

BY THE SEA, BY THE SEA, BY THE BEAUTIFUL SEA

Franklin A. Nash, Jr., Ph.D.

Prepared for Delivery at the Athenaeum Society

Hopkinsville, Kentucky

March 3, 1988

THE TITLE FOR MY PAPER IS TAKEN FROM A SONG THAT WAS QUITE POPULAR BACK IN THE EARLY 1900'S, "BY THE SEA, BY THE SEA, BY THE BEAUTIFUL SEA."

IF YOU ARE THINKING ABOUT GOING TO THE BEACH THIS SUMMER, JUST WAIT AROUND FOR AWHILE AND YOU MIGHT NOT HAVE AS FAR TO GO. THE BEACH MAY BE COMING TO YOU! SEVERAL YEARS AGO I ATTENDED A TRAINING WORKSHOP IN MIAMI BEACH, FLORIDA, AND WAS EAGERLY LOOKING FORWARD TO NOT ONLY THE WORKSHOP BUT TO ENJOYING THIS WORLD FAMOUS BEACH. THE HOTEL WAS LOCATED RIGHT ON THE BEACH AND AT THE FIRST BREAK I RUSHED DOWNSTAIRS AND OUT THE BACK ONLY TO DISCOVER A HANDFUL OF ROCKS, AND THE WATER SPLASHING RIGHT UP ON THE STEPS. THERE WAS NO BEACH! THE ONLY BEACH I FOUND ON THE WHOLE TRIP WAS A STRETCH ABOUT HALF A BLOCK LONG THAT HAD BEEN SET ASIDE AS A PARK.

LAST SPRING WE VISITED TYBEE ISLAND, ONE OF THE GEORGIA COASTAL ISLANDS NEAR SAVANAH. THE BEACH THERE WAS FAIRLY NICE BUT WE FOUND THAT TO GET TO IT WE HAD TO CLIMB OVER A LARGE PIPE-LINE AND THERE WERE DOZER TRACKS ALL OVER THE PLACE. WE LEARNED LATER THAT THE BEACH HAD ALMOST WASHED AWAY AND THAT AN OPERATION WAS IN PROGRESS PUMPING SAND IN FROM ANOTHER SOURCE IN AN ATTEMPT TO REBUILD THE BEACH.

LATER IN THE SUMMER WE SPENT SOME TIME ON THE BEACH OF EDISTO ISLAND, SOUTH CAROLINA. NOW THIS WAS TRULY A BEAUTIFUL, WIDE BEACH WITHOUT ANY HOTELS TO MAR THE SCENERY OR COVER THE SAND. HOWEVER, NEAR THE END OF THE WEEK I HAD ANOTHER SURPRISE WHEN ONE OF THE NATIVE RESIDENTS WE HAD MET COMMENTED THAT WHEN

HE CAME TO THE ISLAND IN THE 1940'S THE BEACH THAT IS NOW RIGHT NEXT TO THE RESTAURANT WE WERE LOOKING AT WAS A FULL FOUR BLOCKS FURTHER OUT!

WHAT WAS HAPPENING WITH ALL OF THIS? I BEGAN TO WONDER ABOUT THE ADVISABILITY OF ANYONE INVESTING IN BEACHFRONT PROPERTY! IRONICALLY, THE WEEK AFTER WE GOT HOME TIME MAGAZINE HAD A COVER PICTURE AND FEATURE ARTICLE ENTITLED, "WHERE'S THE BEACH? AMERICA'S VANISHING COAST LINE," AND IN THE MONTHS TO FOLLOW I NOTICED OTHER ARTICLES AND TV NEWS SPOTS THAT FOCUSED ON OUR "SHRINKING SHORES," A SERIOUS PROBLEM THAT IS HAPPENING NOT ONLY IN THE UNITED STATES BUT ALSO IN MANY OTHER PARTS OF THE WORLD.

AT SOMETIMES AN ASTOUNDING AND FRIGHTENING RATE COASTAL LANDS ARE BEING WASHED AWAY AND SINKING INTO THE OCEANS. THE PROBLEM IS BEING FELT ALL OVER THE WORLD AND ESPECIALLY IN SUCH COUNTRIES AS BRITAIN, WEST GERMANY AND THE NETHERLANDS WHERE THERE HAS BEEN MORE DEVELOPMENT OF BEACHFRONT PROPERTY. IN THE UNITED STATES ALMOST ALL OF THE SHORELINE IN EVERY STATE THAT BORDERS AN OCEAN, THE GULF OF MEXICO, OR THE GREAT LAKES IS BEING AFFECTED.

ABOUT EIGHTY-SIX PERCENT OF CALIFORNIA'S ONE THOUSAND, ONE HUNDRED MILES OF SHORELINE IS RECEDING AT A RATE RANGING FROM SIX INCHES TO TWO FEET PER YEAR ON THE AVERAGE WITH SOME AREAS LOSING AS MUCH AS FIFTEEN FEET PER YEAR. ONE COUPLE WITH A

BLUFF-TOP HOME ON THE COAST JUST NORTH OF SAN FRANCISCO NOTED THAT FIFTEEN FEET OF EARTH IN FRONT OF THEIR HOUSE SLID INTO THE SEA IN 1982 AND ANOTHER FIFTEEN FEET FELL OFF IN 1983. THEY MOVED THE HOUSE BACK THIRTY-TWO FEET AND IN 1985 ANOTHER THIRTY FEET DROPPED OFF LEAVING THE HOME HANGING ON THE EDGE. ONE AREA IN WASHINGTON STATE HAS LOST MORE THAN TWO MILES OF COASTAL DEPTH SINCE 1910!

ON THE EAST AND GULF COASTS ALL OF THE BARRIER ISLANDS ARE SHRINKING AND MOVING TOWARD THE MAINLAND BY ONE TO TEN FEET PER YEAR. THE HIGH WATER LINE OF LONG ISLAND IS ABOUT ONE HUNDRED FEET FURTHER INLAND THAN IT WAS FIFTY YEARS AGO. A COUPLE WHO OWN A SUMMER HOME ON A UPPER CLASS AREA OF LONG ISLAND BEACH RECALL THAT WHEN THEY BOUGHT THE HOME FOUR YEARS AGO THERE WAS A SAND DUNE IN FRONT OF THE HOUSE AND A NICE BEACH IN FRONT OF THAT. DURING THEIR FIRST WINTER THERE A STORM WASHED THE DUNE AWAY AND SINCE THAT TIME, ANOTHER EIGHT FEET OF THE SANDY BEACH HAS DISAPPEARED. ONE AREA IN NORTH CAROLINA LOST ABOUT SIXTY FEET OF BEACH DEPTH IN 1987 ALONE. SOME OR ALL OF SEVERAL TOWNS, STREETS AND MONUMENTS HAVE BEEN LOST TO THE SEA SUCH AS EDINGSVILLE BEACH, SOUTH CAROLINA; HOG ISLAND, VIRGINIA; AND THE CONFEDERATE FORT FISHER IN NORTH CAROLINA. PARTS OF CHAMBERS COUNTY, TEXAS, HAVE LOST NINE FEET OF COAST TO GALVESTON BAY IN NINE MONTHS AND LOUISIANA HAS SHRUNK BY AS MUCH AS THREE HUNDRED SQUARE MILES SINCE 1970. DIFFERENT SOURCES NOW ESTIMATE THAT AN ADDITIONAL FORTY, FIFTY TO SIXTY SQUARE MILES OF LOUISIANA ARE

VANISHING EVERY YEAR AND THE RATE OF LOSS SEEMS TO BE INCREASING. IN THE MID 1800'S THE TOWN OF BAILIZE, LOUISIANA, WAS THE BUSY HOME OF RIVER PILOTS AND OTHERS WHO MADE THEIR LIVING ON THE RIVER AND GULF. IT WAS LOCATED AT THE TIP OF THE MISSISSIPPI RIVER DELTA THEN BUT TODAY IT WOULD TAKE SOME OF SAM TRAUGHBER'S SCUBA GEAR TO EXPLORE WHAT IS LEFT OF IT, NOW UNDER FIFTEEN FEET OF WATER.

IN ADDITION TO THE LOSS OF LAND AND BEACH THE TREND ALSO RESULTS IN THE LOSS OF FRESH WATER SOURCES IN SOME COASTAL AREAS AS THE SALT WATERS MAKE THEIR WAY FURTHER INLAND. AND AS THE SHORELINES RECEDE BUILDINGS ARE CLOSER TO THE WATER (IF NOT IN IT) AND THEREFORE BECOME MORE SUSCEPTIBLE TO STORM DAMAGE. IN SPITE OF ALL THIS PEOPLE ARE MORE DETERMINED TO FLOCK TO THE WATER'S EDGE AND TO TRY TO PLANT ROOTS THERE, SEEMINGLY UNAWARE OF OR IGNORING THE PROBLEMS AND RISKS INVOLVED.

IN CONTRAST THERE ARE SOME ISOLATED AREAS ALL OVER WHERE A BUILDUP OF SHORE PROPERTY IS BEING EXPERIENCED BUT THESE SEEM TO BE RELATIVELY FEW. THIS PHENOMENON OF THE CHANGING SHORELINE IS CERTAINLY NOT NEW, HAVING BEEN A PART OF GEOLOGICAL HISTORY SINCE THE SEAS WERE FIRST FORMED, BUT IT DOES APPEAR TO HAVE BEEN ACCELERATING AT A SIGNIFICANT RATE IN RELATIVELY RECENT YEARS.

WHAT IS HAPPENING TO CAUSE THIS PATTERN OF CHANGE? IS IT JUST A CONTINUATION OF NORMAL GEOLOGICAL EVOLUTION OR ARE THERE OTHER FACTORS CONTRIBUTING TO THE PROBLEM? IS THERE ANY-

THING AT ALL THAT CAN BE EFFECTIVELY DONE TO CONTROL THE PROBLEM? AS WITH MOST ANY PROBLEM, THE ANSWER TO THE QUESTION OF CONTROL DEPENDS A LOT ON THE ANSWER TO THE FIRST QUESTION OF UNDERSTANDING AND BEING ABLE TO ACCEPT THE REALITY OF THE CAUSES OF THE PROBLEM.

THERE IS NO DOUBT THAT MUCH OF WHAT IS HAPPENING TO THE SHORELINES IS THE RESULT OF CONTINUING GEOLOGICAL PHENOMENA. MANY FACTORS IN THE ONGOING GEOLOGICAL PROCESS RESULT IN THE RISE AND FALL OF LAND MASSES. MOUNTAINS ARE BUILT UP OR BLOWN AWAY THROUGH VOLCANIC ACTION. THE MOVEMENT OF THE EARTH'S CRUST AS SEEN IN PLATE TECTONICS CAN RESULT IN LIFTING AND FOLDING OF ROCK MASSES. THE WEIGHT OF LAND BUILT UP THROUGH SOIL DEPOSITION BY RIVERS AND OTHER FORCES CAN LATER CAUSE A SETTLING OR SINKING EFFECT, WHICH IS PART OF WHAT IS HAPPENING IN LOUISIANA TODAY. MARINE FOSSIL DEPOSITS ARE FOUND HIGH IN THE MOUNTAINS FAR FROM ANY PRESENT DAY OCEAN, ATTESTING TO THE RISE AND FALL OF LANDS AND SEAS. EVEN THE GROUND ON WHICH WE LIVE HERE IN CHRISTIAN COUNTY WAS ONCE AN OCEAN FLOOR. MANY EXAMPLES OF MARINE FOSSILS ARE ALL AROUND US.

NOT ONLY DOES THE LAND RISE, FALL AND MOVE SIDWAYS BUT THE LEVEL OF THE SEAS AND OCEANS IS ALSO IN CONTINUOUS CHANGE OVER GEOLOGICAL TIME. AT THE PRESENT TIME THE SEA LEVEL IS CONTINUING TO RISE AS IT HAS SINCE THE END OF THE LAST ICE AGE ABOUT ELEVEN THOUSAND TO NINETEEN THOUSAND YEARS AGO. SCIENTISTS HAVE BEEN MEASURING THE RELATIVE SEA LEVEL AT TIDE GAUGE STATIONS

AROUND THE WORLD FOR ABOUT ONE HUNDRED YEARS NOW AND IT IS ESTIMATED THAT DURING THAT TIME THE SEAS WORLDWIDE HAVE CLIMBED ABOUT FOUR TO SIX INCHES. IT HAS ALSO BEEN SHOWN THAT DURING THE PAST FIFTY YEARS THERE HAS BEEN SOME ACCELERATION IN THE RISE AND A CONTINUED ACCELERATION IS PREDICTED BY MANY. WITH THE ACTUAL RISE IN SEA LEVEL FROM AN INCREASE IN VOLUME OF WATER AND THE COMBINED EFFECT OF LAND SINKING NEAR MUCH OF THE U.S. COASTAL AREA IT HAS BEEN STATED BY A NUMBER OF SOURCES THAT THE EFFECTIVE RISE IN SEA LEVEL FOR THE UNITED STATES HAS BEEN AT LEAST ONE FOOT OVER THE LAST ONE HUNDRED YEARS. THE NATIONAL ACADEMY OF SCIENCE, FOR EXAMPLE, HAS DOCUMENTED A ONE FOOT RISE IN THE ATLANTIC OCEAN SINCE 1900. A RISE OF ONLY A FEW INCHES MIGHT NOT SOUND LIKE ENOUGH TO BE CONCERNED ABOUT, ESPECIALLY OVER SUCH A LONG PERIOD OF TIME, BUT THE EFFECT IS MORE THAN YOU MIGHT EXPECT AND IS ONLY ONE OF THE FACTORS INVOLVED. A PREDICTED RISE IN SEA LEVEL OF ONE FOOT WITHIN THE NEXT THIRTY TO FIFTY YEARS, THE TIME DEPENDING ON WHOSE PREDICTION YOU READ, WOULD DRIVE MUCH OF THE ATLANTIC AND GULF SHORELINE OF THE U.S. INLAND BY ANYWHERE FROM ONE HUNDRED TO ONE THOUSAND FEET, DEPENDING ON THE LOCATION.

PART OF THE REASON FOR THIS RISE IN SEA LEVEL IS THE WARMING OF THE WATER TEMPERATURE AND THAT OF THE SURROUNDING AIR. THIS WARMING RESULTS IN AN EXPANSION OF THE WATER ITSELF AND ALSO IN THE MELTING OF THE GREAT ICE MASSES IN SOME POLAR REGIONS AND HIGHLAND GLACIERS, THUS ADDING TO THE VOLUME OF WATER. THIS TREND IS PART OF A NORMAL GEOLOGICAL AND METEOROLOGICAL CYCLE THAT

HAS BEEN HAPPENING SINCE THE EARTH BEGAN. AT LEAST FIVE ICE AGES ARE KNOWN TO HAVE OCCURRED WITH THE MOST RECENT ONE STARTING SOME ONE MILLION, SIX HUNDRED THOUSAND YEARS AGO AND ENDING APPROXIMATELY ELEVEN THOUSAND YEARS AGO, AND INCLUDING ABOUT EIGHTEEN ADVANCES AND RETREATS OF ICE SHEETS WITH WARMING PERIODS IN BETWEEN EACH ONE. SOME OF THESE WARMING PERIODS HAVE BEEN WARMER THAN IT IS NOW (PALM TREE FOSSILS HAVE BEEN FOUND IN CANADA!), AND IT IS POSSIBLE THAT WE MAY NOW ONLY BE IN ANOTHER INTER-GLACIAL WARMING PERIOD WITH YET ANOTHER ICE ADVANCE TO COME.

SINCE ABOUT 1900 THE OCEAN'S SURFACE TEMPERATURE HAS INCREASED BY 0.5 TO 1.0 DEGREE FARENHEIT, WITH A SIMILAR WARMING OF AIR TEMPERATURE. AGAIN WHILE THIS IS SEEN AS PART OF THE NORMAL WARMING CYCLE, SOME SCIENTISTS BELIEVE THAT A NEW FACTOR HAS BEEN INTRODUCED BY MODERN CIVILIZATION, A FACTOR THAT IS BEING CALLED THE "GREENHOUSE EFFECT." AS I UNDERSTAND IT CARBON DIOXIDE ALLOWS THE WARMING RAYS OF THE SUN TO REACH THE EARTH BUT BLOCKS HEAT THAT WOULD OTHERWISE RADIATE BACK OUT INTO SPACE. SINCE THE INDUSTRIAL REVOLUTION GREATER QUANTITIES OF FOSSIL FUELS SUCH AS COAL, OIL AND GAS HAVE BEEN BURNED, AND ONE BY-PRODUCT OF THIS BURNING IS CARBON DIOXIDE WHICH IS RELEASED INTO THE ATMOSPHERE. ACCORDING TO THE DEPARTMENT OF ENERGY, ATMOSPHERIC CONCENTRATIONS OF CARBON DIOXIDE HAVE RISEN BY ABOUT TWENTY-FIVE PERCENT DURING THE PAST ONE HUNDRED YEARS WITH THE RATE OF INCREASE ACCELERATING. SOME SOURCES ESTIMATE THAT THE CARBON DIOXIDE LEVEL WILL DOUBLE OVER THE NEXT ONE HUNDRED YEARS

AND THAT THIS WOULD RAISE THE OCEAN TEMPERATURES BY AT LEAST FOUR TO SEVEN DEGREES FARENHEIT. ALTHOUGH THERE IS AT LEAST SOME "EDUCATED GUESSWORK" INVOLVED, SUCH AN INCREASE COULD MELT ICE SHEETS AT A CATASTROPHIC RATE. THE ENVIRONMENTAL PROTECTION AGENCY HAS ESTIMATED A RISE IN SEA LEVEL OF ABOUT ONE FOOT DURING THE NEXT THIRTY TO FORTY YEARS AND AS MUCH AS THREE TO FIVE FEET OVER THE NEXT ONE HUNDRED YEARS.

SO WE BEGIN TO SEE THAT THE PROBLEM WITH OUR SHORE LINES AND BEACHES ISN'T ALL JUST A "NORMAL COURSE OF EVENTS." IN ADDITION TO THE GREENHOUSE EFFECT THERE ARE OTHER CONTRIBUTIONS THAT HUMANITY HAS MADE TO THE PROBLEM. IN THE CASE OF THE PROBLEM IN LOUISIANA, EFFORTS TO CONTROL THE MISSISSIPPI RIVER AND ITS TRIBUTARIES HAVE HAD A SIGNIFICANT EFFECT. BEFORE, THE RIVER WOULD FLOW MORE SLOWLY, FLOOD ITS BANKS DURING HIGH WATER SEASONS, AND DEPOSIT LARGE AMOUNTS OF SEDIMENT, NOT ONLY IN THE UPPER REGIONS BUT IN THE COASTAL DELTA AREA. BUT NOW, DAMS ON TRIBUTARY RIVERS REDUCE A LOT OF SEDIMENT FLOW AND THE LEVEE SYSTEM ON THE MISSISSIPPI HAS SHORTENED THE RIVER BY MORE THAN ONE HUNDRED, FIFTY MILES WITH THE RESULT THAT THE SLOPE, VOLUME AND SEDIMENT DISCHARGE HAS BEEN SIGNIFICANTLY EFFECTED. NOW MUCH OF THE SEDIMENT IS RUSHED RIGHT INTO THE GULF OF MEXICO RATHER THAN BEING DEPOSITED INLAND. THE SYSTEM OF LEVEES PARTLY RESPONSIBLE FOR THIS IS SOME FIFTEEN TO THIRTY FEET HIGH AND RUNS FROM CAPE GIRARDEAU, MISSOURI, TO THE GULF. THIS IS ONE THOUSAND, SIX HUNDRED MILES, MAKING THE LEVEE THE LONGEST MANMADE STRUCTURE

IN THE WORLD - - EVEN LONGER THAN THE GREAT WALL OF CHINA WHICH IS ONLY A LITTLE OVER ONE THOUSAND, FIVE HUNDRED MILES LONG. OF COURSE, THE GREAT WALL IS STILL A LOT MORE IMPRESSIVE AS A STRUCTURE THAN THE MOUNDS OF DIRT AND ROCK THAT FORM THE LEVEES.

IN SOME OF THE COASTAL REGIONS THAT ARE BORDERED BY HIGH BLUFFS AND ROCKS SUCH AS THOSE ON OUR PACIFIC AND NORTHEAST ATLANTIC COASTS, DIFFERENT PROBLEMS OCCUR. AREAS ON TOP OF THE CLIFFS HAVE BEEN BUILT UP WITH HOUSES AND OTHER BUILDINGS. LAWNS, GARDENS AND TREES HAVE BEEN PLANTED CLOSE TO THE EDGE AND IRRIGATION SYSTEMS HAVE BEEN INSTALLED. ALL OF THIS HAS CREATED PROBLEMS IN THE FORM OF DIFFERENT RUNOFF PATTERNS FOR RAINFALL, WEAKENING OF THE SOIL FROM SEEPAGE FROM THE IRRIGATION AND WATERING OF LAWNS AND GARDENS, AND FROM STREET RUNOFF AS WELL AS FROM DAMAGE CREATED BY TREE ROOTS PLANTED TOO CLOSE TO THE EDGE. ANOTHER FACTOR IS THAT MANY MILES INLAND, DAMS ON RIVERS ARE CUTTING OFF THE SUPPLY OF SAND THAT WAS ONCE CARRIED TO THE COAST --MUCH LIKE THE PROBLEM IN LOUISIANA. THIS CONTRIBUTES TO THE BEACHES BECOMING MORE NARROW AND THUS ALLOWING THE FORCE OF THE WAVES TO MORE OFTEN SLAM AGAINST THE CLIFFS BRINGING THEM CRASHING DOWN ALONG WITH THE BUILDINGS ON TOP.

ON THE ATLANTIC AND GULF BEACHES THE HUMAN CONTRIBUTIONS TO THE PROBLEM ARE YET DIFFERENT. IN SUCH COASTAL AREAS AS THESE, INCLUDING THE BARRIER ISLANDS, THE SAND DUNES ARE EXTREMELY IMPORTANT IN KEEPING THE AREA INTACT, SERVING AS A BUFFER AGAINST THE FORCE OF THE WAVES DURING HIGH TIDES AND

STORMS. HOWEVER, IN MANY PLACES SUCH AS OCEAN CITY, MARYLAND, DEVELOPERS HAVE BEEN BUILDING HIGHRISE CONDO'S AND HOTELS RIGHT ON THE DUNE LINE, BULLDOZING THE DUNES AWAY SO THAT OCCUPANTS OF THE LOWER FLOORS CAN HAVE A CLEAR VIEW OF THE OCEAN. BUT THE OCEAN HAS FOUGHT BACK BY MOVING RIGHT ON IN, AND NOW BENEATH MANY OF THE BUILDINGS THE PILINGS ARE EXPOSED AND BEING HAMMERED AWAY BY THE WAVES. IT MAY BE THAT BEFORE LONG SOME OF THOSE FIRST FLOOR RESIDENTS WILL BE ABLE TO BOAST HAVING THE WORLD'S LARGEST JACCUZI RIGHT IN THEIR LIVING ROOM! BEFORE WORLD WAR II ONLY ABOUT TWENTY-EIGHT OF THE TWO HUNDRED, EIGHTY TO TWO HUNDRED, NINETY-FIVE U.S. BARRIER ISLANDS WERE EVEN PARTLY BUILT UP. TODAY AT LEAST SEVENTY ARE HIGHLY OVERDEVELOPED. ATLANTIC CITY, NEW JERSEY; MIAMI BEACH, FLORIDA; OCEAN CITY, MARYLAND; CONEY ISLAND, NEW YORK; VIRGINIA BEACH, VIRGINIA; AND HILTON HEAD, SOUTH CAROLINA, BEING JUST A FEW EXAMPLES.

ANOTHER WAY THAT PEOPLE DESTROY THE ALL-IMPORTANT DUNES IS LESS DRAMATIC AND SLOWER THAN THE BULLDOZER BUT EVENTUALLY JUST AS DESTRUCTIVE. FOR SAND DUNES TO FORM IN THE FIRST PLACE THE SAND MUST BE TRAPPED AND HELD, AND THE THING THAT DOES THIS IS THE VARIOUS FORMS OF DUNE GRASS LIKE THE BEAUTIFUL SEA OATS FOUND ON THE SOUTHEAST COAST. THESE GRASSES WITH ROOTS THAT ANCHOR THE SAND IN PLACE ARE ABLE TO WITHSTAND THE SALT SPRAY AND HIGH WINDS BUT THEY ARE NOT ABLE TO HOLD UP UNDER THE POUNDING FROM DUNE BUGGIES AND THOUSANDS OF FOOTPRINTS. IT DOESN'T TAKE MUCH OF THIS TO KILL THE DUNE GRASSES, AND SOON THE ROOTS ARE GONE AND

THEN SO IS THE DUNE, AND THE OCEAN IS MORE FREE TO MOVE ON INLAND. I AM REMINDED OF A T.V. COMMERCIAL FROM A FEW YEARS AGO, "IT ISN'T NICE TO FOOL MOTHER NATURE," -- OR WE MIGHT ADD, "TO FOOL WITH MOTHER NATURE."

CONSIDERING THE IMMENSE FINANCIAL LOSSES FROM THE INLAND MARCH OF THE SEA AND THE LOSS OF LIVES FROM INCREASED STORM DAMAGE, IS THERE ANYTHING THAT CAN BE DONE TO "HOLD BACK THE TIDE?" A FEW "STOPGAP" MEASURES ARE BEING TRIED IN DIFFERENT AREAS BUT WITH AT LEAST QUESTIONABLE LONG-TERM EFFECTIVENESS. IN LOUISIANA, SMALL DAM-LIKE STRUCTURES HAVE BEEN INSTALLED AT CRITICAL POINTS IN A FAIRLY SUCCESSFUL EFFORT TO CONTROL THE BALANCE BETWEEN SALT WATER AND FRESH WATER MARSHES, V-SHAPED "FENCES" HAVE BEEN INSTALLED IN THE RIVER DELTA AREA TO ENCOURAGE THE GROWTH OF SMALL ISLANDS ON THEIR DOWNSTREAM SIDE BY THE DEPOSITION OF SEDIMENT, AND OTHER SUCH MEASURES ARE BEING CONSIDERED UPSTREAM, BUT NO REALLY SIGNIFICANT IMPROVEMENT IN THE OVERALL PROBLEM HAS BEEN MADE. IN THE GALVESTON BAY, TEXAS, AREA A NUMBER OF FRANTIC EFFORTS HAVE BEEN TRIED. RANCHERS HAVE LINED THE SHORE WITH JUNKED CARS TO TRY TO KEEP ROADS FROM WASHING AWAY AND ANOTHER PERSON IS PLANNING THE USE OF WIRE MESH AND OLD TIRES TO HOLD BACK THE LOSS OF HIS BLUFFS WHICH ARE DROPPING OFF AT THE RATE OF TEN FEET PER YEAR. ON LONG ISLAND, RESIDENTS HAVE TRIED TO PROTECT THE DUNES WITH DRIFTWOOD AND OLD TIRES, AND IN ONE CALIFORNIA COMMUNITY THEY HAVE TRIED LAYING A LONG TUBE-LIKE PLASTIC STRUCTURE ALONG THE BEACH TO TRY TO TRAP THE SAND BEING

WASHED AWAY DURING HIGH TIDE.

SOME MORE ELABORATE EFFORTS SUCH AS BUILDING SEA WALLS AND RIPRAP WALLS THAT RUN PARALLEL TO THE BEACH; OR GROIN FIELDS, STRUCTURES THAT EXTEND OUTWARD FROM THE BEACH INTO THE WATER AND SPACED EVERY ONE HUNDRED YARDS OR MORE APART, SEEM TO BE EFFECTIVE AT FIRST IN PROTECTING ISOLATED AREAS. HOWEVER, THESE HAVE USUALLY RESULTED IN EVEN MORE EROSION TO AREAS NEARBY. THE SEA WALLS MAY TEMPORARILY PROTECT THE AREA BEHIND THEM BUT MAKE THE EROSION OF THE BEACH IN FRONT OF THEM EVEN WORSE, AND THE GROIN FIELDS AND SIMILAR STRUCTURES INTERFERE WITH THE NORMAL DRIFT OF BEACH SANDS AND CAUSE A GREATER LOSS FURTHER DOWN THE COAST.

PERHAPS THE MOST EFFECTIVE EFFORT SO FAR HAS BEEN THE GENERAL TECHNIQUE KNOWN AS BEACH NOURISHMENT. THIS INVOLVES USING A NUMBER OF POSSIBLE TECHNIQUES TO REPLACE THE SAND LOST FROM THE BEACHES AND IS WHAT WAS BEING DONE WITH THE PIPELINE ON THE BEACH AT TYBEE ISLAND THAT WAS MENTIONED AT THE BEGINNING. THIS RATHER EXPENSIVE PROCESS USUALLY INVOLVES THE USE OF HYDRAULIC PUMPS TO SUCK UP SAND FROM THE OCEAN AND PUMP IT SOME DISTANCE AWAY TO THE BEACH. SEVERAL IMPRESSIVE EFFORTS WITH THIS HAVE BEEN MADE SUCH AS AT KEY BISCAYNE, FLORIDA, WHERE THE ARMY CORPS OF ENGINEERS RAN THEIR PUMP TWENTY-FOUR HOURS A DAY FOR ALMOST THREE MONTHS AT A COST OF 1.55 MILLION DOLLARS. AT WRIGHTSVILLE BEACH, NORTH CAROLINA, THE BEACH WAS WIDENED BY TWO HUNDRED FEET AND NEW DUNES WERE BUILT AT A COST OF 2.95 MILLION

DOLLARS; MYRTLE BEACH, SOUTH CAROLINA, WAS SIGNIFICANTLY WIDENED TO THE TUNE OF 4.5 MILLION DOLLARS, AND NEW YORK CITY IS PLANNING TO SPEND FIFTH-TWO MILLION DOLLARS IN CITY, STATE AND FEDERAL FUNDS OVER THE NEXT TWELVE YEARS TO REBUILD ROCKAWAY BEACH. IS IT ALL WORTH IT? WILL IT LAST? SO MUCH OF THIS APPARENT SUCCESS IS LIKE THE CHILD'S BEAUTIFUL SAND CASTLE BUILT NEAR THE WATER'S EDGE AT LOW TIDE. WHEN HE OR SHE AWAKENS IN THE MORNING AND RUSHES DOWN TO THE BEACH ALL THE HANDIWORK AND EFFORT HAVE DISAPPEARED. AT OCEAN CITY, NEW JERSEY, FIVE MILLION DOLLARS WAS SPENT ON BEACH NOURISHMENT WITH THE PROJECT BEING COMPLETED JUST BEFORE THE FALL STORM SEASON. WITHIN TEN DAYS SEVERAL BAD LOCAL STORMS WASHED AWAY OVER SIXTY PERCENT OF THE SAND!

THE MOST EFFECTIVE METHODS OF DEALING WITH THE WHOLE PROBLEM IN THE LONG RUN WILL HAVE TO INVOLVE STRINGENT REGULATIONS AND CONTROL WITH REFERENCE TO THE DEVELOPMENT AND USE OF COASTAL LANDS. HOWEVER, WITH THE POPULATION'S LOVE OF THE BEACH, THE GREED OF DEVELOPERS, POLITICAL LOOPHOLES, AND CLOSED EYES, ANY FAR-REACHING CHANGES ARE LIKELY TO BE VERY SLOW IN COMING.

PERHAPS ANOTHER APPROACH COULD BE OF HELP, THAT OF EDUCATING THE PUBLIC MORE ABOUT WHAT THE PROBLEM REALLY IS. UNTIL I STARTED WORKING ON THIS PAPER I HAD NO IDEA OF THE EXTENT OF WHAT IS HAPPENING EVEN THOUGH WE HAD JUST VISITED TWO OF THE BEACHES INVOLVED IN THE PROBLEM. THERE WERE A FEW SIGNS AROUND THE BEACH AT EDISTO ISLAND SAYING THAT IT IS UNLAWFUL TO

PICK THE SEA OATS GROWING ON THE DUNES BUT NO MENTION OF WHY. IN FACT, THE LAW MAY NOT HAVE HAD ANYTHING TO DO WITH PROTECTING THE DUNES IN THE FIRST PLACE SINCE THE SEA OATS ARE ALSO A BEAUTIFUL CONTRIBUTION TO THE SCENERY THERE. MORE NEEDS TO BE DONE TO LET THE PEOPLE KNOW WHAT IS INVOLVED. AT LEAST ONE SUCH EFFORT IS BEING MADE IN GEORGIA. THE GEORGIA CONSERVANCY WAS FOUNDED IN 1967 AS A NONPROFIT ORGANIZATION DEDICATED TO "PRESERVING, PROTECTING, AND IMPROVING GEORGIA'S NATURAL RESOURCES, HISTORY AND ENVIRONMENT," INCLUDING THE COASTAL LANDS AND ISLANDS. THEIR GOAL IS TO EDUCATE THE PUBLIC AND TO LOBBY FOR THE WISEST USE OF RESOURCES. NOW, I AM AWARE OF SOME OF THE OTHER CONSERVATION ORGANIZATIONS AROUND THE COUNTRY AND THAT SOME OF THEM TEND TO GET CARRIED AWAY WITH WHAT THEY ATTEMPT TO DO BUT WE CANNOT CONTINUE WITH SOME OF OUR WAYS OF TRYING TO USE THE LAND AND SEA WITHOUT PAYING A TREMENDOUS PRICE IN THE LONG RUN.

WE MIGHT PUMP A LITTLE SAND ON DWINDLING BEACHES OR ERECT BARRIERS IN FRONT OF A BLUFF OR HOLD OUR HAND OUT TO TRY TO STOP THE WAVES, BUT IT WILL BE OF LITTLE EFFECT. ONE THING IS CLEAR: THERE IS NO WAY THAT WE CAN HOLD BACK THE FORCES OF NATURE. IT THEREFORE REMAINS THAT WE MUST CHANGE THE WAY WE "FOOL WITH MOTHER NATURE" AND LEARN TO ADJUST TO THE INEVITABLE CHANGES SHE BRINGS.

AND NOW, IF YOU WILL EXCUSE ME, I AM GOING TO END THIS PAPER SO I CAN GET HOME AS EARLY AS I CAN AND GET BACK TO MAKING PLANS FOR OUR SPRING-BREAK TRIP BACK TO THE EDISTO ISLAND BEACH WHILE IT IS STILL THERE!

B I B L I O G R A P H Y

Field and Stream. July, 1987.

Gilbert, Susan. America Washing Away. Science Digest.
August 30, 1986.

Harrington, John W. Dance of the Continents - Adventures With
Rocks and Time. Los Angeles, California. J.P. Tarcher,
Inc., 1983.

Newsweek. "An Icy Warning of a Global Warming?" December 28,
1987.

Southern Living. February, 1987.

Time. "Where's the Beach?" New York, N.Y. Time, Inc.
August 10, 1987.

The World Book Encyclopedia of Science. The Planet Earth.
Chicago, Ill. World Book, Inc. 1985.