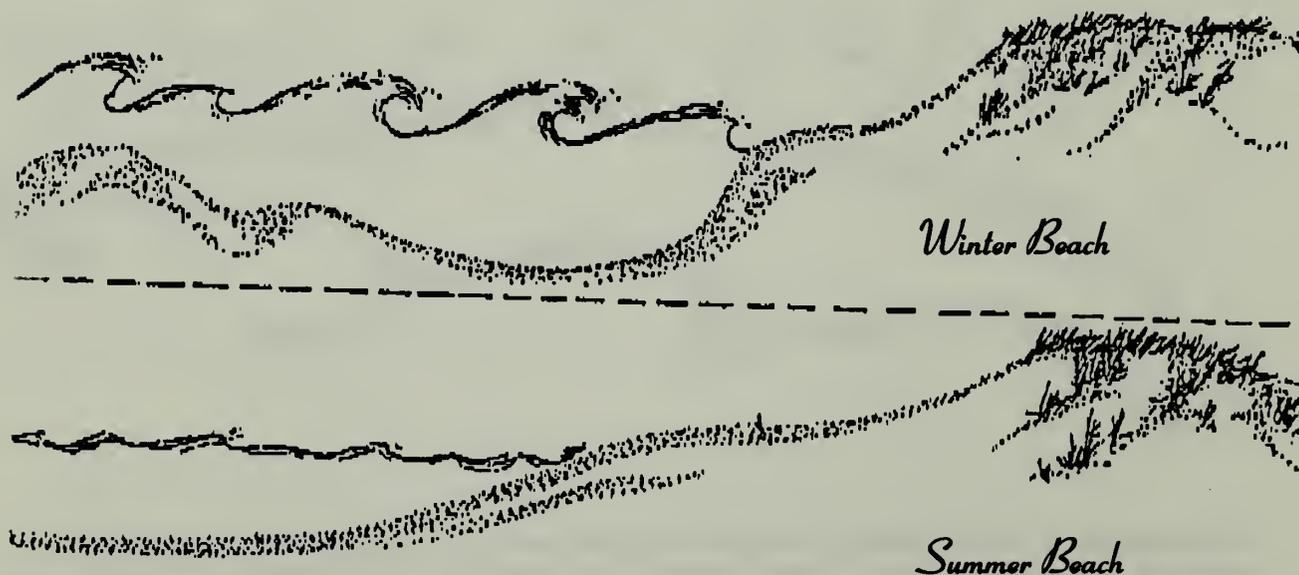


As the longshore current continues to transport sand to the northern tip of Sandy Hook, it is continually eroding the southern beach areas. A series of jetties were constructed on the shoreline at the southern end of Sandy Hook to trap sand as it is carried north by the current. A jetty is composed of boulders that jut out into the ocean perpendicular to the beach. Although the sand has built up on the southern sides of the jetties, the northern sides have been severely gouged out, interrupting the natural dynamic behavior of the longshore current.



In its history, Sandy Hook has been an island several times due to severe storms breaking through the narrow neck of its southern end. As a result, a protective seawall was constructed between 1914 and 1921 along the ocean side from Sea Bright to Sandy Hook.

The seasonal changes on Sandy Hook can be seen clearly on its beaches. During the summer, the waves are long and smooth and the beach is wide. In contrast, the winter months are characterized by shorter and much higher waves that chop away at the beach, removing much of the sand and depositing it on an offshore sand bar until summer, when the sand is returned to the beach.



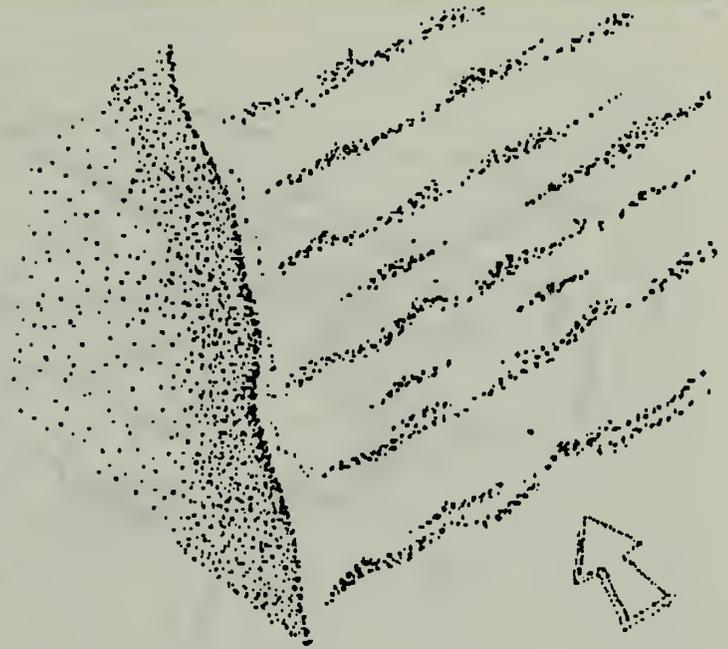
THE DYNAMIC BEACH

The beach is a result of the interaction between the ocean and the land. Sandy Hook's beaches are composed of small, rounded sand grains that were eroded from broken rocks of former mountains and carried to the ocean by rivers and streams. The most abundant grains are the light-colored quartz crystals which have resisted destruction by wind and wave action; the dark-colored grains are iron containing titanium minerals.

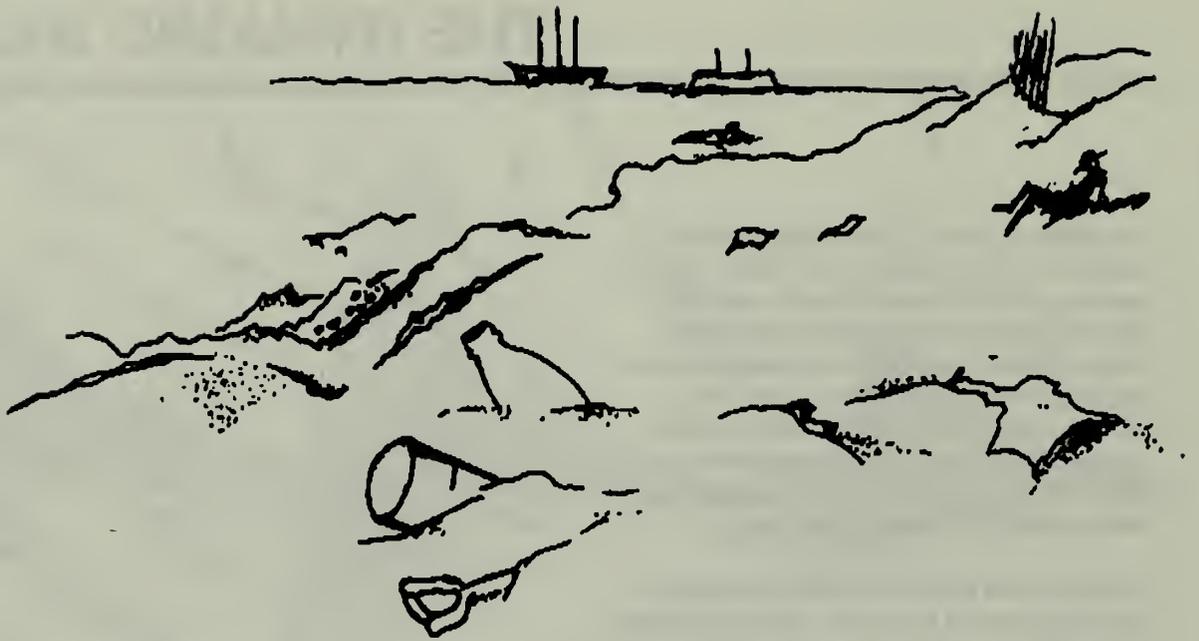
Waves are the result of winds pushing upon open expanses of the ocean. As waves move into shallow water, friction against the ocean bottom causes them to reach a certain height and crash. At Sandy Hook, water rushing onto the beach from breaking waves does not come straight up on the shore, but approaches it at an angle.

The water slows down and then retreats at the same angle, but in the opposite direction, forming a v-shaped pattern. This wave action results in a northerly movement of the water close to the shore called the longshore current. The current, in addition to the wave pattern, moves sand and shell particles along the beach in a process called littoral drifting. Often, people swimming in the ocean find themselves being carried along the shoreline by this current.

Life along the shore varies with each section of the beach. The highest area, the dunes, would not survive without the stabilizing effects of the dune plants, which survive the extremes of the tides, winds, ocean spray and storm waves. The upper beach area is covered by water only during high tides. It is inhabited mainly by microscopic organisms living between sand grains, insects and birds. The lower beach area is always underwater. Some of the animals that live in the submerged sands are clams, crabs, sand dollars, scallops, snails and starfish, while others, such as fish, dart about feeding on smaller plants and animals.

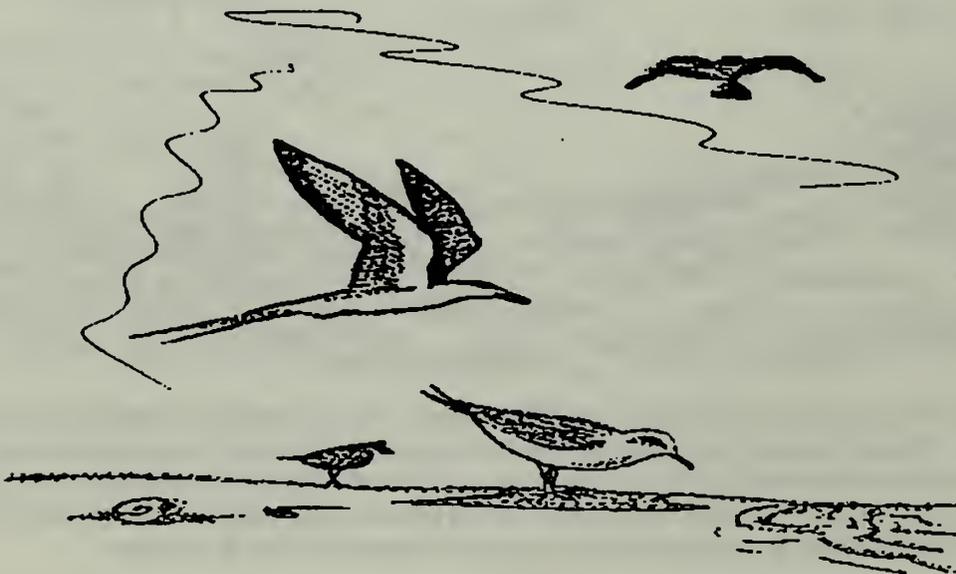


The birds along the shore such as the gulls, sandpipers and terns have adapted in several ways to the sand and the ocean. Webbed feet and long legs allow the birds to avoid waves and move quickly over the beach. Long, pointed beaks enable them to fish and probe for soft-bodied organisms in the sand with greater ease. Roving flocks of terns prey on smaller fish who are forced to surface by larger predatory game fish. This serves as a natural indicator to fishermen, announcing the presence of fish in the area.



The interaction of the ocean and land environments has developed into a finely tuned ecosystem which can adjust over a period of time to changes from severe storms or other natural phenomena. Man's interference is placing a tremendous strain on this ecosystem. Broken bottles, plastic and metal containers and other unnatural objects litter the beach. Chemical pollutants in the water can be harmful to both plant and animal communities inhabiting the ocean as well as the shore communities that depend on these marine organisms.

With increasing technology, and an expanding population, man must develop more efficient methods for waste disposal and land use. In addition, man must learn to adapt to the land and sea, resisting the temptation to constantly change and redirect the natural actions of Nature.



THE DUNES

Dunes are little sand hills formed by the action of wind and wave. The wind carries the sand. It is caught and held by the plants. This sand accumulation builds a dune.

Wind Patterns over Dunes - The wind dominates on the ocean side of Sandy Hook. It dries and sandblasts the plants while coating them with salt spray. Landward there is wind, sand and salt, but less of each. The dunes slow the wind, causing it to drop much of its salt and sand load. Its main force is directed upward over the tops of low plants growing in the sheltered zones. This area is called the salt spray community; the wind creates what is called the salt spray horizon. The main effects occur in the winter months when storm-blown sand and salt spray reach the tops of the plants, establishing an uppermost limit to their growth and leaving dead tops protruding above the community canopy. Particularly noticeable are the dead Eastern Red Cedars rising above all other plants and creating a "ghost forest."



A Pioneer Plant Community - Closest to the ocean beach, the first sand hill to be formed is the primary dune. A few hardy plants have anchored themselves in the shifting sand by deep or spreading roots. These are the pioneer plants of this primary dune environment - astonishingly tolerant to high salinity, extreme glare from the sun, soils lacking humus, and uncertain and changing supply of water. As the sand piles around the neck of the plants, the roots extend below ground and the stems and leaves rise from the sand. The result is a



dense mat of roots which hold or stabilize the dune below and the leaves and stems that entrap blowing sand and anchor it above ground level.

The pioneer plants hold the sand and enrich the soil as they die and decay. Thus, by providing nutrients they allow other plants to follow them. Some of the most prominent pioneer community plants growing on Sandy Hook's dunes are Beach Grass, Sea Rocket, Beach Heather, Seaside Goldenrod, Virginia Creeper, Dusty Miller,

Poison Ivy, and the fragrant Bayberry. As one looks toward the landward side the vegetation increases in abundance and variety. Succession has progressed from pioneer grasses to pioneer shrubs and trees like beach plum, winged sumac, wild black cherry and eastern red cedars. This area is called the back or secondary dune.



Back-Dune Formation - The dune building process does not end after the main or primary dune is formed. More sand is washed in by ocean waves and the windblown sand starts the dune building process again. A new primary dune is created and the old primary dune becomes the secondary or back-dune area. This back-dune area is more stable now since it has moved farther inland from the ocean. Plant succession continues and additional plant growth includes holly trees. Plants here are also well adapted to a harsh seashore environment.

How plants have adapted - Seashores resemble deserts in some ways; the shore dune plants often show characteristics of plants in arid regions. Some have deep penetrating roots (Beach Plum) and are good sand stabilizers; some have small leathery spiny or waxy leaves (Holly). A number are succulents capable of storing water (Prickly Pear Cactus). All are thrifty, and quite resistant to wind, salt spray and drought. Cactus and Golden Heather compete with each other for growing space and water by releasing poisonous chemicals from their roots.

Animal life of the dunes - A surprising number of animals live in this sparse sandy community. Ants and various insects and spiders share the area with numerous small mammals, among them eastern cottontail rabbits. The rabbits often chew on prickly pear cactus to obtain fresh water. Meadow mice and tiny white-footed deer mice can also be found in this habitat.

The destructive forces - The stability of Sandy Hook's shore is dependent upon the anchoring dune vegetation. There is a continuous contest with the wind and sea. Large storms with fierce winds and high waves take their toll on the relatively small sand dunes. Man also has an impact on the dunes. Constant walking in certain areas in connection with wind damage can cause large portions to "blow out" or disappear. Nature's process of dune building is extremely slow, and the pioneer plants must be protected. So to avoid trampling the important grasses and plants, people should stay off the dunes. After all, dunes and their protective plant covers are our only defense against storms.

THE HOLLY FOREST

The Holly Forest is a special place for plants and wild animals to live and grow safely in their natural environment. It is against the law to harm or take any plant or animal from Sandy Hook.

Succession - The presence of this American Holly Forest indicates a temporary balance of forces. In order for a climax forest to develop, like the present Holly Forest, a slow process of soil development and plant succession must occur. Succession is a process of slow change in flora (plant life) as the soil conditions change because of the preceding flora.

Barrier beach sandbars, such as Sandy Hook, migrate northwestward by being overwashed by storms and tides as the sea level continues to rise and wash over the coastline. However, parts of Sandy Hook have become stable long enough for grass-covered dunes to become shrub-covered and even forest-covered.



The Holly Forest is relatively young, the oldest known tree being about one hundred and fifty years old. Holly trees thrust out their branches, the leaves forming a thick canopy to shade the forest below. This forest is replacing the remnants of an old cedar forest in a natural succession.

First there were many more and older cedars, but now there are more and older hollies. You can still see the skeleton of many older dead or dying cedars standing about Sandy Hook. The forest floor is dark year-round, so green briar, Virginia creeper and poison ivy vines climb the trees to spread their leaves in the canopy. Red cedar, black cherry and hackberry trees compete for space in available sunlight. On the ground, a variety of seashore plants which include prickly pear cactus, poison ivy, beach plum, seaside

goldenrod, and winged sumac grow in forest clearings and on open dunes. Yet, the holly tree seems to control and dominate the forest. A balance of plants is temporarily established from the barren seaside to the sheltered bayside Holly Forest.

Because Sandy Hook is on the Atlantic Flyway, many migratory birds find shelter and food here. Protected birds include the Osprey (fish hawk), Great Horned Owl, Great Blue Heron and many other species. In addition, the Holly Forest offers habitat for mammals such as Cotton-tailed Rabbits, Muskrats, Meadow Mice, Deer Mice and reptiles such as the Box Turtle and Diamond-backed Terrapin.

THE SALT MARSH

The salt marshes are located along the bay side of Sandy Hook. They are lowland areas which are safe from the battering sea and whose muddy flats and salt resistant plants are flooded at high tides. The marsh is truly a wonderland of aquatic and shoreline life, and the thick, luxuriant grasses rank among the most organically productive environments in the world.

The tall, dense cover of Marsh Elder and Cord Grass and the nutrient rich muck of the marsh floor provide the growing state for most of the important creatures of the salt marsh. Here, a variety of snails and tiny periwinkles exist in seclusion. Fiddler Crabs scoop up algae with their claws and seek hiding places in small burrows in the mud. March Grasshoppers consume Cord Grass and in turn are eaten by spiders, fishes, and birds. Clams, scallops, mussels and sponges are the saltwater filter feeders. These animals strain the microscopic plant and animal plankton from the water and serve an important role in the marsh food chain. Other important links in the chain are fishes like killies and sticklebacks which follow the rising water in tidal streams in search of food. The diamond backed terrapin can also be found in the marsh and feeds on fishes.

The marsh grasses provide an excellent habitat for various birds and larger animals. Red-winged blackbirds call from the upper windblown plumes of marsh grasses and the agile Marsh Hawks hover overhead in search of mice. Between the sturdy cord grass stems other animals such as Clapper Rails, Green Herons, and Muskrats search for food. The surrounding waters of the cover provide a haven and refuge for many species of wild waterfowl. Here birds find resting and feeding space during their long spring or fall migrations. Some of the typical migrants to Sandy Hook's protected coves are: Mute Swans, Brant Geese, and many ducks - Blacks, Mallards, Scaup, Goldeneyes, Buffleheads and Ruddy Ducks.

Over the years the water quality at Sandy Hook has steadily decreased and today the bay waters along the Hook are no longer suitable for shell fishing. Pollution is just one of the many problems facing salt marshes today. Environmental threats to salt marshes are ever increasing. With today's continually growing population and expanding urban areas, greater demands are being placed upon "space." Not outer space, but space for people to live, work and for travel. Thousands of acres of tidal marshes have been drained or filled in for housing developments, industrial sites, parking lots, trash and garbage dumps, highways and airport extensions. Many marshes have been dredged for sand or gravel or for channels to boat marinas. During its history, New Jersey has lost about 30% or 60,000 acres of its tidal marshes; 230,000 acres remain. The salt marshes at Sandy Hook are strictly protected and left entirely undisturbed. However, this doesn't mean that changes are not occurring in the marsh. They are, but primarily the slow, steady alterations of nature.

What is the value of a salt marsh? Can we really measure the significance of the natural systems of life? There is no doubt of the ecological worth of the salt marsh. It is the spawning ground for our coastal and marine fishes. Here too, the nutrients forming the cycle of life in the ocean have their origins. Perhaps 80% to 90% of the edible marine fish gathered for market around the world come from shallow coastal waters. Marshes provide feeding and resting areas for shorebirds and waterfowl. Several species of birds, mammals, and many aquatic animals breed in the marsh. Another, though frequently overlooked, value of a tidal marsh is its beauty - a scenic part of the natural environment. The salt marsh is a natural system of life that man can change or protect, can preserve or destroy - but never really dominate.



THE BIRDS OF SANDY HOOK

Birdlife forms the larger portion of wildlife or animal life on Sandy Hook. There are several reasons why. First, Sandy Hook is located on the major bird migration flyway in the eastern U.S., the Atlantic Flyway. Secondly, the very shape of Sandy Hook, extending far out into the open water, welcomes migrating birds.

Thus, whether moving south in the fall or flying north in the spring, birds of all kinds pass through Sandy Hook on their migratory flights. Sandy Hook serves as a kind of "natural funnel" for birds flying up the coast and inland for quite a number of miles, and they naturally funnel onto Sandy Hook before crossing over the large area of water known as New York Bay.



However, the major reason why so many birds rest, feed and find nesting homes here is because of so many different and agreeable places to live and an abundance of various foods, from marine organisms and insects to seeds and berries. Almost 300 different species of birds have been seen at Sandy Hook, attracted mainly by the variety of habitats - ocean; beaches and salt lagoons; dunes; grassland and fields; fresh water marshes and ponds; saltwater marshes and tidal streams and wooded mature forests.

What interesting birds are found at Sandy Hook? The ocean and beach habitats provide a feeding place for a number of birds. A variety of sandpipers, plovers, and seagulls roam the beach, and common and least terns dive from the air to catch fish in the ocean.

In the dune, field, and brushy areas can be found Bobwhite Quails making their familiar "Bobwhite" call. Goldfinches, Mourning Doves, Field Sparrows, Towhees, Catbirds, Mockingbirds, Thrashers frequent these areas as well as the smaller Kinglets and many colorful Warblers.

The marsh and pond areas provide an aquatic habitat and thus feeding and nesting areas for many other ducks and wading birds such as Clapper Rails, Great Blue Herons, Black-crowned Night Herons and Green Herons. Smaller birds in these wet areas include Kingfishers, Red-winged Blackbirds, Marsh Wrens, and Swallows which dip into the fresh-water ponds during flight to get a drink of salt-free water. The protected coves of the bayside of the Hook feed and harbor the numerous migrating waterfowl in the fall and winter months. Such species as Mute Swans, Brant and Canada Geese, Cormorants, the beautiful American Widgeons, Scaup, Goldeneyes, Ruddy Ducks, Buffleheads, Mergansers, and Oldsquaws frequent these coves.



The forested areas are havens for woodland birds like the Warblers, Sparrows, Robin, Jays, Woodpeckers, Chickadees, Crows, Vireos, Woodcock and Thrushes as well as the various birds of prey that roost, feed or nest at Sandy Hook. The Great Horned Owl and Osprey are just two of the magnificent birds that nest in forested areas. The smaller Sparrow Hawk can be seen soaring and hovering at most times of the year.

Sanctuaries - Certain areas of Sandy Hook where rare or endangered birds are nesting are called sanctuaries and are strictly protected. The Great Blue Heron is one of the rare nesting birds along New Jersey's coast which lives in this sanctuary during the warmer months. Their huge stick nests in treetops and unusual flight characteristic of long folded neck and long legs extending out in back, make the Great Blue Heron an exciting sight. The Osprey, or Fish Hawk as it is more commonly called, also nests here during the summer. These birds can be expected to return like clockwork every spring on or about March 25. They, too, build stick nests sometimes up to a ton in weight, usually in dead cedar trees or on a man-made wooden platform and pole. The osprey populations have fluctuated due to the once widespread use of DDT and other harmful pesticides. These chemicals have since been banned. These birds make Sandy Hook their home for only a few months during the nesting season returning to the warmer south during the winter. Unlike these nesting birds and other summer and/or winter residents, most birds visit Sandy Hook for only a day or two on their way north or south. While they are here, they provide great enjoyment for the people who watch them.

RESOURCE LIST

1. **The Complete Family Nature Guide** - J.R. Worthley-Doubleday, 1976. Discusses a variety of habitats to explore from marshes to gardens to sidewalks to one's own home. There are a great many activities in the book which do not require collecting.
2. **It's Going to Sting Me! A Coward's Guide to the Great Outdoors** - R.Rood - Simon & Schuster, 1976. Dangerous and non-dangerous critters discussed. Your fears of the outdoors will be submerged in the wonders of observation. Very witty.
3. **"The Curious Naturalist"** - Massachusetts Audubon Society, Lincoln, MA 01773.
4. **Manual of Outdoor Interpretation** - J.J. Shamond - National Audubon Society - Nature Centers Division - 1130 Fifth Avenue, New York, New York 10028, \$3.00. Philosophy and Ideas with a section on urban interpretation.
5. **Life and Death of the Salt Marsh** - J & M. Teal - Ballantine Books (paperback). An excellent background text about these important natural areas.
6. **City Critters** - H.R. Russell - Wilkins Printers, Cortland, N.Y., 1968, rev. 1975. Excellent ideas for observations of nature in urban and suburban areas. Gives the idea that nature study is not confined to the "country."
7. **Handbook of Nature Study** - A.B. Comstock - Comstock Publishers Associates, Cornell University Press, Ithaca, N.Y., 1939, rev. 1970. A classic work. Ms. Comstock discusses many of our "modern" ideas, including the integration of environmental education with regular curricula.
8. **Resources Guide to Environmental Education** - New Jersey Department of Education, Division of Curriculum & Instruction, 225 W. State Street, Trenton, NJ, 08625. Lists books, periodicals, films, etc.
9. **Man and His Environment - Publications** - Sales Sections, NEA, 1202 16th St., N.W., Washington, D.C., 20036. Correlates the STRAND approach with other subjects in the curriculum.
10. **Denver Urban Education Stories** - Executive Director of Instructional Services, Denver Public Schools, Denver, CO. Their ideas can be adapted for use almost anywhere.
11. **Coming to Our Senses** - Education Committee, S.T.O.P., 2502 Saint Catherine St., West, Montreal 108, Quebec, Canada. Somewhat extreme, but has extensive reading lists.
12. **The Indians of New Jersey: Dickin Among the Lenapes** - M.R. Harrington - Rutgers University Press, New Brunswick, NJ, 1966
13. **Fundamental of Ecology** - Eugene Odum, W.W. Saunders Company, Philadelphia, 1971.
14. **The Life of the Seashore** - William H. Amos, McGraw Hill Book Company, 1966.
15. **Shells From Cape Cod to Cape May** - Morris K. Jacobson and William K. Emerson, Dover Publications, Inc., New York 1971.
16. **1,000 Questions Answered About the Seashore** - Berrill, Dover Publications.
17. **The Beaches are Moving, The Drowning of America's Shoreline** - Wallace Kaufman and Orrin A. Pilkey, Jr., Duke University Press, N.C., 1983.
18. **Barrier Island Handbook** - Stephen P. Leatherman, University of Maryland, Maryland, 1982.

