

**PROCEEDINGS**

**CIRCULATING COPY**  
**Sea Grant Depository**

**of the**

**Wetlands Management Seminar**

**Sponsored by**

**The Regional Marine Resources Council of the**

**Nassau-Suffolk Regional Planning Board**

**in cooperation with**

**The National Oceanic and Atmospheric Administration**

**September 15, 1972**

**Hauppauge, New York**

**NATIONAL SEA GRANT DEPOSITORY  
PELL LIBRARY BUILDING  
URI, NARRAGANSETT BAY CAMPUS  
NARRAGANSETT, RI 02882**

PROCEEDINGS  
OF THE  
WETLANDS MANAGEMENT SEMINAR

**CIRCULATING COPY**  
**Sea Grant Depository**

Sponsored by  
The Regional Marine Resources Council of the  
Nassau-Suffolk Regional Planning Board  
in cooperation with  
The National Oceanic and Atmospheric Administration

NATIONAL SEA GRANT DEPOSITORY  
PELL LIBRARY BUILDING  
URI, NARRAGANSETT BAY CAMPUS  
NARRAGANSETT, RI 02882

September 15, 1972

Hauppauge, New York

NASSAU-SUFFOLK REGIONAL PLANNING BOARD

Hon. Leonard W. Hall, Chairman

Seth A. Hubbard, Vice Chairman  
H. Lee Dennison

Walter G. Michaelis  
Vincent R. Balletta, Jr.

Thomas Halsey

Ex-Officio

John H. Peters  
M. Halsted Christ

Rudolph M. Kammerer  
Henry D. Claussen

Advisory

Hon. Ralph G. Caso  
Hon. Francis T. Purcell

Hon. John V.N. Klein  
Hon. Michael J. Grant

REGIONAL MARINE RESOURCES COUNCIL

RAdm. E. C. Stephan, USN (ret), Chairman

Dr. John C. Baiardi  
Dr. A. Harry Brenowitz  
Hon. John J. Burns  
Leo Geyer  
Edward Patterson  
Joseph Shapiro  
Harold Udell

Ann Carl  
Dr. Edward R. Baylor  
Matthew M. Klein  
Prof. Walter L. Smith  
John E. Suydam  
Nathaniel Talmage  
George Vanderborgh, Jr.

Dennis Puleston

Advisory

Carl Eisenschmeid  
John Flynn  
Stanley Juczak  
Dr. Edith Tanenbaum  
Edward Bevelander  
Albert Jensen  
Howard Quinn  
Carlyn S. Larson  
Charles Barnett

Randolph Stelle  
Dr. John Winslow  
Morris Colen  
Charles Durfor  
James W. Godbolt  
Cmdr. James Waskiewicz  
Louis Pinata  
Clair Stern  
L. Ruggles Porter

Staff

Dr. Lee E. Koppelman  
Dr. Clarke Williams  
DeWitt Davies  
Hazel Ladore

Arthur H. Kunz  
H. Crane Miller  
Eleanor M. Carlson  
Eileen Retzger

TABLE OF CONTENTS

Foreword .....	1
OPENING REMARKS .....	3
Dr. Lee E. Koppelman Nassau-Suffolk Regional Planning Board	
SETTING THE STAGE .....	5
Hon. John V. N. Klein Suffolk County Executive	
INTRODUCTION TO THE MORNING SESSION .....	11
RAdm. Edward C. Stephan, USN (ret) Regional Marine Resources Council	
NATURAL VALUES OF WETLANDS - PLANNING ELEMENTS .....	13
John R. Clark The Conservation Foundation	
THE VALUE OF WETLANDS IN THEIR DEVELOPED STATE, PART I .....	27
Robert Troutman, Jr., Esq. James D. Newton Co., Fort Myers Beach, Florida	
THE VALUE OF WETLANDS IN THEIR DEVELOPED STATE, PART II .....	35
Dr. Durbin Tabb University of Miami Marine Institute	
ECOLOGICAL/BIOLOGICAL STATE-OF-THE-ART FOR WETLANDS MANAGEMENT .....	43
Dr. William Aron Office of Ecology and Environmental Conservation, NOAA	
LEGAL/ECONOMIC STATE-OF-THE-ART FOR WETLANDS MANAGEMENT .....	51
Dr. Robert Bish University of Southern California	
AFTERNOON SESSION - OPENING REMARKS .....	59
Dr. Robert Abel Director, Office of Sea Grant, NOAA	
PRESENT GUIDELINES FOR WETLANDS MANAGEMENT AT THE FEDERAL LEVEL .....	63
Warren T. Olds, Jr. Bureau of Sport Fisheries and Wildlife, Northeast Region	
PRESENT GUIDELINES FOR WETLANDS MANAGEMENT AT THE STATE LEVEL .....	71
Arthur W. Brownell Commissioner, Dept. of Natural Resources, Commonwealth of Mass.	
PRESENT GUIDELINES FOR WETLANDS MANAGEMENT AT THE LOCAL LEVEL .....	79
Sondra K. Slade, Esq. Crawford & Diamond, Wayne, Penn.	

RESEARCH NEEDS FOR WETLANDS PLANNING AND MANAGEMENT - SOCIAL/ECONOMIC LEVEL .....	89
Dr. Robert Bish University of Southern California	
RESEARCH NEEDS FOR WETLANDS PLANNING AND MANAGEMENT - ECOLOGICAL/BIOLOGICAL LEVEL .....	99
Dr. Bostwick H. Ketchum Woods Hole Oceanographic Institution	
RESEARCH NEEDS FOR WETLANDS PLANNING AND MANAGEMENT - ENGINEERING/PHYSICAL LEVEL .....	111
Col. Robert R. Werner U.S. Army Corps of Engineers	
RESEARCH NEEDS FOR WETLANDS PLANNING AND MANAGEMENT - POLLUTION .....	119
Joel L. Fisher Environmental Protection Agency	
SUMMARY .....	127
David H. Wallace Associate Administrator for Marine Resources, NOAA	
SPEAKER INFORMATION .....	131

## FOREWORD

The Oceanographic Committee of the Nassau-Suffolk Regional Planning Board voiced its concern and support for wetlands preservation on Long Island in 1966 with the publication of its report, The Status and Potential of the Marine Environment. This report also recommended the creation of the Regional Marine Resources Council (MRC). The major objective of the MRC has been the development of a planning methodology for the optimum use of the marine resources of Long Island's coastal zone. This effort has been supported by the Nassau-Suffolk Regional Planning Board and the National Sea Grant Program. The MRC research program has again emphasized wetlands preservation as a high priority problem area, and has stressed the need for planning guidelines to rationally control the use of those remaining wetlands that have not been destroyed. As part of the process of guidelines formulation, the MRC sought input from the representatives of local municipalities and the State of New York. In order to profit from the experiences of those in other parts of the nation, the MRC requested the help of the National Oceanic and Atmospheric Administration (NOAA), and the result was joint sponsorship of this seminar on the state-of-the-art of wetlands management.

Dr. Lee E. Koppelman and RAdm. E.C. Setphan, USN (ret) worked in conjunction with Dr. Robert Abel, Director of the National Sea Grant Program, NOAA, and Mr. David Wallace, Associate Administrator for Marine Resources, NOAA, to organize the conference. They were assisted by Dr. Edith G. Tanenbaum and Dr. Clarke Williams of the Regional Planning Board and Mr. Charles Chapman of NOAA.

The seminar was intended to present current research concepts and management tools involving wetlands to those persons responsible for developing public policy decisions in the Nassau-Suffolk region. The program was designed as an exchange of ideas for planners and administrators charged with the responsibility of managing our coastal resources.

I would like to thank the speakers for their review of the transcript of the proceedings. I also wish to thank Mrs. Eileen Retzger and Mrs. Eleanor Carlson for their efforts in preparing the proceedings for publication, and the other members of the Planning Department staff who helped make the arrangements for the seminar.

January 1973

DeWitt Davies  
Marine Environmental Planner  
Regional Marine Resources Council



## OPENING REMARKS

Dr. Lee E. Koppelman  
Executive Director, Nassau-Suffolk Regional Planning Board

Good morning, ladies and gentlemen. I have the pleasure this morning of introducing our County Executive, but I think one or two words are in order to set the mood for today's symposium, and also to properly introduce our County Executive.

The revision of the Suffolk County Charter in 1960 established the Planning function in Suffolk as a non-partisan endeavor. Under the first County Executive, it was carried forth in that fashion. And with the current County Executive, who served in the capacity of Supervisor of the Town of Smithtown and Presiding Legislator, before assuming the position of County Executive, the non-partisan image of planning was maintained. In fact, the coordination between the former County Executive and the then loyal opposition was of such a nature that the two gentlemen were dubbed the "Gold Dust Twins". This was an indication of the integrity and the dedication to non-partisan and totally professional endeavors related to the planning field.

The comprehensive planning process in our area has benefited from non-partisan action. We have one of the few regional plans that has been formally endorsed and adopted by the County Government in which the plan was prepared. It is the only plan that I know of in the State of New York that was similarly adopted and endorsed by the Governor of the State of New York, and included as that portion of the State Plan for the Counties of Nassau and Suffolk. Yet, I think I would be remiss if I didn't point out that there is a partisan aspect between the development of a plan and the adoption of a plan. The then Presiding Legislator had the courage and the integrity to place his political future on



the line; and campaigned for a program that had been developed by a previous administration. This was before he had the title of County Executive.

While his personality is different from the first County Executive, I think it is significant that both gentlemen are with us today, and before I introduce our current County Executive, for one moment I would like the former County Executive, H. Lee Dennison, to please take a bow.

It is indicative of the quality of government we have in Suffolk County, and particularly the integrity of these two gentlemen, that we are where we are today. It is with a great deal of personal pleasure that I introduce to you the Honorable John V.N. Klein, County Executive of Suffolk County.

## SETTING THE STAGE

Hon. John V. N. Klein  
Suffolk County Executive

My allotted portion of this auspicious Seminar, I have been informed, in addition to extending a cordial welcome to this distinguished assemblage of officials, scientists and concerned citizens, is that of a stage setter.

I have, according to the advance copies of the day's program, been granted thirty minutes to set the stage for this Seminar. I assure you, it will take considerably less. I want you all to know that I made very sure that the lights were turned on, that the public address system is in fair working order for a change and that the place was dusted properly as befits a Seminar of this importance. So, by my calculations, by getting here early this morning I have gotten the jump on my assignment. I hope you are pleased with the accommodations. If you are not, please direct your grievances to the County Legislature, not to me. It is their hall, not mine, you see. So much for the first part of my assignment here this morning.

I am very pleased to extend Suffolk County's welcome to the National Oceanic & Atmospheric Administration -- I want you to know I spent 20 minutes last night being certain that name came out right -- the Environmental Protection Agency, the Department of the Interior, the U.S. Army Corps of Engineers, their consultants, the scientific community, planners, conservationists and representatives of industry here today.

Our focus today is on the problems of wetlands management, and I think that is a very unusual, but important assignment. Our assignment will home in on these problems from the point of view of elected and appointed officials of all levels of government, the men and women vested with the authority to make

decisions on the use and conservation of wetlands. What knowledge of wetlands must we officials have to make wise decisions? What research should be fostered that will best aid that decision making process? What guidelines should be applied for sound management of wetlands: These are all questions that are at the root of our objectives, and, frankly, finding answers to them at this point could not be more timely, in my judgment.

What we are experiencing on Long Island is a microcosm of a global phenomenon. A high percentage of the world's population is concentrated in a thin strand surrounding the global seas and oceans, upwards of about 70 percent. Serious environmental problems related to man's life and use of this narrow land area have been created by such population concentrations. Thus, I was pleased to see the resolution adopted by the Second International Parliamentary Conference on the Environment last June in Vienna, the operative part of which said, and I quote: "Governments should enact legislation and prepare and implement programs to manage more wisely man's habitation and use of urban, rural and coastal areas. Particular attention should be given to the interaction of urban and rural land uses with the marine environment, notably wetlands and living resources dependent on the world's coastal zones for sustenance."

I am going to make my formal presentation very brief and to the point. We meet here today at what is practically the center of a Nassau-Suffolk region encompassing an island 120 miles long and 20 miles wide, where no one in this entire region is ever more than 10 miles from a magnificent, but fragile, marine environment. And, we meet in an area that is acutely aware and very sensitive to the myriad of ecological perils which confront modern man in today's society.

More than four years ago, threatened by unprecedented population, housing and industrial growth, the Counties of Nassau and Suffolk dedicated themselves to a quest for long-range planning to enhance, preserve and restore our priceless marine environment. Long Island pioneered, first on its own, then with

the support of the National Sea Grant Program; zeroing in on four specific areas. They include wetlands management, fresh water resources and wastewater disposal, dredging and dredge spoil disposal and beach protection.

The Federal aid we have received in these fields is and continues to be immeasurable, not only from a funding standpoint, but also from the expertise and brain power that has been made available to us. The problems of wetlands management are so complex and so perplexing that we, on a local level, must have the cooperation and coordination of every level of government and science if we are to succeed.

In Suffolk County this year, we are voting on a shoreline zoning review proposal which will place in the expert hands of our fine Suffolk County Planning Commission the right of review of any change of zoning, variance or special permit by any municipality of land within 500 feet of our shoreline and estuaries. This, I sincerely believe, will give this County a landmark breakthrough in protecting our shorelines. And, I might parenthetically add that that is a campaign in which I am embarked in this political scene with a great deal of enthusiasm, to personally try to convince the people of this County who will have the opportunity to vote, that they should do so in a positive fashion. I am sure you are all aware of the continuing threat of the possibility of offshore drilling, against which we have mounted a serious drive, and which remains quite uncertain, but no less a dangerous threat to this area.

I also know that this is, indeed, an age of specialization, that scientists must be free to conduct their studies in their own manner and by their own means. But there is a dangerous gap developing here, and I raise my voice today at this Seminar for the purpose of identifying it and warning against it.

There is, today, a crisis need for any Federal program which will result

in scientific findings being handed to those elected and appointed officials charged with preserving our environment in such a manner that they can be readily understood. This is not the time to get muscle-bound trying to decipher some scientific jargon into everyday layman's language. I know when I speak, after eight years in government, the last five of which have been super sensitive in the field of environmental consideration; finding myself between two eminently qualified men of science explaining to me, diametrically opposed points of view on the benefit or lack of benefit of aerial spraying against the gypsy moth. As a layman who doesn't understand 40 percent of the vocabulary used by those gentlemen, and as the man who is charged with the responsibility as to making the decision as to whether we will or will not engage in that activity, my inability to communicate as a layman with the scientific community is a serious problem, and it makes my responsibility that much more difficult and my decision that much more risky.

It is the job of government to understand what the scientists are saying and to take the kind of positive, quick action needed to keep us on course in our fight for survival. Conversely, it is a responsibility of the scientists and technicians to speak to us in government in clear and unmistakable language.

If there is one point that I would like to leave here with you this morning, it is simply that to the scientists, we look for your expert advice and interpretation of the specific problems, whatever the area or region of this nation. Give us that kind of tool, and we, in government, will respond with appropriate action. But anything short of that, I am sorry to predict, only helps to further confuse local government officials into inaction, or into the wrong action.

I thank you for, first of all, your coming here; secondly, for the

opportunity to talk with you briefly. I hope I have made myself and my position clear, and I look forward to a new kind of scientific-governmental future working relationship.



## INTRODUCTION TO THE MORNING SESSION

RAdm. Edward E. Stephan, USN (ret)  
Chairman, Nassau-Suffolk Regional Marine Resources Council

Today the mountain has come to Hauppauge. The mountain is a large Federal agency with associates from all over the country, and Hauppauge has the privilege of having them here.

I want to thank the National Oceanic and Atmospheric Administration for their help in the funding of this session.

The first step here, and I think a first step around the country, is this transfer of science in a usable form to the elected and appointed officials that Mr. Klein has spoken of. I think we all agree that it is a Federal responsibility to assimilate, weigh and interpret scientific knowledge, and put it into layman terms. I think it is the local responsibility to apply the political, the social, and the economic considerations that exist at the local level.

I want to welcome the people from out of town who are here today. Most of all I want to welcome the elected and appointed officials who are here, as we try to start this transfer from the scientist to the public and to the elected officials.

The elected and appointed officials are the customers. The customer only gets what he wants, if he knows what he wants, and knows how, when and where he wants it delivered. In this case, this is the responsibility of you, the elected officials. We hope you will contribute to this meeting by making clear, at least in your comments afterwards, what you want, and in what form and when and where you want it delivered.





## NATURAL VALUES OF WETLANDS - PLANNING ELEMENTS

John R. Clark  
The Conservation Foundation

What are the wetlands? There are a number of definitions to choose from, but for our purposes, let us define them as the developable shore lands under the influence of salt water. Then we are talking essentially about a problem of land use, wetland use.

We must, of course, give attention to the contiguous bay water on the outer fringe and to the adjacent drylands or backlands on the inner side -- those lands that lie above the level of the highest rise of the tides. In this way, we may give attention in planning to the boundaries of influence of both the sea and the land and project the most complete and realistic view of our subject. We can then account for all the variety of ecological influence and the major interactions between the backlands, the wetlands and the contiguous waters.

The ecological heart of the wetlands is this edge where the land meets the sea. This is the richest, and the most essential and sensitive part, from the ecological standpoint. The marshes have a definite function insofar as water life is concerned, and the water has a definite function insofar as marsh ecology is concerned.

Figure 1 is a simplified diagram of the way the marshes work to provide the nutrients and foodstuffs that fish and shellfish require to feed and grow. The basic food material is grown in the marsh -- grasses and other plants which decay into fine particles that are washed into the water by the tides. Here the particles serve as food for plankton, shrimp, and baitfish, which themselves become the diet of fish and shellfish.

Vast numbers of fish and wildlife species living in coastal waters are

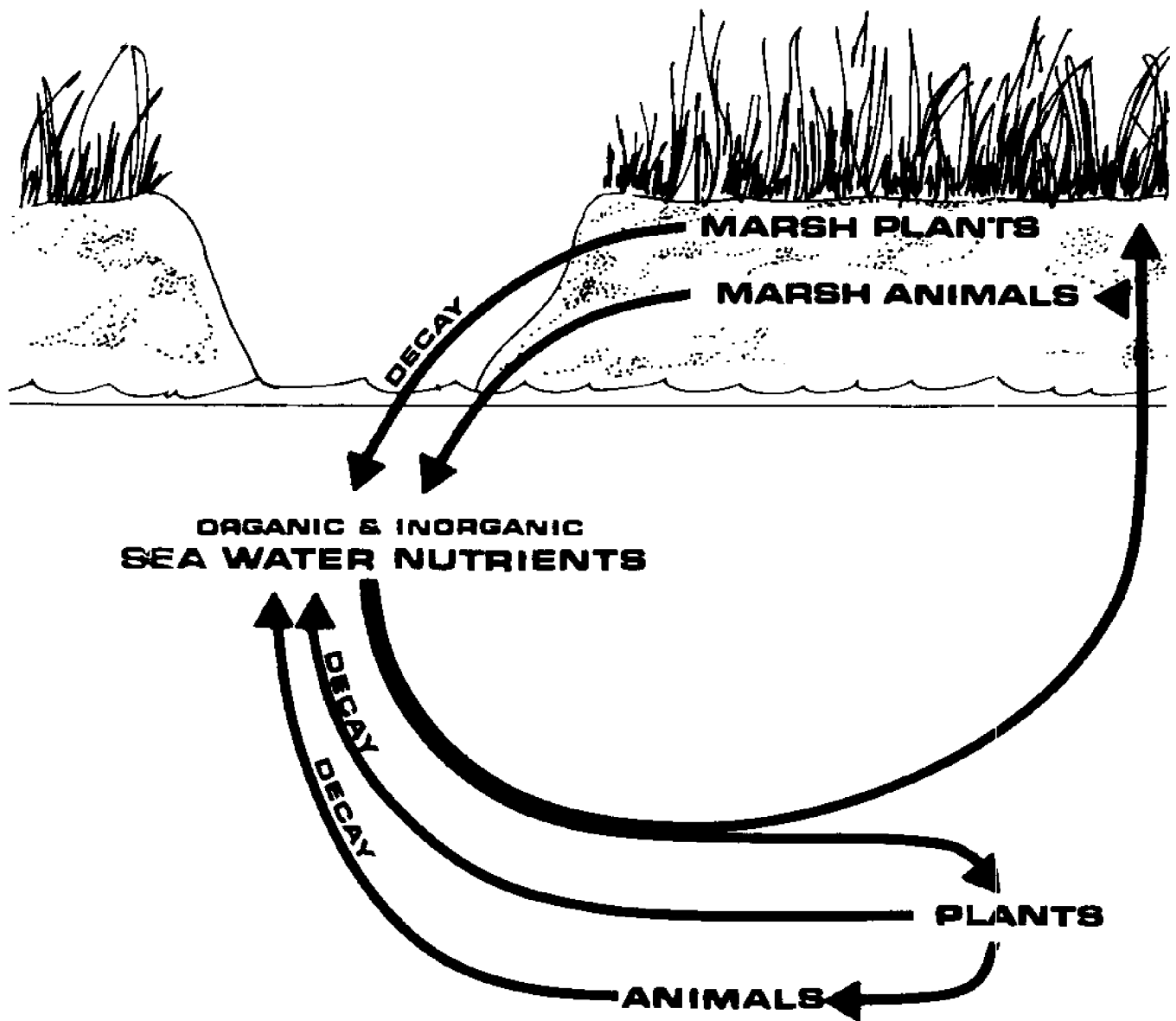


Figure 1. A typical wetland food cycle.

important to us for food, for sports and recreation, or for the inspirational values we derive from the presence of a variety of wildlife. Hundred of species are supported in some important way by the wetlands and the foodstuffs produced there. This feeding pattern is often described as a food pyramid, which means a building process from the plant material at the bottom of the pyramid, on up through the smaller life, to those that feed on the smaller ones, then to the ones that feed on them, and so forth. In this way, the pyramid builds upwards to support only a few of the largest animals in the sea on top.

A more detailed way to look at the process is as a closed circuit, with cycling and recycling of the foodstuffs between the wetlands and the adjacent waters. Here the small plants are eaten and cycle through the invertebrates, on to the largest fish or shellfish and then cycle via excretia and decomposing bacteria back through the system again. The whole process of life support for the fish and wildlife in this area is actually a web of interconnection between the kinds of life that live there and the vegetation itself.

The bringing together of all the food that is produced and collected in the marshes, results finally in attraction to our coastlines of the populations of sea fishes that we find so delightful, such as the bluefish, mackerel, fluke and striped bass.

So, in the way of taking stock of the value of the wetlands, we may add up all these valuable products, compile a physical inventory of the units of this ecological system and establish for each of them a value. We have then to add in the patterns of waterflow and of climate in order to get a true comprehensive picture of the wetlands as an element in the broader coastal environment. Finally, we superimpose on the system the vital energy inputs, energy flow patterns, and energy outputs of the wetlands ecosystem to provide its dynamic character.

The basic force driving this system is the sun. Its radiant energy provides the energy necessary for photosynthesis, or plant growth, and for warming the earth, air and water. Winds produce the waves and currents that stir and keep the system moving. Tides enhance the water movement. River flows add more kinetic energy and bring nutrient supplies down from the land to nourish life in the coastal zone.

How can one recognize the wetlands in order to properly take them into account in land planning and management? The principal way of drawing boundaries on the wetlands is by recognition of the assemblage of plants growing there. These are special plants that have developed a compatibility with salt water and salty soils, which enables them to live in wetland areas where upland plants would perish. This capability is based on complex mechanisms the plants have developed for handling the salt.

A great variety of hardy plants grow in the wetland areas of Long Island. The most important are the grasses. Saltmarsh grasses are the major plants that we use to identify a wetlands area. A person familiar with the botany of wetlands can usually tell exactly where mean low tide or mean high tide line is. He can look at the assemblage of plants and draw a good set of tidal bounds. The soil, also, has special characteristics and special constituents by which one can identify wetlands. But nothing is so simple to observe and to classify as the plants, and this is the primary way it is done.

In most states, as in New York State, lands below mean high water are the common property of the people. These lands are held in trust for the people by the State government. Often the State as trustee will allow certain persons to make use of these tidal or submerged lands for various purposes. Often a royalty of some kind is paid back to the people, via the trustees. However, almost

never is this payment, itself, sufficient to compensate for the loss of benefits, or the ecological damage that often results to these public wetlands in development.

The problem is simply that in years gone by, we have not recognized the true value of these wetland areas. The land above mean high water and above this public trust domain is most often in private ownership and, therefore, available for development -- for direct human use -- with only the usual constraints of zoning, building codes, health provisions, and so forth, which often permit development regardless of adverse ecological effects.

This current situation is perhaps the result of shortsightedness on the part of our forefathers. Planning for the use of coastal lands would certainly have been far simpler if the public trust doctrine had embraced all wetlands, including those flooded by storm and high spring tides -- those that occur less regularly than twice per day -- or, in other words, all land that is under the influence of all the tides. For now we are concerned with finding the average line of high tides -- mean high water. Finding the exact position of this line is a frustrating experience and accomplishes only a legal purpose. How much better it would be for us if the lines separating the private and public domains had been drawn at the upper level of the influence of the sea -- at the highest level of the highest flows. For now, we have to work within this arrangement. To ecologists, it requires that we look very differently at the private and public trust sectors of the wetlands, even though they are totally interlocked units of a single ecosystem. It requires that we reach conclusions about the lower part separate from the higher part in providing information to planners.

Land use planning for any seaside community must reckon with the special value of wetlands, both public and private sectors. Even though there has been

no full-scale ecological study of wetlands, we are able to describe their primary values. Basically, there are four major categories of value.

First, the wetlands supply food, shelter, breeding places, wintering areas, and other functions for the clams, fishes, and waterfowl.

The whole ecosystem can be viewed as three units: 1) the physical setting of soils and so forth; 2) the biota of plants and animals, and 3) the energy circuits -- the inputs of sun, wind, water movements, and the like. With the elements functioning together in natural harmony the wetlands ecosystem has a high value. With any of these elements reduced, or functioning out of harmony, much of its value is wasted. It is that simple.

In this section of the coast we have seen numerous examples of mistreatment of wetlands and we have observed the consequences. For example, there have been extreme reductions in many of the fisheries' populations along the coast. The collective fisheries off our coasts suffered a ninety percent reduction in catches during the 1960's, completely collapsing certain fishery economies. A substantial, but unmeasured, part of this disaster was due to damage to the wetlands. Our marine resources are very sensitive to environmental alteration, and they depend extensively on this wetland fringe.

We should ask ourselves what we could substitute for wasted wetlands. Perhaps we could switch to aquaculture or to foreign imports for our table fare -- shrimps, clams, lobsters, fishes, and so forth. But there are many values of wetlands for which we can't find a substitute, like the simple pleasures that come from just being out on a marsh or bay -- there really is no substitute for a great blue heron silently stalking its food, a black duck on the wing, or a striped bass on the line.

The second value category of the wetlands is their ability to purify the

waters that flow over them. The marshes are flooded every day by the tide and they, along with the submerged beds of aquatic plants, like eel grass, wigeon grass, or sea lettuce, purify the waters that pass over them. They remove toxic contaminants, and absorb the excess nutrients which overfertilize the waters and turn them into a brownish soup. The water is purified as the harmful material is removed by these plants and stored in their tissues to be released later in a more beneficial way.

The wetlands also function to remove carbon dioxide from the water and replace it with oxygen. Oxygen is, of course, one of life's vital substances on which all animals depend, aquatic or terrestrial. For example, one marsh of 500 acres that the Conservation Foundation studied in Pennsylvania was found to generate 20 tons of oxygen per day!

A substitute for this particular aspect of the wetlands could be expensive tertiary treatment of sewage. Or, perhaps, we could give up and go somewhere further away to swim, water ski, or to catch a striper. However, these are not really acceptable substitutes for keeping our coastal waters pure and inviting.

The third value is the protection that the wetlands give to the land itself. They decrease storm damage and flooding. Wave energy is greatly dissipated before reaching the upland or developed part of the shore -- as the storm waves pass over the wetlands -- thereby lessening potential damage to our habitations. Then too, wetlands assist in flood control. Marshes tend to physically sponge up water as it passes over them, tending to reduce the flooding of the shorelands.

Erosion is controlled by the wetlands, too. The marshes lying along the front of the shoreland stabilize the soils with their roots and provide a firm



shoreline. This works so well in nature that in certain places along the coast, scientists are working to develop marshes where presently they don't exist, for the specific purpose of stabilizing the shoreline. For example, there is an institute in Maryland, where botanists grow marsh plants in a greenhouse, and transplant them to a marsh on the Chesapeake shore. Built of nine varieties of plants, the experimental marsh stabilized a shoreline that was being eroded away by wave forces. In this way, these scientists, working for the Nature Conservancy, have found a natural process, the growth of marshes, to substitute for expensive bulkheads or other artificial structures. The Chesapeake Bay marsh builders estimate a cost of about \$13 a foot for marsh stabilization of the shoreline as opposed to \$35 or \$40 a foot for conventional rip-rap or wooden bulkheads.

The fourth value of natural wetlands is the inspirational value they provide -- the open space and scenic vistas that are so important to our state of mind and our appreciation of what is around us.

Marshlands have a unique quality of beauty throughout the seasons. An undeveloped seashore is quiet and restful. The sounds and smells of the sea are delightful. The bird life is exceptional. There is really no substitute for these amenities. These aesthetic values are unique to the wetlands and beaches. They are felt by all of us, but they are elusive and difficult to measure and to score on a dollar scale.

In summary, wetlands are productive of life and natural shore areas are a powerful scenic attraction. But their eternal value is often threatened by the power of the dollar -- development of shorelands can be most profitable.

Therefore, some hard decisions have to be made on the trade-offs between natural and developed coasts. The easiest place to transact these trade-offs is the marketplace. Consequently, we often are asked to place a dollar value on

wetlands. Most ecologists and conservationists are dubious about the marketplace being the right place for these decisions to be made -- we doubt that one can really put a pricetag on the ecological, recreational and spiritual values they afford. Nevertheless, wetland experts are prevailed upon to help assign dollar values.

Recently, a statement of value of wetlands was done by the Institute of Ecology in Georgia, where researchers have studied marshes for dozens of years. They have figured the annual output of wetlands within a range of 100 to 2000 dollars per acre, per year, depending upon the type of use considered and the social objectives involved.

In attempting to place a value on annual output, whether it is going to be 100 or 2000 dollars, one must define the separate value categories. You can consider the values for fish, shellfish and wildlife. One can obtain a separate value for water purification, for handling the oxygen demand, or cleaning and taking the inorganic nutrients out of the water. Or, one can try it from a standpoint of basic energy, using a rule-of-thumb figure, say, 10,000 kilocalories equal to a dollar -- which is about the average for energy on the market today in the U.S. The total potential energy value then is the number of kilocalories that would be produced by a piece of marsh multiplied by the appropriate number of dollars. Then too, shore protection can be added in as a kind of insurance premium. Finally, one could add in the amenities by finding some way of calculating the value of a sunset, or a sweet breeze, or a mallard in flight. All in all, \$1000 a year is not an exaggerated estimate of the potential output of an acre of wetland per year. One might then estimate the capitalized value of wetlands. Based on a 5% return function, the production worth would be \$20,000 per acre.

It is interesting to compare this figure with what average farmland in this country produces. In 1970, it averaged about \$80 an acre for 59 different kinds of crops. A high estimate for 1972 might be \$100 an acre, of which \$67 is the cost of production and \$33 represents the net profit for the acre. A capitalized value of \$660.

Society looks to science for answers, and when we look into our bag of facts, we find that we already know enough about the natural values of wetlands to justify conserving them. However, we have nowhere near the amount of knowledge necessary to justify altering them. We simply cannot write a safe prescription for development of wetlands. Ecologists, asked to comment on development, must answer with extreme caution because their data is scanty. They are reluctant to endorse using up these wetland resources until our scientific efforts have provided a sufficient data background to know just exactly what will happen.

At the Conservation Foundation, we have been studying this situation with funds from the American Conservation Association. Our efforts are directed toward establishing guidelines for preservation of the natural values of wetlands. This is a beginning effort, so far, and we will not be through until next year. As an example I am presenting a tentative list of constraints on site selection for housing development of shorelands (Table 1).

We have suggested stronger constraints on the wetlands themselves than upon the adjacent lands. In the shorelands, those areas that are salt influenced, it is usually not acceptable to build at all on shallow, submerged bottoms, whether the fill is dredged from the bay or obtained inland, because of disruption to the aquatic environment. Those wetlands, marshes, swamps and the like that are only periodically flooded should not be built on either, because they are an essential food source for sustaining aquatic life, for flood and storm pro-

TABLE 1. CONSTRAINTS ON SITE SELECTION FOR HOUSING DEVELOPMENTS IN SHORELANDS

Shorelands

In the shorelands (salt influenced) it usually is not acceptable to build on:

- 1) Shallow submerged bottoms, whether fill is dredged from the bay or obtained inland, because of disruption of the aquatic environment.
- 2) Wetlands (marshes, swamps, and the like that are regularly or periodically flooded), because they are essential for sustaining aquatic life and for flood and storm protection.
- 3) Dune lines: neither the fore dune nor the back dune, because they are essential for protection of the shore.

Adjacent Lands - Direct

In the lands immediately adjacent to shorelands it usually is not acceptable to build in such a way as to:

- 1) Adversely affect the watershed drainage into shorelands, either surface or subsurface, or to cause erosion which results in increased silt loading of the waterways.
- 2) Require the excavation of artificial waterways or the enlargement of natural waterways.
- 3) Pollute the shorelands, groundwater, surface water, or waterways with any contaminants (organic or chemical wastes, thermal, fertilizers, particulate or bulk solids, etc.).
- 4) Adversely affect the natural biota of any protected shorelands or adjacent lands (buffer zones are required).
- 5) Pre-empt lands that are scheduled for protection as natural areas (greenbelt, open space, sanctuaries, buffer zones) or that are critical environmental areas but not yet scheduled for protection.

Adjacent Lands - Indirect

In the lands immediately adjacent to shorelands it usually is not acceptable to develop in such a way as to require, stimulate or force:

- 1) Development of public service facilities (marinas, shopping centers, parking lots, etc.) that conflict with constraints above.
- 2) Building of roadways through shore areas that conflict with constraints above.
- 3) Intensification of insect control (mosquito extermination, etc.) programs.
- 4) Removal or alteration of dunes.
- 5) Dredging of waterways (channel enlargement, etc.).

tection, and for high aesthetic value.

Neither should there be any development on dune lines, because they too, are essential for the protection of the shore. So much for the shorelands.

Now, on the adjacent lands, those that are immediately adjacent to shorelands and have a direct influence on them, we are recommending that care be exercised to prevent damage to the shore area from upland effects. We consider it not acceptable to build in such a way as to: adversely affect the watershed drainage into shorelands, to cause erosion which results in increased silt loading of the waterways, to excavate artificial waterways, nor to pollute the shoreland ground water, surface water, or waterways with any contaminants, organic or chemical waste, or bulk solids.

We are particularly concerned that development not pre-empt lands that are, or should be, scheduled for protection of natural areas, green belt, open space, sanctuaries or buffer zones.

These rules are strong but there are ways to live with them. One should be able to develop land and capture something of economic value in the shore area without causing significant harm to ecological functions.

There are other rules that should be observed in planning which relate to indirect, forcing, effects on these adjacent lands. There should not be any development in the uplands that would act in such a way as to force, require, or stimulate the development of public service facilities, shopping centers, parking lots, and so forth, that conflict with the protective measures mentioned above. One shouldn't allow development that forces the building of roadways through shore areas, nor that would require intensification of insect control programs with toxic chemicals, or cause removal or alteration of dunes, or dredging of waterways.

At the Conservation Foundation we believe that coastal zone planning must start with ecology. Therefore, we are compiling planning data like this for each aspect of coastal zone development and behind each set of constraints will be dozens of ecological facts to back up each contention. We are committed to the philosophy that progress can mesh smoothly with environmental protection.



THE VALUE OF WETLANDS IN  
THEIR DEVELOPED STATE, PART I

Robert Troutman, Jr.  
James D. Newton Co., Fort Myers Beach, Florida

Admiral, I appreciate the opportunity to be here today. I am totally sympathetic with the problems as mentioned by County Executive Klein. I understand them, as one who must deal with scientists, and with facts. I understand very well what Mr. Clark had to say. I have become a big believer in the principals of conservation, and I knew very little about them a year or two ago. Today, I am going to tell you about a project in Florida, how it came about, and perhaps how it relates to those of you planning for the coastal zone of Long Island.

I learned last night that the Nassau-Suffolk area shortly after World War II had a population of 250,000 people. Today, the population is about 2.5 million people -- a 10 to one rise in a quarter of a century. The same statistics prevail in an area of the United States that caught my fancy about three years ago -- the East Coast of Florida.

Broward County, Florida, adjacent to Dade and Palm Beach Counties had about 60,000 people when you had 250,000. Today, Broward County boasts nearly 800,000 people and it is growing. This year alone it will grow about 80,000. The thing that is interesting is that the great growth, and almost the entire growth, started with a wetlands area and has been working inland. The growth is caused by the influx of people from the north who feel that in their retirement, they want to get away from the busy life and settle in a place that has sunshine, is close to the water, and offers the opportunity of doing the things they have always dreamed of doing. They have come in tremendous numbers, and there has



been a great deal of development with essentially no real planning.

There was no such thing as ecology 15 or 20 years ago. No thought was given to the value of wetlands in their natural state. Those who came sought closeness to the sea, and they began living there. Any of you who have been to Miami Beach will understand this. If you fly over New York City, you will see concrete, and more concrete. The people who had developed Miami came out of this environment in New York. So, you have the same thing in Miami Beach and Fort Lauderdale -- one high rise after another, using every possible inch of ground. The only two tracts available on Miami Beach sell on the basis of \$10,000 a foot, which turns out to be 2 million dollars an acre. There are four tracts in Fort Lauderdale that have approximately the same asking price, approximately 2 million dollars. Developers have been forced to put people in the air, and make them live vertically rather than horizontally. These conditions have made living somewhat less pleasant.

I am a student of the market place, and I realize that the law of supply and demand in this country is such that all those people in the north and the midwest who do desire to retire, want one simple thing. They want year-round sunshine and water. Texas, California, and North Florida do not have these amenities. You have very limited supply and a fantastic demand, and the East Coast of Florida no longer has the supply. They have very little water frontage. Development there has been taking place 10 to 15 miles inland.

I became interested in this problem three years ago. I watched it like a hawk for several years, and the thing was so clear, the demand so great, that I wondered would it be possible to find another area of the United States that had the same proclivities of sun and sea, and find an area big enough to develop a community, a city, a town that had all of the elements that humans desire for a

complete life, and to try to develop that area in a way that protects the public interest. I wanted to see if it would not be possible in my lifetime to establish a community there that would be consistent with nature, that 100 years from now, or 500 years from now, would be doing the job for mankind and for nature, but at the same time would allow human beings to derive some direct benefits from it.

This idea became a dream, and I started looking and finally found on the West Coast of Florida an area of waterfront at Fort Myers, Florida, which is in Lee County. It has every aesthetic beauty that a tropical area could have. A 5000 acre tract of undeveloped land was available in the area. I went to the owners of this land and told them what I wanted to do. The land consisted of wetlands, marshes, and mangrove that had no aesthetic appeal, a billion mosquitos, and all that. I knew that this could be the site of another Fort Lauderdale. The area could have a potential population of 2 million people, as a tremendous market in retirement housing is projected in Florida for the next 20 years.

The demand exists. I know we have the finest piece of remaining, undeveloped land in Florida. The question is how should the land be developed. First of all, there is no doubt that this land is above mean high tide. We own the land. We can do precisely what has been done at Lauderdale, with minor exceptions. The question remains, is that the right thing to do, and in the long run, is that the most profitable path available to us?

I looked to the government agencies for help in determining what constituted the public interest. I found that 10 agencies of government have a right to express themselves on what we wanted to do. I went to each of those 10 agencies at the working level, to see the staff head of the working level, and told them the following: "I have under contract, and under control, this very

large piece of coastal Florida, and I desire to develop it, and I desire to develop it for a profit. I desire to develop it so that human beings can live in their retirement in the nicest way possible. But, in addition to that I desire to develop it in a way for future generations, because it may be the most sensitive piece of Florida that exists." (I think Dr. Tabb will tell you that I wanted to do it in a way that nature's functions can continue to operate properly.) "I also want to know the proper position of the public in this matter. Just what should be maintained and preserved for future generations? Would you mind naming to me a team of people in the proper disciplines who can evaluate the public interest? I must have people who cannot be prostituted because I pay them. Often, hired professionals will produce a report that says exactly what you want it to say." We had to have people who would call it like they truly saw it. I asked them to name a research team, and these agencies went to private groups, the Conservation Foundation, the Audubon Society, the Isaac Walton League, and then to a number of the government agencies, and then finally down into the local county commission. They named a team of people, and one fellow's name was on everybody's list. His name was Durbin T. Tabb from the University of Miami. He was an expert in estuarine biology, and I didn't know what that meant at the time.

We employed that team and from then until now, they have been at work. I have one understanding with them. I never want to talk with them until they have done their study and made their recommendations and put them on paper. Then I want to know if that team of people, having evaluated the public interest in that area, would then sit down with people of equal competence in land planning, engineering, architecture, and so forth, and see if they could devise a way for this land to be developed, land which we could develop in the same fashion as on the East Coast.

A team was put together, and the team went to work. Mr. Philip Hammer is our man in Washington, D.C. Mr. Hammer is, by business, an economic expert, but by hobby, a conservationist linked with the Conservation Foundation. He acted as the coordinator for this team of scientists and they worked for a number of months, and at the end of December, they came up and said, "We are prepared to tell you what we think ought to be done if you truly want to preserve this land in the public interest."

By that time our land had gone from about a 5000 acre potential to about 12,000 acres. They said, "All right, if you stay true to this, we think you ought to take out of your plan for use about 1,700 acres." That was the 1,700 acres right on the water. They then said, "If you want to go the full story, take out an additional 1,300 acres." Again, this land was right on the water. That was 3,000 acres. This land was worth \$10,000 an acre. You start multiplying 3,000 acres by \$10,000 an acre and that's 30 million dollars. That is talking about true money. This is not fictitious money. We were being asked by our group not to use this land, and leave it in the public domain.

The State of Florida didn't have 30 million dollars to pay for the land. The question was, would we be willing to take our finest land, 30 million dollars of true value, 30 million dollars we could get in the marketplace, and preserve it for all the nice things that Mr. Clark talked about earlier. That shook me up rather heavily, and it shook up the lending institution rather heavily.

I started studying the plan that Doctor Tabb will explain to you. Would we be able to get some aesthetic benefits from being able to look out on mangroves rather than out on open water like they do over in Miami and Lauderdale? We concluded that such an opportunity would turn out to be a sufficient plus that will more than offset the loss of that 30 million dollars, because we are talking

about a development with a density of three units per acre on a tract of 13,000 acres. That is about 40,000 units. If each unit sells for \$30,000, total receipts amount to 1 billion 200 million dollars.

As far as I am concerned, 30 million dollars gets lost when you compare it with 1 billion 200 million. Doctor Tabb doesn't think in terms of these numbers. He thinks of nothing but what I was told, and that is the way those bays should be maintained for producing the animal life for future generations.

However, he shook us up for about 90 to 120 days, and convinced us that in the long run, people will live happier amidst plenty of fish and birds. So, we are going forward with this idea of establishing a community with the initial input coming from people who had no interest other than to preserve the natural values for public use.

We have made much progress, and there is every reason for us to believe that we are going to succeed. Dr. Tabb will explain how the team proposes to save the environment. We take as gospel anything they tell us. I feel like Mr. Klein felt, that the scientific community has a much greater responsibility, and pretty soon they are going to have to come up with some answers. They can come up with 1000 questions, and their answers are going to have to be qualified, because when I start looking at 30 million dollars, I could very easily say, "Doc, let's talk about this 30 million dollars. Just exactly how many sports fishermen are truly enjoying those bays there? How many commercial fishermen are utilizing the bays? Let's get the numbers right up on the table."

If those numbers came up right now, Dr. Tabb would lose out. He would lose out because I have done a little toying around with some figures. I could also say, "Doc, you want me to preserve mangroves. You realize how many thousands of acres are being preserved down in the Everglades?" I start thinking of

all the people working hard in Minneapolis today who are going to be denied wonderful retirement on those 3,000 acres. If you have just 10 people an acre, that is a lot of people. So, he would lose out on those terms. But, he can talk to me in terms of 500 years, and I will lose out.

So, we are going along with the scientists, who admit they don't have all the answers. They think they have studied this enough to believe they are in the right direction, and if the governmental agencies are in agreement with them, I am going along with the project, even though it could cost us 30 million dollars to make it work.

Those of you here who are planners would call me a developer. There is one thing for sure -- those in governmental agencies never worry the big developers. They are powerful. They are strong. They are smart. They are working nights while you are all working eight to five. They are never going to lose out no matter how you direct them. They can take care of themselves if you can direct them. The big thing is not to be carried away. It would be easy to say, "Let's preserve all wetlands." That would be asinine. You don't want to preserve every acre. Just how much should be preserved is the question.

I am a planner by nature. I believe in looking before you leap. But, I want to be sure I am right, and I don't believe the government ought to own the whole coastal area. However, I don't worry about planners and the government agencies being too tough, because one way or another, the developer is going to accomplish it, because there has got to be development to meet the demand.



THE VALUE OF WETLANDS IN  
THEIR DEVELOPED STATE, PART II

Dr. Durbin Tabb  
University of Miami Marine Institute

Mr. Chairman, ladies and gentlemen. I think you can tell from Mr. Troutman's previous remarks that his project in Florida poses some new problems for the biologist members of the team he has described. He has passed the challenge to us and said, in effect, alright I believe you when you say developers can do a more responsible job of managing coastal resources, show me how it can be done.

The novelty of his offer lies in the opportunity it implies. Pious statements about the environment have no place in our thinking when we really come to grips with the question how can development be made compatible with coastal resources? The gut issue becomes one of considering the financial investment being asked in order to safeguard the coastal bay ecosystem when we know that we probably never will have all the ecological inputs to guarantee success.

It has been very difficult to answer his many requests for quantification. It has been difficult to be as precise in our data as engineers might be, for example. In spite of our inadequacies, Mr. Troutman has offered us an unprecedented opportunity to factor environmental data into the equation for development and we are grateful for this opportunity to try a new approach and to come to grips with the problems inherent in working out environmental alternatives.

I came here today with some reservations because, as Mr. Troutman pointed out, Florida's problems seemed too different from yours in Long Island. However, although the two regions differ in climate, they are somewhat similar in topography and if we consider mangroves of Florida and Spartina of Long Island as



analog of the marsh environment, then perhaps our story can be instructive.

I also accepted your invitation because I consider such visits a valid part of the University of Miami Sea Grant extension program. Under Sea Grant we have had an unusual opportunity to put together a team of specialists in different scientific disciplines to consider more of the ramifications of coastal resource management than is usually done in conventional environmental research.

Now to the project at hand. For many years biologists like myself have been responding to "environmental crisis." Whatever talent we had was consumed by the day-to-day crises. All of us yearned for an opportunity to pull away from these and to obtain a more realistic perspective on the larger problems of the ecosystem. Sea Grant offers that opportunity. It also affords us time to synthesize information from many different sources and mobilize the results into new management innovations.

Projects like Mr. Troutman's give us a proving ground or demonstration area within which we can apply our collective best efforts. If successful, as we expect we will be, people can come to look, evaluate and adopt the principles for other areas.

We have learned something else in the recent environmental crisis. Research biologists do not have regulatory authority. This is properly in the hands of local, state and federal bodies. Nor do biologists make the ultimate decision as to whether coastal lands will or will not be developed. All biologists can do, other than their science, is to use their best judgement as to the economic and social costs of different development alternatives and to use moral persuasion to see that all the alternatives are given fair hearing.

Mr. Troutman told you of his new-found realization that the view across mangrove marshes and tidal creeks can become an economic plus. This has been one

of our most difficult but rewarding tasks, that of showing how natural attributes of coastal marshlands can be converted to economic advantage. Difficult, because many of these attributes are aesthetic and involve such things as scenery, bird life, solitude, etc. which are difficult to evaluate quantitatively.

Estero Bay is in southwestern Florida just south of Fort Myers and the mouth of the Caloosahatchee River a major drainage canal from Lake Okeechobee. This region is essentially subtropical in character but does experience killing frost occasionally. Estero Bay itself has been designated as one of Florida's coastal aquatic preserves. For this reason, development on its shores is watched with extreme interest by the public and by agencies charged with maintaining the pristine character of the system. The waters of the preserve are designated as "Class II" waters on the basis of bacterial count and must remain suitable for harvest of oysters for human consumption.

The major upland tract adjacent to and contributing runoff to Estero Bay lies on a large peninsula of land bounded by the Gulf of Mexico in the west and the Caloosahatchee River. Most of the upland lying east of Estero Bay is at elevation less than six feet. Although all uplands (above the Mean High Water Line) are in private ownership very little acreage had been developed.

During our initial survey we found that coastal marsh vegetation was largely intact except for some locally extensive ditching to control mosquitos. Red and black mangroves are the dominant saline marsh plants. A species of "needle rush" called Black rush, Juncus roemerianus, occupies nearly all the sandy flat lands immediately landward of the mangrove forests. Further upland remnants of pine and palmetto palm growths are interspersed with abandoned fields once used for crops but now too salty to serve any agricultural purposes. Exotic plants have invaded these fields with the cajeput, Melaleuca leucadendra, forming

dense forests many acres in extent along natural drainage features. A large shrub called Brazilian pepper or "Florida" holly, Schinus terebinthifolius, is another conspicuous invader of lowlands. Both species have great tolerance to freshwater surface flooding and some tolerance to salt with the holly invading the upper reaches of coastal brackish water streams.

All islands in Estero Bay and the mainland marshes are covered with mangroves. Generally the red mangroves occur in areas which are flooded by daily tides. These trees produce a dense root mass which, in time, raises a natural low "levee" around the edges of islands and along tidal streams. Saline water from high tides and freshwater during rainy seasons tend to be impounded behind these levees and, because there is no dependable tidal flushing, to remain there until evaporated during dry weather. Thus, the impoundments undergo extremes of salinity. The dominant plant of these lower impoundments is the black mangrove.

The red and black mangroves are known to be heavy producers of leaf material. The reds drop as much as three tons of leaves and as much more weight in seeds, bark and twigs from each acre of trees annually. This material falls into tide water and is transported to the adjacent bays where, as detritus it enters the food chain along with the decomposing seagrasses and algae. The primary herbivores are nearly all detritus feeders in Estero Bay. Phytoplankton plays a relatively minor role in the coastal bay ecosystems of south Florida. The most important users of the decomposing plant material are oysters, crabs, commercially valuable shrimp and black mullet. The top carnivores of the Estero Bay system are spotted seatrout which fill the role of blue fish in Dr. Clark's diagram of estuarine food webs. Black mangrove leaves and coarser litter tends to remain in the impoundments where the shallow water often becomes anaerobic. Only a few very adaptable animals live in such areas but they are extremely abundant and

provide a major food supply to wading birds such as ibis, herons and wood storks. The most important of these specialized aquatic animals are the salt marsh mosquitos and their predators the mosquitofish, Gambusia affinis.

During our studies it became apparent that mangrove zonation around Estero Bay is not as clear-cut as is the case in tropical areas of the world. Freezes, salt kills and hurricanes may cause spotty destruction of certain areas of the mangrove forest and, depending on conditions at re-seeding, different species may colonize the "killed" areas. Thus, plant zonation was described in generic terms as (1) mangrove forest (2) black rush zone (3) upland plant associations for the purposes of describing the ecosystem functions. Having these major zones described and, knowing how they functioned in relation to tides and rainy season runoff it became possible to outline the ecologically most desirable alternatives for development if the fundamental decision was made by responsible agencies that development might proceed. Earlier research had indicated that black rush and terrestrial plants were insignificant contributors of detritus to the bays. Thus the most desirable alternative was total preservation of the mangrove forest and the entire submerged bottom of Estero Bay and associated aquatic areas. If this could be accepted by the upland owner, and the quality, volume and timing of upland runoff could be preserved more-or-less intact, the bay should continue to function in a near-natural way.

Even though virtually all the mangroves were in private ownership, Mr. Troutman examined the economics of our suggestion for preserving the mangroves and found that the project he visualized would be viable on that basis. Once this decision was made we embarked on the second or quantitative phase of our ecological investigation and, at the same time, began to contemplate how the mangrove forest might be physically separated from developed uplands and how the runoff from

the uplands might be intercepted, cleansed and spread laterally so that it would enter the bay system across the broadest possible front.

The result of our thinking was a plan for a broad "Interceptor Waterway" which would follow the natural meandering of a chosen contour (e.g. + 1.8 feet MSL). This waterway would intercept runoff, which would thus be spread laterally along the contour and would spill over the seaward edge of the waterway after a certain residence time, passing as a sheet through the mangroves. It was thought that the waterway should be placed in the black rush zone. It would have no deep, uncontrolled access to tidal creeks so that it would be, in effect, a meandering lake with some connection with tide only at high spring tides. Its seaward edge would be built to a uniform height where the dredging crossed deep natural creek channels.

Nutrient removal would be accomplished by aquatic plants and plankton during the prolonged residence of freshwater in the waterway and wind would be the major water circulating agent. The experience of raising shrimp in ponds indicates that the waterway should be no less than 400 feet wide and no deeper than six to seven feet to insure aerobic conditions in the waterway under given loading of nutrients. The nutrient handling capability of the waterway is such that sewage must be disposed of separately and this is being planned. Nutrients in runoff which originate in an urban development will be intercepted, diverted and "pre-scrubbed" in large development lakes and then the runoff will be permitted to enter the interceptor waterway where it will be further bound by biological agents before flowing seaward.

A planned spring tide intrusion into the waterway for a few days each month will permit some nutrient removal in the form of fish and invertebrates. There has been some criticism of the "Interceptor Waterway" but we see it as a

workable buffer between development and nature preserves. Outright purchase of uplands to serve as a buffer zone simply seems unworkable to us in view of the fact that 1.5 million acres of upland "buffer" in the form of Everglades National Park has been insufficient to guarantee the ecological integrity of Florida Bay and estuarine areas of the 10,000 islands in southwestern Florida.

We now are engaged in collecting the all-important tide data which will allow us to choose the land contour along which the seaward edge of the Interceptor Waterway will run. At the same time we are studying the seasonal changes in physical and biological character of Estero Bay. These data, gathered in pre-development times will become the "yardstick" against which future performance of the total development water management plan will be compared.

Assuming that there are basic similarities in topography and biota between southern Florida and Long Island, perhaps what I have described briefly here will be useful to you. This is my hope. Thank you for the invitation, Admiral Stephan.



ECOLOGICAL/BIOLOGICAL STATE OF THE  
ART FOR WETLANDS MANAGEMENT

Dr. William Aron  
Office of Ecology and Environmental Conservation, NOAA

Ladies and Gentlemen. I have almost an exactly opposite reaction from Doctor Tabb and Mr. Troutman. There is a certain conceit in being in Washington, and when Admiral Stephan asked me to come here I said, "Sure. It is great. I would be happy to come." But, after listening to some of the people here this morning and to the sessions we had last night, I think all of you should recognize, and I think, also, the people in this area should recognize, that they are very lucky to have the quality of people as Admiral Stephan, Dr. Koppelman and Mr. Klein. And, all of you, I think here today have, I think, a pretty fundamental grasp on the problem at hand, a fundamental concern, and I am not sure that the wise men of Washington really can bring very much new insight to you. I think you do recognize just how complicated the problem is and, at the best, we can share with you some of our own ignorance and hope perhaps we can do better in the future.

I think the biggest thing has already occurred. The biggest thing has been, I think, the recognition and concern about the health of the wetlands. After hearing some of the talks, I feel very much better about what is going on, but not so very happy about being here myself.

It is fairly clear that from all points of view -- biological, economic, esthetic, etc., the wetlands are extremely valuable properties. The aim of most management programs must be the maximization of benefits for the broadest spectrum of users. Management techniques tend to apply some form of cost/benefit analysis to the problems at hand in the development of alternative engineering solutions to engineering problems. For example, in considering a new model car



and its production, our knowledge base is adequate to provide a reasonable estimate of the costs for specific modifications as opposed to the probable benefits of increased sales. Even here, however, an industry with both considerable experience and an excellent hand on the pulse of national taste could produce an Edsel.

Dealing with the problems of the wetlands is, and I am sure you will all agree, vastly more complicated than building a new model automobile. The user groups for the wetlands, while possibly fewer in number than our automobile owners, are shockingly more competitive in their demands for right-of-way than even the most callous of Brooklyn taxicab drivers. Measuring the costs -- and one must understand my own bias -- any use of the wetlands will involve some costs -- is even more difficult.

The extremes of wetland "management" range from total protection (basically abstention) to uncontrolled development (let the devil take the hindmost). From my own point of view, neither of these approaches means management. They are, in fact, the antithesis of management. Management implies conservation, and conservation of our wetlands involves the rational use of this most important natural resource for the broadest possible user community. Rational use further implies a certain baseline of information -- a degree of knowledge that would permit predictions to be made of the consequences of specific actions. What happens to the wetlands with the establishment of a new town, a new supertanker port, a marina, etc.?

Where do we stand on this baseline? What knowledge do we have, and what knowledge do we lack that either permits or fails to allow reasonably accurate predictions about the consequences of environmental alteration?

We have some knowledge of the kinds and numbers of plants and animals

that live in the wetlands. We know something about their life histories, we know somewhat less about their interrelationships to one another and to their environment. We know the general consequences of acute change -- filling in a particular wetland removes a specific proportion of spawning area for a number of species -- the traumatic rains of agenes can substantially destroy populations of soft-shelled clams. These are important kinds of knowledge, but they are only the surface skin of the onion which must be penetrated if we are to really understand and manage the coastal zone.

I feel our biggest concern must be focused on the chronic but highly evident problems rather than on those that are acute. We know that a certain trivial amount of cyanide is lethal, and we can comfortably accept rules and regulations that keep cyanide out of our food and drink and generally out of our swimming water. We also know, on the other hand (it says this on every package of cigarettes) that smoking ain't very good for you. The action impact of this knowledge is somewhat hard to measure -- until for a few (and hopefully only a very few), it is too late.

We can easily avoid the kinds of environmental degradation that characterized our early use of the wetlands. This degradation largely reflected a lack of understanding, rather than malicious abuse. We could not, in the early days of our development, realize that in this land of plenty, any of our natural resources were truly finite. We used what we needed, when and where we needed it, with the full expectation that our course of action was reasonable and totally consistent with national goals. We now know otherwise. We have seen the first glimpses of our future, glimpses that scream a warning and have already evoked a new environmental awareness. We have reacted, and in some cases possibly overreacted, to a wide variety of environmental activities such as nuclear power

plants and new port facilities which are pointed at the wetlands. In any case, it is fairly clear that the new and major changes that will occur in our wetlands areas will only occur after careful consideration of their environmental consequences.

Chronic problems can be divided into two general categories. The first may be best described as "creeping pollution". An excellent example of this is provided by the changes which have occurred in the kelp populations of the Los Angeles area. The kelp are extremely large marine algae found along the coast. They are harvested commercially and processed for a number of important chemicals, including the alginates that are used in most of the ice cream we eat. Perhaps more important than their commercial harvest is the fact that the kelp form a protective forest for a large number of marine animals that are of considerable economic and recreational importance to the southern California area.

During the past 50 years the kelp have been disappearing at a rate of about one percent per year. While the year to year changes are virtually undetectable, particularly in light of the normal variability of biological populations, the fact that the long term decline has occurred is irrefutable. Few people can get excited about a trivial decline. However, the combination of increasing populations, increasing leisure time and declining availability of sport fishing spots has finally caused a recognition of the facts, recognition in this case apparently coming early enough to reverse the trend and restore (we hope) these kelp forests and their associated inhabitants to health.

I am sorry to take you off to the wetlands of California, but unfortunately that is where I have found the best data to demonstrate my point. The loss of the kelp has been attributed to the increasing burden of sewage and other pollutants in the southern California area. The ability to detect the changes

and document them in a meaningful scientific manner depended upon the past availability of baseline information -- a knowledge of the kelp forests of 50 years ago, along with some of the estimates of their regular population shifts. Unfortunately, such baseline information is rarely available for other parts of the country or for other kinds of plants and animals. This point is vital to the management of our wetlands.

Even with the best of intentions and the finest technology available, one must confess that our knowledge of the ecology of wetlands is inadequate to forecast the long term impact of "small" changes. We do not know, for example, the possible significance to the health and well being of a wetland subject to an annual temperature increment of 0.5 degrees centigrade as the result of thermal effluents from a power plant. The change is small compared to the daily perturbations brought about by tidal action or the much larger changes between seasons. We do not know the long term significance of raising the levels of heavy metals, chlorinated hydrocarbons or nutrients. We have insights provided by the acute cases -- the deaths of people in Japan from mercury poisoning, the failure of a number of birds to reproduce because of high levels of DDT and related compounds in their body tissues, or the eutrophication of certain waters because of massive increases of phosphates and nitrates. A total failure of reproduction of any species is spectacular and noticeable and can stir action, hopefully in advance of the point of no return. What about the consequences of an annual one percent decline in fertility, a decline which would have to be measured against normal population changes that may exceed 500 percent during short time intervals for many marine species? I see this as a fundamental problem in the ecological management of the wetlands. I see this as a problem without any short term solution, probably without any solution at all, except for the

establishment and maintenance of ecological baselines to provide the earliest warning possible for otherwise undetectable damage. This warning will hopefully come in sufficient time to take remedial action and restore the afflicted populations.

The second category of chronic problems may not, in fact, be correctly termed as "chronic". The problem may best be defined by asking the question, "How much is enough"? We know how much space people require for residences, how much is required for a refinery, a factory and a marina. We don't know how much wetlands are required to maintain a viable population of striped bass or any other species that may use the wetlands as either a spawning or nursery grounds. Let me illustrate this point by taking you out to the west coast again, to Alaska and the pink salmon fishery. Our data base is excellent and shows that there is an enormous variability in the numbers of pink salmon between successive spawning runs. The variability in numbers is paralleled in an inverse way by variability in size -- a low number of fish can be correlated with fish of larger size. The result is that the variation in total poundage between successive spawnings is small. This suggests the view that the availability of food in the open ocean is the prime limiting factor, rather than the extent or availability of spawning areas.

The fact is that natural systems are far from perfect, and one of the compensatory techniques for this imperfection is the overproduction of young. As a youngster, growing up in Brooklyn, but spending summers in Long Beach, I fished my heart out for striped bass. In six summers from 1946 to 1951, I caught three stripers -- as many as most of my friends. The fish were just not available. I doubt that anyone of you would argue that the state of our wetlands today is better than it was more than 20 years ago. The facts are, however,

that striped bass, a fish that depends very heavily on the wetlands for critical phases of its life history, are more abundant than ever. Why? We just don't know, and this ignorance is a major reflection of the kinds of problems facing the wetland manager who must decide if any area is to be set aside for industry, residences, or as a wildlife refuge. It is a problem that makes the management on a county by county basis somewhat less than adequate, particularly when you realize that a striped bass caught off Cape Cod may have been born in waters feeding Chesapeake Bay. Local management is important - but all of you must realize that the local plans, no matter how excellent -- no matter how well implemented -- are doomed to failure in at least some of their aspects if adjacent counties and even some not so adjacent states do not coordinate and develop compatible rules and regulations.

I find this talk a hard one to close -- the ecological knowledge gap is so large. While one could assign basic pessimism to the tone of this discussion, I do not have a pessimistic view. While we know less than we really need for totally successful management of our ecosystems -- we know enough to begin. And begin we must.



## LEGAL/ECONOMIC STATE-OF-THE-ART FOR WETLANDS MANAGEMENT

Dr. Robert Bish  
University of Southern California

I am here today to inform you of work that we have completed on Puget Sound in the State of Washington over the last four years, under Sea Grant sponsorship. I will also be on the panel this afternoon and will deal with some of the more detailed questions of management planning. While some of this material might more appropriately be placed according to the titles of each session, the division I have selected will permit a more coherent presentation in terms of what we have learned in the Puget Sound area.

In 1969, a group of social scientists, primarily economists and political scientists began to look at Puget Sound to find out: 1. what kind of uses were being made on the land-water interface; 2. what kind of uses could be predicted to be demanded or made in the future; 3. how decisions were being made; and 4. how to predict the consequences of different types of legislation that may be enacted on shoreline management. Puget Sound, for those of you not familiar with it, is about 1500 square miles in area. It has about 2000 miles of shoreline. There are no channels less than 150 feet deep. Most of the central sound is 600 feet deep. Ten major rivers empty into the Sound. The total population of the surrounding area is only about 2 million people. It combines very urbanized areas with very rural areas, with extreme differences in income between urban and rural counties.

Puget Sound, in some respects, is not a good comparison for Long Island because Puget Sound is not in trouble in terms of pollution or development. There is a lot of undeveloped shoreline and there are very few people. I still think we have learned some things that bear very directly upon what is happening on shore-



lines, and we have done some of the first empirical research to find out what is happening in shoreline uses.

Forecasts predict that 60 to 70 percent of the United States population will eventually be located in coastal counties. Usage patterns become very important. Historically, the reason people located at the land-water interface was primarily because of low transportation costs, good access up-river to inland areas where natural resources could be obtained, and good access by ship to other countries, or other coastal areas. With the development of rail transportation, cities developed away from water as well, but, in general, most of our developments still remain in the original locations - at the land-water interface - usually in estuaries where you find flat land, and where some of the most productive agricultural lands are located. These are the areas that were most easy to develop for industry and related transportation needs.

There is no question in our mind that the early demand on shorelines was almost exclusively, if not very heavily, dominated by what we would call productive, or derived-demand activities. In other words, producing a product, and then the product is sold for consumption. Production activities are primarily industry, ports, and all economic activities that we generally look at as producing income and jobs, however related to the products they produce.

We were very concerned in regards to what was happening in terms of trend in the Puget Sound region. We took 21 categories of uses -- various kinds of fishing, transportation, agriculture, industry, housing, recreation, port facilities, management and resources, dredging, filling, sewage control, and so on. We developed physical measures for each of these uses that showed some effect of their impingement on water resources. Then we looked at the rate of change in the uses to see what was happening from 1950 to 1970, and what we could expect to happen in the future.

The most significant thing that we discovered was that from 1950 to 1960, and especially from 1960 to 1970, the rates of growth of our derived-demand activities, our traditional marine resource users, such as fisheries, such as port areas required for port usage (not necessarily tonnage, because changes in technology may be used to reduce the area needed) - all of our former traditional activities - were growing at lower rates than activities we associate with direct consumption, such as recreational usage, commercial housing (multi-family housing and condominiums) or single family housing to some extent. People were using the shoreline area directly for satisfaction they received from it, and they were not using the shoreline area to generate income.

This is also shown for most of our projections for the future. Some of the things we expect to be critical issues in the future are: 1. more commercial housing developments; 2. increased demands for parks; 3. increased demands for wildlife refuges; and 4. increased usage for power plants. These are uses, with the exception of utilities, that are very much direct consumption. They are the ones growing the fastest.

On the other hand, it has traditionally been viewed, at least in the northwest, that the activities that cause the most problems are the uses for production activity - the pulp mills, the disposal of municipal sewage - the more traditional activities. We have very little data to know or predict, for instance, the impact of intense residential housing. The problems are similar to those confronting Durbin Tabb and Robert Troutman in their development of a residential community.

These kinds of issues are quite consistent with what is going on in the rest of the economy. More leisure time and services and higher incomes has led to increased use of natural resources. Because of a possible four-day work week,

there may be even a greater increase in leisure time to spend in second family homes along with a tremendous expansion of water related recreation activity, partially because of changing technology and the reduced cost of outboard motor boats, which makes boating accessible to people with relatively lower incomes.

In fact, we are forecasting that in the future, an increasing number of location decisions are going to be made in relation to residential amenities rather than job location - with jobs following qualified labor forces rather than vice versa. We see some very great changes in terms of economic development patterns in the future that are really going to cause problems for areas like Long Island, which is outside of New York and provides a relatively desirable environment of low density living, and where firms are relocating at a rather rapid rate. The problem will be maintaining the quality of environment which people demand as the initial reason for decentralizing to those areas. We don't know a lot about these problems except that we can predict they are going to happen.

I will discuss more this afternoon on why we predict they are going to happen in spite of what planners may prefer, or what some people may prefer as alternatives. The one thing that we found out in Puget Sound is that the political system as presently organized was not very responsive to the changing demands. The political system was traditional in the sense that traditional marine users - fisheries, chambers of commerce looking for industrial sites, port commissions - were the interest groups that were the best organized, that had the ability to deal with county planning commissions and state agencies to express their preferences. On the other hand, citizens desiring direct consumption uses of shorelines were not well organized.

We concluded that a lot of the instability in the political system dealing with shoreline management results from the increased demands by non-organized

groups. We found that this sort of instability forced many decisions into the courts.

An important thing that we discovered in gathering all our data to make forecasts is worth pointing out here, rather than waiting until this afternoon. It is the nature of the information on which planners and governmental officials based their decisions. Most of the information was produced by adversaries, or by advocates for a particular program or policy. In other words, the port districts produced the information on how much more area they needed for ports.

One of the conflicts that we studied in depth was the proposed development of the last large undeveloped estuary into a major super port. Another study area was the development of a smaller estuary for recreational housing. Both contained wetland marsh areas that people wanted for development. In each case, the information that was readily available was produced by people with a stake, a very strong stake, in one direction or another. In virtually every case, the organized groups were able to marshal their information more effectively. If you want information, you can go to the Corps of Engineers or your local port district. This is almost it in terms of where you will find information on port development.

In analyzing the data, we found that it would be extremely difficult, if not impossible, for the planning organizations, at least in the county and the State of Washington to challenge data provided by interested parties. They did not have the technical expertise to determine whether data was good, bad or what it meant. They had to rely on outside consultants, and sometimes the outside consultants were not producing better data than anyone else. Data problems can be extremely difficult. For example, for port development, foreign trade was forecast as related to G.N.P. by the Corps of Engineers. However, the correlation of foreign trade with G.N.P. is not very good. If you look at the goods part, not

the services part of G.N.P., you get much better results. The results of the two forecasts can be significantly different. Use of G.N.P. data biased estimates of increasing foreign trade, and hence, needed port lands, upward considerably.

In the Pacific northwest, there is also a tendency to make forecasts when the economy is going up towards a peak, and you can justify a development. If you make the forecast when the economy is declining, you can say you don't need anymore development of any kind. All of the "official" studies used for planning shoreline development in Washington were made when we were headed up the peak, naturally leading to conflict with those who preferred less shoreline development. These kind of data problems can be very serious. I think that you will have to try to take advantage of the expertise that exists, not only in consulting agencies and in-house people, but you can call on the university, where you can find people to take an independent look at data that is produced. It is a lot easier to attack existing data than to produce original data. However, you should be hesitant to rely on any single data source in any of the decisions that become extremely important.

By looking at all the planning agencies, we found those that didn't have any in-house staff to deal with technical data really couldn't determine what kind of data they should use or not use. I think you will find this increasingly important, not only in areas of biology or marine science, but in areas of straight economics, such as the generation of taxes and the costs on local government generated by a development.

This covers, in very brief summary form, some of our initial findings in the Puget Sound study. This afternoon, I will try to draw some conclusions, or some implications we found for the planning process that you may find useful as

local planners. I imagine you recognize the trends in land use that are happening, although you will find very little hard data from people looking at shorelines. We would expect the trends we identified are similar all over the United States.

In California, the more urbanized regions are finding the same trends in a much more advanced state. Consumption activities, rather than port or production activities, are really becoming dominant. There is virtually never a proposal now for a production activity on undeveloped shoreline in Southern California. Productive activities are looking towards technology for offshore airports. Offshore facilities are being considered not only off Santa Monica, but off Chicago, and in other areas as well. It looks like much more activity will ultimately be moved offshore rather than placed onshore. The technology exists. One thing that is nice about productive type activities is that you have a much greater potential range for substitution before you get your final product, and floating platforms of various kinds for productive use will avoid many of the problems on shorelines that result from disturbing marshlands and wetlands. So, it is not only a question of developing a wetland, or not developing a wetland. It is more a question of what can you get so that you may have some minimal development in consumption type activities, such as residential housing and recreation, while moving industrial or derived-demand activities into other areas.

I think some of these questions will be relevant questions on Long Island. Puget Sound, of course, is a different situation and our problems aren't as serious as yours. The trends we identify, however, are going to be extremely crucial here on Long Island, as well as in Puget Sound and in Southern California.



AFTERNOON SESSION - OPENING REMARKS

Dr. Robert Abel  
Director, Office of Sea Grant, NOAA

My pleasure at being here this afternoon is quite double because not only is it certainly an honor to be able to participate with such an ecologically active community, but I can't help relating to my only previous appearance on Long Island about two years ago. In fact, it is almost exactly two years ago when I had the honor of being banquet speaker for one of the largest and most active conservation groups -- not yours, John -- about a little less than an hour's drive from here and, of course, I was on the other side of the fence at that time. You see, I was being introduced, in this case, by the gentleman who had founded the society.

Now, as everyone here knows, conservationists are, very passionate, devoted people and this gentleman was certainly no exception. He rumbled to his feet, launched into a heartfelt dissertation about the general subject over which the society was meeting and 20 minutes later, he finished what he had to say. Then, apparently oblivious of what he had been asked to do, he sat down, which would have been all right. I mean, anybody can simply get up and announce himself and tell what he is going to do. Unfortunately, in this case, the emcee, the chairman of the day's proceedings, sitting beside me at the banquet table, forgot that he had a live microphone in front of him and in a stage whisper, which was heard clear across the auditorium, he said, "Oh, my God, the stupid creep forgot to introduce the speaker."

You know, at that point, you might think that there would be a certain amount of pressure thus evolving upon the speaker. Actually, it is just the opposite, because, at that point, you see, I could have gotten to my feet and sung the first two stanzas of God Bless America and no one would have known the difference.



Now, of course, I am on the other side. This is my chance at retribution and it is not an opportunity that I will fail to take advantage of.

In a more serious vein, I am attached to something called a National Sea Grant Program, which was alluded to by Mr. Klein this morning and described so eloquently by Durbin Tabb and Bob Bish. (Fellows, you made your million dollars. You can relax for the rest of the day. That's off the record, of course.) This is a federal granting program and, of course, everybody knows what a federal granting program is. It is a great big flaccid money bag. Right? Wrong!

This program has a mission. Missions are accomplished by people, and if they are going to be successful in said accomplishment, they must be talented people and they must be dedicated people. The program is very active in New York, at least as much so as in any part of the country.

Why? Well, in order to tell you best, perhaps, I should simply capsule by singling out two of all the people who really deserve the attention, but in this case most particularly. The Nassau-Suffolk County Planning Board came to us with a proposal to perform an extraordinarily complex series of investigations and reports respecting the ecology and practical translation into man's needs for Long Island and Long Island Sound which, incidentally, culminated in this enormous series of 14 volumes available through DeWitt Davies of the Marine Resources Council.

When the proposal was first suggested to us in the office, it was that complicated that we, frankly, didn't know quite how to handle it. Fortunately, we has a philosophy. This hypothesis was that when in doubt, you cannot go wrong in backing Ed Stephan and of course, it is pleasant to relate now, having the report on hand, that the hypothesis was more than borne out by the results.

There is, also, a very large scale institutional program underway, unique in this state in two ways. First, it combines, under the adroit, skillful leadership of Doctor Donald Squires of the SUNY system, 20 universities and colleges in

SUNY and Cornell.

Secondly, it is unique in that it encompasses the aquatic environments in both the Atlantic and the Great Lakes. Again, an extraordinarily complicated system.

We are very proud, therefore, to have in the network these two gentlemen and, of course, their colleagues and that is why, you see, I am particularly happy to be in New York State this afternoon.

One of the most delightful aspects of this meeting has been, to me at least, the recognition of a partnership so essential for solving the kinds of ecological problems enumerated this morning. I refer, of course, to the alliance between federal, state and local government. The first section of this afternoon's session is, as you can see from your program, explicitly addressed to this partnership.



PRESENT GUIDLINES FOR WETLANDS  
MANAGEMENT AT THE FEDERAL LEVEL

Warrent T. Olds, Jr.  
Regional Supervisor, Division of River Basin  
Studies, Bureau of Sport Fisheries and Wildlife,  
Northeast Region

Thank you, Dr. Abel. Good afternoon, ladies and gentlemen. It is, indeed a pleasure and an honor for me to be with you today, and particularly to participate with such an elite group.

During the morning session, the stage has been ably set regarding the nature, value and importance of wetlands to man's environment. This afternoon, I would like to discuss with you, in general, the present guidelines for wetland management at the Federal level and, specifically, the responsibilities of the Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. The Federal level of wetland management is generally limited to those acres held to be a Federal responsibility by the Constitution, such as regulating interstate commerce, entering into treaties and other international agreements, protecting the public trust, and other similar constitutional functions.

I am sure that you are aware of the important role fish and wildlife resources and their associated habitats, including wetlands, have played in this great nation of ours. Prior to the coming of European man these resources provided most of the basic necessities for the American Indian, such as food, clothing, shelter, tools, etc. Upon the arrival of European man, these resources continued to provide many of his basic needs even though he brought with him domestic plants and animals and other materials from a more technical society. As our country has advanced through time, fish and wildlife resources have maintained a very important role in our civilization. Today they are one of the most important, if not the most important, indicators of the health and well-

being of man's environment.

As a reflection of this importance, the Congress has passed numerous pieces of legislation dealing with the protection and management of fish and wildlife resources. Section 2 of the Fish and Wildlife Act of 1956 probably represents the best declaration of National policy with respect to fish and wildlife and their supporting habitats. "The Congress declares that fish, shellfish and wildlife resources of the Nation make a material contribution to our national economy and food supply, as well as a material contribution to the health, recreation and well-being of our citizens;.....; and that properly developed, such fish and wildlife resources are capable of steadily increasing these valuable contributions to the life of the Nation."

In past years, wetland management including preservation, development and rehabilitation has primarily evolved from the standpoint of managing fish and wildlife resources. Programs for wetland management at the Federal level have been generated from or authorized by the following Congressional Acts (not all inclusive):

1. Fish and Wildlife Act of 1956
2. Fish and wildlife Coordination Act. (Act of 10 March 1934)
3. Act of 2 September 1960 establishing cooperative research and training units
4. Migratory Bird Treaty Act (Act of 3 July 1918)
5. Migratory Bird Hunting Stamp Act (Duck Stamp Act, 16 March 1934)
6. Migratory Bird Conservation Act (Act of 18 February 1929)
7. Act of October 1961 authorizing additional appropriations for acquisition of wetlands and other waterfowl habitat.
8. Soil Conservation and Domestic Allotment Act (Act of 27 April 1935)

limiting Federal assistance for wetland drainage on farms.

9. Federal Aid in Wildlife Restoration Act (Pittman-Robertson Act. 2 September 1937)
10. A series of special acts relating to establishment and maintenance of numerous national wildlife refuges and ranges administered by the Secretary of Interior, and others relating to protection of game and fish resources on other Federal lands.
11. A series of acts relating to protection and management of fish and wildlife resources in conjunction with water resource development projects.
12. Wilderness Act (Act of 3 September 1964)
13. Land and Water Conservation Fund Act of 1965
14. Estuary Protection Act (Act of 3 August 1968)
15. Endangered Species Conservation Act of 1969
16. National Environmental Policy Act of 1969

Through these and other Acts, the current system of wetland protection and management has developed at the Federal level. This system includes the acquisition of wetlands (i.e. National Wildlife Refuges, Waterfowl Production Areas, National Parks, National Recreation Areas, National Seashores, National Forests, etc.); establishing protective easements; federal aid to States for acquisition, management and research; promulgating and enforcing regulations; and, reviewing and reporting on federal or federally licensed or assisted water resource development projects.

It is the latter segment of this system or program which I think will be of the most interest to the group assembled here today. The first Fish and Wildlife Coordination Act, dated 10 March 1934, established the first Federal policy

toward fish and wildlife conservation associated with water development projects. It required that the Fish and Wildlife Service be given the opportunity to use federally impounded waters for Federal fish cultural stations and migratory bird nesting and resting areas. Also, construction agencies were required to consult with our predecessor, the Bureau of Fisheries, on provisions deemed necessary and economically practical for passage of fish at any dam constructed by the Federal Government or by a private agency under a Federal license.

Prior to this Act the Congress established a national policy for the control of navigable waters with the passage of the River and Harbor Act of 1899. Section 9 of this Act required congressional approval for construction of any bridge, dam, dike, etc. across any navigable waterway. However, if the proposed structures were to be constructed under State authority in a single State, the Chief of Engineers could give approval. Section 10 prohibited the creation of obstructions to navigation, except as authorized according to plans recommended by the Chief of Engineers. Section 13 of this Act, known as the "Refuse Act", prohibits the deposit of refuse in navigable waters of the United States or tributaries thereto, except that flowing from streets and sewers, or under permit from the Chief of Engineers. Section 17 provided that the Justice Department should conduct the legal proceedings necessary to enforce the provisions of Sections 9 through 16.

The "Fletcher Act" (Public Law 16-72 dated 10 February 1932) classified recreational boating as commerce in relationship to defining navigable waterways. The Act of 14 August 1946 amended the Act of 10 March 1934 or the first fish and wildlife coordination act, and authorized the Fish and Wildlife Service to provide assistance to, and cooperate with Federal, State or private agencies in planning for fish and wildlife at any project that impounded, diverted or other-

wise controlled any stream or body of water. It also provided for making project lands available for administration by Federal and State fish and wildlife agencies.

In August 1958 the current Fish and Wildlife Coordination Act amended the Act of 14 August 1946, by inserting provisions relating to recognition of the vital contributions of wildlife resources to the Nation, the increasing public interest and significance thereof and to provide for equal consideration of fish and wildlife resources in water development planning. It also included in Section 2 (a) that any public or private agency conducting works under a Federal permit in any stream or body of water should consult with the U.S. Fish and Wildlife Service and the appropriate State agency with a view to the conservation of wildlife resources.

Now, there was a decision of the Fifth United State Circuit Court of Appeals in a ruling dated 16 July 1970, regarding the Zabell-Russell versus Tabb case, where the court ruled that the Secretary of the Army could legally refuse a permit on the basis of conservation. The court further ruled that the denial of a permit to fill privately-owned submerged property did not constitute taking of private property without just compensation since the waters and underlying lands are subject to the paramount servitude of the Federal government, which the Submerged Lands Act expressly reserved as an incident of power to the Commerce Clause.

Later, in a case here in New York, the U.S. District Court of Southern New York ruled on 30 July 1971 in the case of U.S. versus Baker, that tidelands and tidal marshes are part of the navigable waterways subject to the provisions of Section 10 of the River and Harbor Act of 1899. And in this case, the defendant was ordered to remove the rubble and fill placed in such marshes without a permit.



Now considering the foregoing succession of Federal legislation and court rulings, the Fish and Wildlife Service has been able to intensify its efforts and accomplish more to protect and preserve wetland fish and wildlife habitat. In order to accomplish the objective of conserving this Nation's dwindling wetland resources, the Service has developed a continually stronger policy relating to the review and presentation of recommendations regarding proposed federal or federally licensed or permitted projects in the water resource development field. However, the Federal jurisdiction is limited to areas seaward of the mean high water line.

Recently, we have requested that the Corps of Engineers jurisdiction on the East Coast be adjusted to the mean of the higher high water as it is on the Pacific Coast. We haven't heard a response, but this was just a recent letter. Possibly, that might be a means of extending the line of protection above the mean high water line, where it currently is here on the East Coast.

Now, you are all aware that shorelines and wetlands are being subjected to increasing degradation, whereas the availability of these resources is extremely limited. The result has been the continued and usually irreversible reduction of our valuable shorelines and productive wetland areas. In order to maintain optimum public values and to meet future long-term needs, the continuing destruction or loss of these areas for non-aquatic uses must be and should be restricted or prevented.

A possibility here might be the pending coastal zone legislation, which could be at least a partial solution to the problem.

Where appropriate, the Fish and Wildlife Service considers the following factors to ascertain whether the public or private works are acceptable and can be accomplished without significant damages to fish, and wildlife and the environment.

First, the project originators must clearly demonstrate that any proposed works which involve the alteration or destruction of valuable estuarine or wetland areas are water-related or water-dependent; there are no alternative upland sites available, and there is an overall public need.

Secondly, any proposed works which are determined to be acceptable uses of public aquatic or wetland resources must be designed, constructed and operated in such a way as to minimize adverse impacts on fish and wildlife and the public interest in the waters and adjacent lands.

The Service will object to or recommend against proposed projects which directly or indirectly degrade wetlands identified in the Fish and Wildlife Circular 39, entitled Wetlands of the United States. This was first published in 1956 and later reissued in 1971.

The Service will, also, object and recommend against projects which are not designed to prevent significant damages to fish and wildlife resources and their associated habitats, and those that do not utilize upland sites as alternatives to wetland areas and to assure the protection of adjacent wetland areas.

At the present time, the Service does not have published formal nationwide guidelines for the review of applications for Federal permits to perform work in navigable waters of the U. S. However, specific guidelines for this purpose are being formulated and should be complete, at least in draft form, in the near future. I also understand that the Office of the Chief of Engineers, in cooperation with the Council on Environmental Quality and Department of the Interior, is presently preparing revised regulations for the review and processing of permit applications.

In summary, the Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, along with other bureaus of the Department of the Interior has broad

responsibilities to protect the public interest in all areas subject to Federal jurisdictions. This public interest includes, but is not limited to, factors such as conservation and use of fish and wildlife resources, maintenance and improvement of water quality, aesthetics, general recreational use, water supply and preservation, restoration and maintenance of ecosystems. To fulfill these broad public responsibilities, the Service is continually reassessing its policy and programs in an effort to achieve maximum effective results.

There probably will be some questions regarding some of these pieces of legislation that I have discussed and the Service's Program, but I think at this point I will defer and let the next two speakers present their part, and we can cover any questions at the discussion stage.

PRESENT GUIDELINES FOR WETLANDS  
MANAGEMENT AT THE STATE LEVEL

Arthur W. Brownell  
Commissioner, Department of Natural  
Resources, Commonwealth of Massachusetts

I come to you today, in a sense, not as a biologist or a scientist, but as an administrator of a department that is trying to develop, manage and regulate the natural resources of the Commonwealth of Massachusetts. I come to you as a conservationist, an environmentalist, a preservationist and a person that is actively involved as an advocate of the environmental revolution. That position gets me into problems. Sometimes you wish you could be the advocate, and many times you are put in the position of the mediator of the environmental people, on the one hand, and the developer on the other.

We have, I think, a proud history in Massachusetts when we look at your recent Wetland Protection Acts and our programs, but it goes much further back than many of us ever realized. When we look at our early history and the Colonial Ordinances of 1640 and 1646, it was the intent of the colonists to protect these wetlands. The colonists had the right to pass over private property for fish and fowl, but really it was much more than that at that time.

Their whole livelihood was in this area, particularly, in New England and, significantly, in Massachusetts. Because of the poor roads and poor transportation, we lived very close -- and our agriculture, as it is somewhat today, was a major user of the marsh and our fishing industry developed along with it; but changing times occurred.

Increasing population, better transportation, and the occurrence of the Industrial Revolution caused our cities and major towns to expand into wetland areas and tidal flats. Many were filled and developed - most of the City of

Boston today was once a tidal flat, and many people wish it still was.

This development and the lack of concern for the wetlands and our total shoreline kept up until the early nineteenth hundreds. People started to take a look around and see that something was happening and everything wasn't really as they remembered it. Bridges, houses and roads were taking the place of beautiful marshes. When we look at what happened in Massachusetts until the early nineteen sixties, all of the publications talk about state government in Massachusetts and how it initiated the protection of the wetlands. That is totally incorrect, for it wasn't the Commonwealth that initiated the program of trying to regulate wetlands, it was a town on Cape Cod which was greatly concerned because a great deal of its land was salt marsh. A local by-law regulating development was passed. The idea that we could regulate development grew, and two years later, in 1963, we passed what is called the State Dredge and Fill Law, which stated that before anyone could alter any of these wetlands, they must apply for a permit.

We also realized, at that time, that this was an after the fact situation. It was something that you reacted to rather than acted on. You were looking at a fill project, a development proposal, and you could place restrictions on it, but you couldn't stop it; but we also knew that there was very little information available on all of our wetlands, and two major studies were designed and funded.

One was a very cursory look at all of our wetlands to see how many were left, how many wetlands were under some type of protection, how many were in some type of public ownership, how much land was being affected by development, and what could be done about it. We also knew that we needed some biological information. Studies were started in our Division of Marine Fisheries to give us the biological information needed to go into the courts of Massachusetts, if need be, to substantiate the restrictions on the preservation of these marshes.

Our Wetlands-Fisheries Study was completed in 1964, and it demonstrated that

our dredge and fill law was not the answer, because we had only one percent of the total acreage of coastal wetlands in the Commonwealth of Massachusetts under some type of protection, and that there were approximately 60,000 acres of very important wetlands for shellfishing, hunting, and another area of great importance, the aesthetic value. In 1965 we passed what is now called the Wetland Protection Act which allows the Commissioner of Natural Resources, after due process of public hearing, to restrict the coastal wetlands within our State.

A decision was made at that time when we filed the legislation, that we would rather go with some type of a regulatory authority, even though we had the authority to acquire lands. We felt it would be much faster and much more productive to use the regulatory authority rather than the outright acquisition to preserve these coastal wetlands. We have extended this, and now all of our wetlands are involved in one form or another, with some type of regulatory or protection law passed by our State.

In 1965, we also had the Inland Wetland Dredge and Fill Law. The same thing happened here as occurred with the coastal areas. We found that the dredge and fill law wasn't adequate enough. We did a study of the inland wetlands and, then, in 1968, passed our Inland Wetland Protection Act. Action had to happen at the local level, and many of these coastal and inland wetland areas were being acquired by local conservation commissions with the help of the Commonwealth in reimbursement and federal funds. Municipalities also developed flood plain zoning ordinances, and coastal regulations as far as wetland facilities was concerned.

Why this instead of acquisition funding?

It was felt, at that time, that 60,000 acres of coastal wetlands, would cost approximately 10 to 15 million dollars to acquire over a time period of 10 to 15 years. Also, the ownership pattern of the coastal wetlands in the State is very difficult to understand. Many of our large coastal wetlands were purchased by

companies in the 1800's. At the local company picnic or outing the companies had each year, small marsh lots on the order of 20 by 20, or 20 by 40 were given to the employees, and many of these lots are still in existence today. People have been, believe it or not, paying taxes on many of these lots for 20,30, or even 40 years. Another key decision at that time regarding the regulation is that this land would not be taken out of private ownership. It would stay in private ownership and not in public ownership. It would stay on the tax rolls and would be producing, though very small indeed, taxes for the local community.

There was also the thought of what form the regulations or the restrictive orders should take. We felt that it should be positive and not negative, because the real question arises as to the taking of private property without compensation. The restrictive order should make it clear that things could happen to the land, that it could be altered; but always realizing that this was a protection act, and the intent of the people and the governor in the legislation was to protect the wetlands and not destroy them. So, we said that agriculture could be carried on, that recreation facilities could be developed, that hunting, and fishing and shellfishing could all be carried on, but that some alteration could take place, limited in scope, but it could take place. But then, the law states that "You shall not alter, dredge or fill any of that marsh that would destroy the biological and nutrient and aesthetic value of that area".

How does it work? Because it sounds very complicated and when our good attorneys presented this many years ago, I think we all said the same thing; but what we tried to do was bring all of these interests together, knowing some of the legal constraints that we were faced with and also knowing that someday this order would be tested by someone and a decision would be made by the Supreme Judicial Court of Massachusetts. So, it is negative in many of its respects.

What have been the accomplishments of the restrictive powers under our Act?

At the present time, we have 23,000 acres of land that have been restricted in 16 municipalities along our coast involving 9,200 land owners. Of these 9,200 land owners, only 14 have made appeals on the restrictions. There has been one case that has gone to the Superior Court of Massachusetts, and the Superior Court has ruled against the Commissioner of Natural Resources. Many of you have seen that case - S. Volpe Construction Company versus Arthur W. Brownell. That case was not appealed. We left the finding as it was and we did not appeal it. So, to date, there is still no decision by the Supreme Judicial Court of Massachusetts and we feel that that finding against the Department on that particular restriction affected just a small part of our total program. It was only 27 acres out of a total of 23,000 acres under restriction.

We felt we did not want to appeal it because of certain legal characteristics of the Master's Report which was held on that case, and this case and this finding only dealt with one particular restriction.

Hearings have been held, maps have been drawn and the restrictions will be recorded within the next two months on an additional 43,000 acres.

Of this total, there are roughly 12,800 acres of coastal marsh, 5,500 acres of barrier beach, and 7,200 acres of tidal flats. Our law that says we can restrict coastal wetlands says "Contiguous wetlands" or "Contiguous areas", and I think we have to be discreet in that, but in some cases I think we are going beyond the coastal marsh, and we are restricting approximately 18,000 acres of contiguous inland wetlands. This gives you the total of 43,000 acres which are distributed among 11 communities and 8,100 land owners.

When this is recorded, all of the major coastal wetlands in Massachusetts will be restricted. We will just have four small areas left in the southern part of Massachusetts and, then, the real complicated areas in the Boston area that we are investigating right now.



Now, what about this question? Our restrictions have been well accepted and have been positive, but what about this restriction versus acquisition idea? I would like to touch on that.

Yes, the restrictions have been faster than what we could do with outright acquisition. By the next couple of months, we will have restricted 67,000 acres of coastal inland and contiguous lands. It has been much less costly - as I said earlier, we thought it would cost us 10 to 15 million dollars in 1965 to purchase the 60,000 acres of coastal wetlands alone. To date, it has cost us approximately 1 million 380 thousand dollars to restrict these 67,000 acres of land, or \$20.60 an acre which includes all of our estuarine study work that has been done by our Division of Marine Fisheries.

There are disadvantages to restriction, for there is no public access to the land. The land is still in private ownership and also, the land can be altered; not very much, but it can be altered.

Of course, the advantages of acquisition over restriction are that the land is in public ownership, that there is public access to it, and that it is protected. I have to say that the only way for the actual preservation of any wetland or any area is not through regulation, but in acquisition, in the public domain or by a private conservation environmental group.

But why has the program been so successful? We talk about the biological value of our marshes, We talk about the lack of biological information. I state to you, today, that while the program has been successful in Massachusetts, it is not because of the biological value of the marsh. Success is based on the aesthetic value of marshes and although that is never written into any law, and probably never will be, the true value of a marsh is just what you see and the selling of this concept, which I think we have done in Massachusetts, is why our program has been so successful.

Most of our marsh is assessed at a very low value. Also, another reason why we have been successful is that the marsh stays under private ownership. The right of land ownership is very important, but so is the education process. The education process carried on by not just this Department, but all of the environmental groups and agencies in the Commonwealth - the Audubon Society, Conservation Foundation, the Conservation Law Foundation and many, many others - who have worked with us is a means where you can get right down to the people, the residents of the community, for the support from the local elected officials and appointed officials that you need.

But what about the future? We hope that we still will have our regulatory authority and program along with an active acquisition program. Our Division of Fisheries and Game received 5 million dollars last year to acquire wetlands, and along with that program, we will be continuing our restrictive program; but some of our laws have been strengthened by the Massachusetts Legislature this year. The dredge and fill laws have all been combined into one.

When we originally passed these laws, we talked about a bank, or a marsh, or a meadow, or a swamp bordering on inland or coastal wetlands. That's been broadened. Now, the law states that, "No person shall alter, fill or dredge any bank, beach, dune, flat, marsh, meadow or swamp bordering on the ocean or any estuary, creek, river, stream, pond or lake, or any land under said waters or any land subject to tidal action, coastal storm flow and/or flooding". It is very, very comprehensive.

In summary, I would like to say that our restrictive program has been very successful. It has been very successful without, really, the support of the courts, because of many minor decisions that have been made. Because of a recent decision on flood plain zoning we hope that we will have more court support, but the regulatory authority has to be handled very discreetly. It is not the

total answer to the protection of our wetlands if you want the areas open to the public and managed as such. But a combination of all of the programs into some type of coastal zone management program is the answer so that we can preserve our coastline and our coastal marshes.

I would like to close by saying that in 1963 through 1965, we did not have the biological data. We really had questionable legal status, but we proceeded because we felt that, somehow or other, we had to preserve and preserve very fast. We cannot wait for biological data. Sometimes, you can't wait for the legal authority, but many administrators of environmental agencies, whether it be at the Federal level or the State level, can do an awful lot through administrative procedures. Our environment is fragile, enough that actions have to be taken possibly without biological support, possibly without legal support; but until such time as the courts say no, do it and see what happens.

## PRESENT GUIDELINES FOR WETLANDS MANAGEMENT AT THE LOCAL LEVEL

Sondra K. Slade  
Crawford & Diamond, Wayne, Pennsylvania

Dr. Abel, Admiral Stephan, ladies and gentlemen. Mr. Brownell's presentation of the scope of Massachusetts environmental action shouldn't be viewed as astonishing. After all, Massachusetts enacted no-fault. It has done more in the environmental field than we even think of doing in Pennsylvania, and it works. More power to Massachusetts. It is a shining example, in both respects, to the rest of us.

I was asked last evening what kind of wetlands the State of Pennsylvania possesses. Unlike Long Island, we have no window on the ocean, and our only doors to the Atlantic are the ports of Philadelphia and Chester on the Delaware River. The Delaware River, of course, has extensive marshes. Tinicum Marsh, abutting Philadelphia International Airport, has just been designated as a Federal wetland preserve, but aside from and without Tinicum Marsh, Pennsylvania has more wetlands, I will bet you, than many of the 50 states in this Union, and if proof of this should be needed, I have only to point to tropical storm Agnes. Agnes, in excruciating detail, showed us the nature, location and extent of Pennsylvania's flood plains.

We had fair warning for Agnes which, of course, we busy Pennsylvanians, didn't pay any attention to. On 13 September 1971, we had a disastrous 100 year storm. Parenthetically, I might tell you that a few days after 13 September, I had a conversation with a township supervisor who I sincerely hope is not given to gambling. On my urging that this township, which had suffered severely in that 13 September storm, enact a flood plain ordinance to forestall, at least, some of the future damage of flooding, he said, "Hell, we had our 100 year storm.

We are not going to have another one for another 100 years."

We had two more 100 year storms in the next two weeks. But to get back to 13 September, that day, little Chester Creek, not the Susquehanna, not the Monongahela, not even the Schuylkill, rose beyond its banks and drowned 12 people, including three people six miles upstream from the City of Chester, back in the boondocks where you can cross Chester Creek and not get your ankles wet. That was our unheeded warning. That was our omen, the bad omen for Agnes.

I can tell you, as an ex-New Yorker, an ex-South Shore New Yorker, I lived through and I well remember the hurricane of 1938. That hurricane couldn't hold a patch on what Agnes did to us.

All of this is by long way of introduction to the point that wetlands are not, they cannot be exclusively considered to be, coastal areas. In the view of those of us who deal with creek and river valleys, wetlands are those lands which are apt to flood, those lands which serve to accommodate extra and even extreme volumes of water and which must be protected in order, in the case of fresh water streams, to protect and preserve the water supply; and in the case of all bodies of water, they must be regulated so as to minimize and prevent further flooding damage and loss of life, and damage to the ecosystem. If these be the aims, then how can they be accomplished on the local level?

There are tremendous opportunities for control of flood plains and wetlands, and from here on in, I shall use the two words interchangeably because I think I have proved my point. There are, also, tremendous incentives to doing so. The first is that obscene word "zoning".

I might point out to you that when the United States celebrates its bicentennial in 1976, zoning will celebrate its fiftieth birthday. It will be the fiftieth year since the formulation by the Department of Commerce of the model

State Zoning Enabling Act. Zoning has over the years changed a good deal. In some ways it hasn't changed at all. I say that for the benefit of zoning boards, and zoning officers, but I say it also for all municipal officials. It offers a lot of opportunities.

There is, first of all, large lot zoning, and I don't want to be understood by anybody here to favor exclusionary zoning. When I say large lot zoning, I mean zoning designed to protect the environment where, particularly with the problem of disposal of human waste and the lack of sewer systems, small lot zoning is going to result in real pollution.

The New York Court of Appeals, which seems to be more farsighted on the issues than the Pennsylvania Supreme Court, has recently upheld one and a half<sup>1</sup> acre zoning for New York on the basis that the soil of the tract involved was not sufficient to absorb or maintain, without health hazard, human waste in septic tanks and fields.

Another possibility zoning creates is what is called the PRD or PUD -- Planned Residential Development or Planned Unit Development. That is a field unto itself, but as simply as I can state it, it is a swap. You give the developer increased density over normal zoning regulations in return for his dedication or reservation of large areas of the tract for open space uses.

In some Pennsylvania ordinances, we have required as much as 75 percent of a given tract to remain open in return for which, the developer instead of getting two dwelling units per acre may get six. It is a carrot and a stick proposition. You have to give him something in return for getting the open space land. The open space land that you get may well be flood plain land, but it is all to the good to preserve that, too.

---

<sup>1</sup> Salamar Builders v Tuttle, 3 ERC 1267.

Mr. Klein, this morning, made mention of something very near and dear to my heart in connection with zoning. He mentioned a proposal whereby the County would review all zoning changes and all variances affecting land within 500 feet of any Suffolk shoreline. This is, I must emphasize, very important because the best zoning ordinance in the world in any one of your municipalities, in any one of the municipalities in my state or any other state, is no better than the Building Inspector or the Zoning Officer who administers it, and it is certainly no better than the Board of Adjustment or zoning Hearing Board that grants variances from it. Thus, the proposed procedure for shoreline review here in Nassau and Suffolk is an excellent one, certainly, with respect to zoning, zoning changes and variances.

There is another aspect of zoning which I have already mentioned, and that is flood plain zoning. We are beginning to do flood plain zoning extensively. It offers a real opportunity for control of wetlands, for prevention of dredge and fill, for prevention of incompatible uses and if you will bear with me, I will describe it more fully in a few minutes.

Another thing the local government can do is to control non-conforming uses. You have a lot of non-conforming uses in your wetlands. We have them in ours. You have buildings where they don't belong, and you should make it your business to make sure that those uses, those developments are not increased in size or intensified.

Subdivision ordinances can be of great benefit, particularly where you can get dedication of open space land through the subdivision procedure.

Performance standards, which is something I have been studying intensively lately, offers possibilities to protect the ecosystem, to protect the flood plains by regulating and seeking to minimize erosion, siltation, and sedimentation. We have developed a series of model ordinances -- here again, they require

policing -- but as they become better and better understood, we should get a lot less of this nonsense of a developer's stockpiling mountains of topsoil and having the first rainstorm wash it all away.

A further alternative -- and I am mirroring Mr. Brownell here because I couldn't agree with him more -- is the use of not one approach, but many. You combine your approaches: zoning, subdivision, flood plain zoning, the possibility of public acquisition.

I know many of you come from municipalities, and municipalities notoriously, are not long on money, but you can buy wetlands just as you buy parks.

The Borough of Avalon in New Jersey, with a winter population of 2000, is buying its marshlands by the hundreds of acres. The Borough of Stone Harbor in New Jersey is considering doing the same thing. There is a possibility, if the State assists you by passing enabling legislation, of using innovative techniques of open space acquisition: easement acquisition, for example.

I can point with pride to Pennsylvania's statute authorizing easement acquisition. The public does not have access to land under easement, but from an environmental point of view, the conservation easement is an excellent tool. There is a model easement program going on right now in Bucks County on the Neshaminy Creek watershed, and it is extensive, well planned and nearly complete.

There is also the possibility -- this would take State action and I don't know, member of the New York Bar though I am, whether New York has done this -- for open space acts such as that adopted by the California Legislature, which would offer a variety of methods of open space acquisition such as sale and lease back, and restrictive covenants. A municipality would buy a piece of land and place on it a restrictive covenant forbidding further development and, then, sell it. The land goes back on the tax rolls. Somebody owns it, is reasonably



happy with it, and it cannot further be developed.

There is an incentive, incidentally, toward working out this package, this variety of approaches, quite aside from the environmental incentive. HUD, three or four years ago, set up, under Federal statute, a re-insurance program which, for the first time, enabled property owners to obtain flood insurance at reasonable cost. Up to that point, flood insurance had been prohibitively expensive.

The way the program works is that a municipality must first indicate its interest in environmental protection and indicate its willingness to pass flood plain ordinances and proper building codes. Once that interest is expressed, HUD approves the municipality for re-insurance and then any residents, any land owners in the township with land in flood prone areas can purchase flood insurance at inexpensive rates. It applies to creeks and rivers and to ocean front property as well.

I mention Avalon, New Jersey and Stone Harbor, New Jersey. Those, as well as Ocean City, the Wildwoods and Cap May have all qualified under the Federal Flood Insurance Program, and many of the people on the South Jersey shore have bought such insurance.

I should point out, that although the program has been running for four years, when Agnes hit Pennsylvania and devastated so much of it, there were six Federal insurance policies in force in the entire City of Harrisburg, and one of them was not on the Governor's 2.5 million dollar mansion which was built in the flood plain of the Susquehanna River. In the City of Wilkes-Barre, which looked after Agnes like Dresden after the bombing, there was not a single home or business insured against flood damage. That's reprehensible.

So, you see, aside from the environmental wisdom of enacting the kind of

controls I have been talking about, there is the positive economic carrot of enabling the residents of a neighboring municipality in the flood plains and coastal zones to insure themselves providently against acts of God.

What do we do when the marsh or the coastal zone has been built up? It's already been despoiled or partially despoiled. Can it be rehabilitated? There are buildings there, there are uses there, there are people there. In the case of Astoria, I would say, probably not, but let's take a different area where there are not so many people, there are a few buildups, but you would like to get rid of the few that are there. This is where you are going to run into real trouble. All of our property is owned by somebody. Somebody, incidentally, who wants to make a buck, as all of us know.

Our law of property, real property is derived from the English, and that law considers property as almost sacred. The courts throughout the United States have told us repeatedly that no government, no unit of government on any level may take property without just compensation and that notion incidentally, comes from the Fifth Amendment to the United States Constitution, the one you only hear about when someone says, "I refuse to answer on the grounds it may tend to incriminate me." But the second half of it is just as important as the first.

This Constitutional requirement that property cannot be taken by government without just compensation has, in many states, been extended to include taking by the enactment of regulations which are so stringent as to work a confiscation, as to prevent any sort of economic return from the land at all. This being the case, we still have the uses in the buildings and what are we going to do with them? Here are some suggestions:

First, and on the local level, the fact that you have development in marshlands or on flood plains should not stop you from mapping your flood plains,

and by mapping, I mean engineering mapping, either by the taking of bores to determine the alluvial soils or by placement of bench marks. This has been done by people going out in rowboats to paint the high water marks on trees. Benchmarks or bores can form the basis, the outline, the perimeters of your flood plain. With these known physical facts, you pass a flood plain ordinance and a good tight one. A good flood plain ordinance will allow uses only compatible with good flood plain management. That might include agriculture, game preserves or marinas.

The ordinance should be tightly drafted and the effect of its enactment will be to render all the uses within the area that are not flood plain uses, non-conforming uses. The non-conforming uses should be carefully monitored so that their expansion is not permitted. In any case, consideration should be given, in my view, particularly in the State of New York, to the passage of what is called amortization ordinances. It is possible to amortize a non-conforming use; that is to say, "We will give you five years and in five years, you better get your economic value out of this property because at the end of five years, the use terminates and the building comes down."

Judge Froessel, for a divided New York Court of Appeals, upheld the constitutionality of amortization. He stipulated that the owner would have to be afforded a reasonable period of time, perhaps one year in the case of a sign, perhaps ten years in the case of a building, before the non-conforming use could be terminated.

If any of you are interested, there is an excellent dissertation on the amortization of non-conforming uses in Anderson's American Law of Zoning, Volume I, and it is written in good plain English and it covers, in great detail, what's going on in the State of New York.

The problem, the real problem with amortization is that it delays rehabilitation of the land, and what you want is rehabilitation. In that case, it may well be that the easy answer -- easy? -- expensive answer would be condemnation. If you want that marsh -- and I can remember from my childhood, places on the south shore where there were buildings where there shouldn't have been buildings in marshes -- if you want that marsh in pristine form, you may have to condemn it, pay the owner and tear the buildings down. It is expensive, but it may well be the only chance.

As far as development of the flood plains and wetlands is concerned, I have already discussed zoning, flood plain zoning and I have pointed out to you that if you want to prevent development, the way to do it, if you want to prevent it totally, is by outright acquisition and, here again, as one who has dealt very closely with municipalities and realizes the money bind, I will let you know a little secret -- Sea Grant is not the only bestower of Federal grants and not the only access to Uncle Sugar. HUD is giving out 50 percent grants for open space acquisitions. It is difficult, but it is nothing that a competent attorney and competent planner can't handle.

Our township, a township with 27,000 people, has gotten close to \$400,000 in open space grants. The Bureau of Outdoor Recreation, also, has open space grants and these should be investigated carefully because they are a source to you of funds that might not otherwise be available, and they might well enable you to buy open space marshes, wetlands that you could not otherwise obtain.

In closing, I would like to point out that you in New York and you in Massachusetts are in a far better position than we are in Pennsylvania to control, rehabilitate, regulate and restrict your wetlands. Despite the shock which Agnes dealt to us, we are late, we are slow, we're tired. The way we seem

to be working in Pennsylvania -- I would hope it would change soon -- really might best be described in terms of the fabled pettifogging Philadelphia lawyer. The courts, including our own Supreme Court seem to be far more concerned with the right of the individual property owner to wrench the last nickel out of every square inch, and it doesn't seem to make any difference to Justices of the Courts what depredation is going to make on the land itself.

Environmental control and rehabilitation is a very slow process and all we can do is to do our own jobs as best we can, directed towards controlling and rehabilitating the environment. In that connection, I give you the following story: Fritz Kreisler, the famous violinist was in Europe just before World War II and about to begin a concert tour. He needed a new pair of dress trousers and, so, he went to the man he knew was the best maker of dress trousers in all of Europe, a tailor in Vienna. He ordered the trousers and the tailor said, "Come back in two weeks."

Kreisler came back in two weeks. No trousers. He said, "I will go to Rome, I will go to London on my tour and I will get back to you." He finally did get back to him six months later, at which time the trousers were, indeed, ready. Kreisler tried them on and they fit beautifully. He said to the tailor, "I don't understand. It took God six days to create the world and it takes you six months to make a pair of trousers."

The tailor looked at him and said, "Look at the world. Now, look at my trousers."

RESEARCH NEEDS FOR WETLANDS PLANNING AND MANAGEMENT  
SOCIO/ECONOMIC LEVEL

Dr. Robert Bish  
University of Southern California

Some of you asked me after the earlier session if any of our work has been published. There is one paper on the Puget Sound study that explains what we are doing and how we are doing it. That paper was published by the Institute for Economic Research at the University of Washington. There is also about an 80 page report of land use requirements for port development which will be available this month from the Sea Grant Program at the University of Washington. There will be a book available, but probably not until about November of 1973.

This morning, I dealt with straight economics in terms of looking at some changes or trends in what is happening, with some implications for political realities, so to speak, as to how those with the highest demands tend to get what they want. This afternoon, I will deal briefly with three issues because of the time limit. The first issue is the question of the complexity of the political system in which we deal, with some of the research needs in the area; another consists of the prerequisites for planning; and the third, something where, I think, the planning-management function has a comparative advantage at the local level over either state or federal agencies. Although, all my time isn't devoted to Sea Grant, almost all of the rest of my research is devoted to the organization and functioning of sub-national government, and I do have some biases toward local government.

You became aware, if you weren't already aware, from the three speakers on federal, state and local government, of the complexity in the environment in which each has to work. The shoreline area is especially complicated because, traditionally, the land above sea level, above some definition of high tide or

higher-high tide, is zoned and dealt with almost exclusively by local governments under state constitutional and state legislative jurisdiction. On the other hand, the minute you move to the water, you come, more or less, under the jurisdiction of the Federal government rather than state or local government, and Federal legislation deals pretty much with what you can put in the water or whether you can block navigation. Thus, you have some jurisdictional problems which create problems in the environment within which one has to deal.

This means you have to deal with a variety of strategies for which there are no simple answers, and one thing that is very frustrating in the academic world, when you talk about research needs in the field of planning - and everybody plans, be it a person for his own family, be it a business, or a governmental agency in terms of what they are going to do - planning implies the ability to predict.

We talk of prediction when we ask the question, "If we put so much sewage effluent into this body of water, what happens to the water quality, to the fish, to the marine life, and so on?" Concerning wetlands we ask, "What happens if we pave them over and make a parking lot?" These are questions of prediction.

When we deal with physical sciences, questions of prediction are not especially difficult. They are difficult in that you have to figure out where the molecules go and so on.

When you move to biological science, you have to find out how animals will adapt. With people you have still more complex problems, because when you are dealing with passing a law, or planning legislation, you are trying to channel the behavior of people who are pretty much looking out for their own interests under one definition or another, and you are saying, "We've passed this law, that we predict people will react this way to, and we will achieve this result."

However, we all know people learn. This makes prediction in the social

sciences dealing with people much more difficult than predictions in the biological and natural sciences. The more we know, the better we can predict, and the better we can take action using what we know about social sciences, biological sciences, etc., to modify outcomes of our initial prediction. However, the greater our ability to predict outcomes and thus, modify them, the more difficult the outcomes are to determine when other people learn and change their behavior too. Thus, the more we know, the harder it may be to predict. This so-called science dilemma is one that natural scientists are not used to thinking about.

In writing regulations, there is no such thing as perfect law, because whatever you draft or whatever you plan, somebody is going to learn to beat the game and, then, you have to be able to react. This is one reason why elements of competition and survival become very important.

Business firms which can't adapt to product markets go out of business. This can happen to the larger firms, like Boise Cascade, which stands to lose almost a billion dollars in court suits because they didn't learn to adapt to some local government legislation, and they were the 61st largest firm in the country. It doesn't seem possible that even the big firms are completely immune to market pressures. The same thing is true of a public agency, those public agencies which can't adapt to beat people in the game, tend to lose their authority to other agencies or to new agencies.

When we see a new problem or a set of problems arise, we see the difficulty of management of the shore area. When people begin to see the complexity of the problems, we have a tremendous lack of information and lack of ability to predict outcomes from different political structures or from different types of legal structures. Really, political science, which one would expect to work in this area, does very little predictive modeling. You just can't make generali-



zations from most political science research in this area.

Economics, on the other hand has an orientation toward predicting economic activity, employment, and so on; but recently, there has been an increasing attempt to apply the predictive tools of economics to political structures. The basic questions are, "If you do this, what happens? How will people react: How do their incentives change and so on?"

To look at a shoreline management program and a variety of other areas - this is, specifically, what we are trying to do on Puget Sound - we found that a large number of places exist where there is a generation gap in learning, or even more seriously, we found people who are presently involved in planning and management don't think about planning in the context of the American Constitutional framework of government. They think more in a simple system framework, where if they can get an agreement on a plan, they can implement it and people will follow it. They tend to forget that individuals who disagree with the plan can get access to other government agencies or some court where they can overcome that agreement or law. You have to recognize that in this kind of a system, the ability to adapt continually, and the ability to get feedback continually, are essential, and that local government, in areas that are changing rapidly, have not been known for responsiveness in learning.

Perhaps, this is going to change in the 70's with the increased interest that has been generated in local government, especially with recognition of some obvious institutional failures, such as the ability to deal with big cities, the ability to deal with minority groups and so on. However, planning will generally run behind the people you are trying to deal with, because they continue to adapt much more flexible. This means that in a planning organization, you have to look for what you can do better than someone else, and where you can make a contribution in a very complex system to make things better, rather than worse.

This is not quite as utopian as some others would prefer, but it is much more pragmatic, and it is similar to how our local politicians function rather than our city planners. Planners really don't make much of a contribution to the development of a city, and if you look at the city plans from the 1920's, you are very thankful planners haven't made much of contribution.

Planning becomes an interesting situation when the technical knowledge planners have is bridged with the demands of certain citizen groups. In order to do this, one should ask some questions about information, information theories, feed back, and so on.

If we look at, very simply, the size of the organization related to its capacity to handle the information, we find that a very large organization is often required to have the resources to generate what we call scientific information, pure science, research, scientific laws, and generalizations. They may want to be centralized for research internally, but you need some pretty heavy funding for that type of work.

On the other hand, questions dealing with time and place information - what happens tomorrow, what happens if you spill effluent in a river, who is doing what in terms of pollution on a river bank - generally can be dealt with much more effectively by a small organization than a large organization. In fact, many people argue that a lot of the larger organizations just don't know what's going on.

Most planning organizations are neither the smallest in a sense of the smallest in the field - the smallest units in local government tend to have the greatest time and place knowledge - but neither are they the largest. Planning tends to fall somewhere in between. That means planners can use, but probably not produce, scientific information. At the same time they should also know about their own local area to relate information to local conditions. They also

can provide, in the hearing process and so on, a focus for groups to get their preferences articulated.

The way we tell governments what we want is not simply by casting a ballot. Voting is a very crude way of indicating what you want. When you go down and bug your elected official, you lobby, or you can hire professional lobbyists. There are a variety of ways in which you make your preference known. This can generate an awful lot of information as to what people want.

In a system as complex as ours, those who want something badly enough can find a way to get it. It is a very adaptive and innovative system. When planners pay attention to what other people want, it is a situation where they have more of an overview than the smallest view of local government, but not quite as big a view as larger governmental units. Such must be the relationship you have - a quasi-colonial relationship between Long Island and New York City. Our situation on Puget Sound is that the wealthy summer owners want no more industry or economic development in the poorer areas of the Sound where they have their summer homes and want to maintain a rural environment. At the same time, others want economic development to generate jobs and income.

The question becomes a very controversial one as to who should control shoreline management - statewide or local government. The large population in King County (Washington) can bring its power to bear to restrict development in rural areas. I can imagine you have that kind of thing here, when one group might want certain uses of wetlands which are different from the highly recreational purposes desired by the residents of New York City.

You can't plan in a vacuum. You always have your state regulations and local regulations, and dealing with other cities, and it makes planning in terms of what you want here a rather difficult thing because you have to take into account the interests of others. Therefore, professional planners have a very

difficult time in really finding out what citizens want. It is like being in a university where you lead an isolated life-style. The preferences of the university professors are radically different from the preferences of most citizens. It is not a very good place to find out what people want. When you ask people to give up development of wetlands, you are asking them to give up something for advantages of preservation. You may say, "We know it has to be preserved," but you have to really convince other people for long-run viability in the system.

This issue of citizens' preferences becomes very crucial and I don't think it is strictly a fad. A lot of people feel that the increasing cost of government, and its unresponsiveness is a serious problem that can be handled better by local governments.

The planners who really play an important role (they are the only trained people in most local governments who know about land use patterns, land use trends - what you can do with some of the more technical aspects of knowledge) are the expertise to the extent it exists. Yet, they tend to isolate themselves in determining what's good and how it should be implemented, rather than acting as an advisor to the decision maker in deciding what do we need and what do we trade off.

This means the planner has a difficult role. He has to know enough about biology, physics, and so on to understand natural phenomena. He also must find the way to assist the politician in terms of relative valuation of alternative uses, but most important, he has to be very careful in predicting changes in human behavior. If you try to implement a policy, you have to ask will that policy really work. That is probably the area, from my point of view as a social scientist, that I find the most interesting, but I also find the least amount of work and research in that area. We just don't know enough. We tend to think if we institute a plan, it will work; but most planners don't believe

that anymore. We have a long list of plans that are not being implemented.

The efforts here seem to be more sophisticated than in the past, but I would warn you to be very careful in determining goals and objectives without extremely intense citizens' participation or, at least, the participation of those groups that are likely to cause the most problems for you. You simply cannot ignore them all the time.

We found this does pose a dilemma. If you want to deal with groups, if you want to bargain and make trades, you have to have a lot of flexibility, especially in the planning organization.

One of our counties dealing with Boise Cascade and the recreational "New Town" they proposed, put in 21 requirements Boise would have to meet, because of Boise's poor record elsewhere. The county said Boise would have to post a large bond. The strict requirements also provide a lot of flexibility where the county can barter or trade off, however, that also opens the county up to recourse in the courts in many situations. If somebody doesn't like what you do, they haul you into court. You have the potential for a very small technicality to result in a decision being thrown out. It becomes a very delicate situation.

So, what I really would like to emphasize - what we have discovered in Puget Sound, what we know exists even more so in California, and what you should have a feeling for here - is the tremendous complexity of the environment with people learning, with attitudinal strategies being pursued by those who want to do things with the environment which you may not like, and the ability of a rather small organization at a time and place in a local area to direct change. Organizations have to be able to draw on scientific knowledge, they have to be able to adapt, and they have to be active in a political situation in responding to what people want. If you back into the use of a paradigm that says the expert or the elite knows best, you simply fall back into the history of city

planning over the past 50 years where it has had virtually no effect. All of the empirical studies showing how cities built up indicate that you cannot tell the difference between a planned city and an unplanned city in its land use patterns.

People can learn during the planning process, but this is not often done in planning programs. Learning as you go, however, is essential to shoreline management issues. I am sure you realize the added complexity of having the Federal government interface, because you have to deal with water, something that city planning doesn't have. It is an environment with a complexity which you are going to have to be extremely cognizant if you are going to be able to deal with it.



RESEARCH NEEDS FOR WETLAND PLANNING AND MANAGEMENT  
ECOLOGICAL/BIOLOGICAL LEVEL

Dr. Bostwick H. Ketchum  
Woods Hole Oceanographic Institution

A fantastic introduction, Bob. I think I have to match my memory with Bob's and tell you a little bit about the first month that he worked with me at Woods Hole. During the first part of that month we taught him to do a few analyses in the laboratory prior to his leaving on the Atlantis. He spent approximately eight months if I remember correctly, in the Mediterranean Sea in order to study the nutrient cycle there.

Well, having been to sea before, I knew well that it is a different thing to do chemical analyses in the laboratory and to do them on shipboard. So, I took the opportunity to leave Woods Hole with him in the fall and go as far as Bermuda which, of course, is a delightful part of the cruise anyway. For about the first day I thought that I had lost what promised to be a good chemist for oceanography for all time because I don't think Bob felt very well.

Leaving Woods Hole and crossing the Gulf Stream is never a very pleasant task in November. However, we got past the Gulf Stream, the seas calmed a bit, and Bob got out on the deck. Bermuda is such a delightful place, and he said, "There must be another place in the world worth seeing." So, he continued on his oceanographic career.

Today, I would like to speak not only for myself, but also for several of my colleagues, who participated in the workshop of the problems of the coastal zone which we held in May and June of this year. I am drawing upon some of the recommendations that were developed at that workshop. Not only were some of the members of the panel present today participants in the workshop, but some of the members of the audience were also participants. There were about 100 scientists,



and since NOAA and Sea Grant have received their full share of acknowledgements, I think I should announce that our program was supported by the National Science Foundation and by the Rockefeller Foundation.

The workshop concerned itself not only with scientific aspects of coastal zone management, but also with the social, economic and legal problems which are inevitably involved in decisions concerning coastal zone management. One of the basic tenets of the workshop was that we would consider the optimum and wisest use for the coastal zone for the benefit of mankind. I am to speak to you today about the biological/ecological problems that require research, but I would like to preface this statement by the fact that even if the biologists and the ecologists knew all of the answers, it is still not only a scientific problem as to what you do with your wetlands and coastal zones. It is a social, economic and legal problem, some aspects of which have already been discussed today.

The workshop approved, by consensus, a set of 26 recommendations. I believe that if these recommendations are actively pursued by the appropriate governmental agencies on all levels, and by the academic community in universities and research institutions, we should go a long way toward developing a rational approach to coastal zone management, rather than our present approach of a crisis-by crisis solution of immediate problems. It is clear that the unregulated continuation of present activities will lead to insidious spread of degradation of the coastal zone, and the controls and modifications of man's actions will be necessary to preserve the essential characteristics of this unique environment.

This environment, where land and sea meet, is of enormous value to mankind. In deference to the gentleman who speaks of the need for food, the United States fishermen alone, harvest about 2 billion pounds of edible seafoods, the majority of which depends, as John Clark has pointed out this morning, upon the coastal waters or estuaries for part or all of their life cycle. Fishermen from other

nations harvest an even greater amount of seafood from waters beyond our legal jurisdiction, but these also include species which must migrate inshore for breeding or nursery grounds. Recreational and aesthetic uses of the nation's water resources have been estimated to involve 3.7 billion man days annually, and industry, particularly in the development of power plants to meet our ever increasing demands for energy, is increasingly utilizing the coastal zone because of the large volume of water available for cooling purposes.

This points up the fact that the various demands and uses of the coastal zone are not always compatible. We recognize three general categories of usage for coastal waters; namely, the concept of multiple use, the concept of exclusive use and the concept of displaceable use.

Historically, the multiple use concept has been our common mode of operation, and, as was pointed out this morning, this has been largely because of a lack of policy rather than a deliberate decision on the part of the governing bodies. The degraded state of most of our major estuaries is ample demonstration that the multiple use concept is not adequate, since the many demands on the waters of our coastal zone are not always compatible with each other. Many acres of our coastal waters are closed for shellfishing because of pollution, and many species of those fish which must migrate into fresh water to breed, particularly the Atlantic Salmon, no longer abound as they did in colonial days, although the sea bass has, as William Aron pointed out, is now more abundant than it used to be and we don't know why.

The concept of exclusive use includes extremes of both development and of preservation. Filling and building upon wetlands excludes other uses or values which have been discussed here today. Also, our large Metropolitan Areas and our industries must have both a water supply and a place to dispose of the waste materials of our society and technology.

Obviously, much can be done to purify our waste effluents and to internalize the costs which have previously been paid by the general population in terms of the loss of amenities, recreational facilities and marine resources. However, continued disposal of these wastes into our estuaries and coastal waters seems inevitable, especially in such areas as Metropolitan New York City, which now disposes of a billion gallons per day of sewage wastes into the Hudson estuary. This is somewhere between 5 and 10 times the accepting capability of this estuary for domestic sewage. At the other extreme, preservation of the natural ecosystem of our coastal zone clearly precludes all but the most limited use by man.

I would like to read one of our recommendations:

"The Coastal Zone Workshop recommends the creation of a national system of Coastal Area Preserves for the permanent protection of the basic genetic stocks of plants and animals and the essential components of their environments, which, together, constitute ecosystems. These Coastal Area Preserves should be severely restricted in use. Some other coastal areas should be developed for recreational usages that are compatible with the natural life of the area."

Obviously, I am not going to cover 26 recommendations today. As a matter of fact, my talk was over 20 minutes ago according to the schedule.

Many uses of the coastal zone are located there historically - and this comes to the question of displaceable use as a concept - primarily because of the ease of water transportation of goods and materials. With the present development of modern transportation facilities, many of these uses could be displaced to less fragile parts of our environment without serious detriment to the activity.

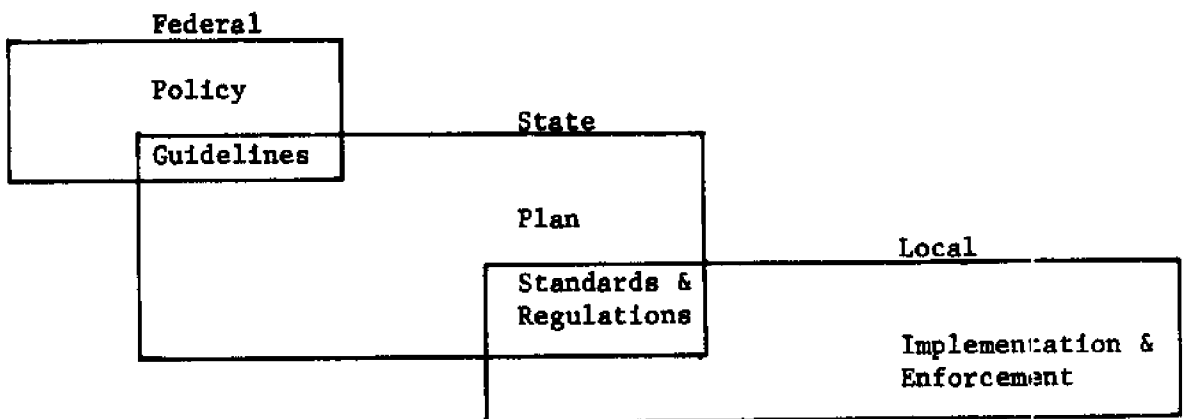
The management of the coastal zone is complex and, obviously, solution of the multitude of problems was not achieved in the two-week workshop. Pertinent

to our discussion today, for example, are a few of our recommendations that I would like to discuss briefly as a background for the biological and ecological needs for research.

The workshop recommended that a national policy be developed by the Federal Government in cooperation with coastal states in order to provide for the wise use of the marine, estuarine, wetland and upland areas bordering the American shores. Figure 1 is a brief summary of how the workshop visualized the distribution of authorities and responsibilities among various governmental agencies. This has already been discussed and, perhaps, I am just reiterating things which were said before. There is, however, the need for a national policy as to how we should proceed with the development of guidelines in cooperation with the states. The states should develop their own plan, as Massachusetts and Maryland have done, and establish standards and regulations. It is on the local level where the knowledge of the problems is the most intimate and the likelihood of living with the effects of any decision, whether good or bad, is the greatest. Consequently, the local levels of government should actively participate in reaching the decisions and should have the authority to enforce regulations formulated either by the state or by the local government, itself. People with administrative or regulatory responsibilities at all levels of government need more precise information on the impact of any decision which might be made.

Consequently, the coastal zone workshop recommended the establishment of coastal zone centers to develop and coordinate natural science, social science and legal research, and to provide relevant information about the coastal zone management to government agencies and the public. Responsibility for the establishment of these centers, we believe, should rest primarily with federal agencies, and this is the direction in which Sea Grant has been proceeding since it was founded. These regional centers should function in cooperation with the

FIGURE 1



existing research organizations, including those housed at universities, independent organizations and industrial research groups.

You have heard the word ecosystem mentioned several times today. Ecology, when I first decided that I was an ecologist, was an esoteric word, known to almost nobody outside of a band of a few hundred that belonged to the Ecological Society of America at that time. Ecosystem was a word that was strange to most ecologists 20 or 30 years ago. I feel it deserves a brief statement because many of our recommendations are at the ecosystem level.

This is a complex system and, like the human body, which is also a complex system, it can be well or it can be ill. None of us in this room are, at present, dead; but I doubt that any of us are in the prime of health, as has been proven by those who broke world records in the recent Olympics. Just in the same sense, an ecosystem may have several illnesses that we have not yet learned to identify. The doctor has a complex, intricate set of tools to investigate the human body, and we have learned to identify a large number of diseases and problems, but we still cannot predict how many of us or which one of us may be alive tomorrow or the day after. In the same sense, an ecosystem may, superficially, look healthy and may have an illness deep within it that we have not yet learned to identify. By the time the human is dead or by the time the ecosystem is dead, it's too late. You can't bring it back to health.

Incidentally, however, I don't agree with the people who call Lake Erie dead or the New York Bight dead. Lake Erie is still the most productive of the Great Lakes. The only trouble is that it is not producing what man wants it to produce. It is producing the wrong kinds of things. The same thing can be said about the New York Bight. It is not producing what we want as it did decades ago.

The workshop recommends ecological and biological research required to

provide the needed information, as shown in Table 1. No such brief list could be complete, but the problems listed are broad enough to encompass many specific programs within them. As Doctor Tabb stated, the scientist is often asked to predict the impact of a proposed development, but it is rare, indeed, to find enough information available to reach a conclusion which is much better than an educated guess. Most of these recommended studies will require a multi-disciplinary approach to specific problems. For example, the recommendation concerning the transport, dispersion, upwelling and cycling of nutrient and hazardous chemicals as they affect the functioning and stability of coastal zone ecosystems will clearly involve physical oceanographers, hydrologists, biologists and chemists if effective results and understanding are to be achieved.

We must also notice the second one indicates the sources and fate of various contaminants, surveillance of input levels of contaminants, especially chlorinated hydrocarbons, petroleum and heavy metals which can be expected to reach the environment in order to develop adequate balance sheets to evaluate trends and to predict future effects if our policies are left unmodified.

Solid waste disposal is an increasingly critical problem for all of our metropolitan centers. Recycling is, obviously, the only answer for solid waste disposal and the filling of wetlands with this refuse has been discontinued in many areas. I have no doubt that Colonel Werner will have something to say on this subject. The Council on Environmental Quality, in its report on Ocean Dumping, stated that nearly 50 million tons of a variety of waste materials are presently being dumped at sea, and this is being done with inadequate knowledge concerning the impact and effects of these disposal operations.

The effects of chronic, long-term, sublethal contaminants on organisms and ecosystems must be better known in order to evaluate the assimilative capacity of coastal zone waters for all kinds of wastes. As Bill Aron pointed out this morning, all too frequently in the past, the short-term effects have been used

Table 1

TO IMPROVE OUR KNOWLEDGE ABOUT THE COASTAL ZONE, THE COASTAL ZONE WORKSHOP RECOMMENDS:

-- basic biological, chemical, and physical research directed toward the following types of problems in the coastal zone:

- a) Transport, dispersion, upwelling and cycling of nutrient and hazardous chemicals as they affect the functioning and stability of coastal zone ecosystems.
- b) Surveillance of input levels of contaminants, especially chlorinated hydrocarbons, petroleum, and heavy metals.
- c) Effects of solid waste disposal.
- d) Effects of chronic, long-term, sublethal contaminants on organisms and ecosystems.
- e) Assimilative capacity of coastal zone for all kinds of wastes.
- f) Epidemiologic and virologic studies.
- g) Recovery processes in damaged ecosystems.
- h) Factors affecting stability, diversity, and productivity of coastal zone ecosystems.
- i) Techniques for increasing production of desirable species or systems.



to evaluate the impact, without adequate recognition that an organism and the ecosystem will be exposed to contaminants throughout the entire lifetime of the organism. The assimilative capacity of these waters, of course, also depends on the chemical characteristics of the waste material and the way it reacts with various constituents of the ecosystem, whether living or non-living, and also upon the general water circulation characteristic of the area. Some of these effects can be evaluated in general terms and the results applied to a variety of localities. There is a transfer of information. Others have to be studied specifically for the localities where the activity is proposed.

Epidemiological and virological studies are necessary to evaluate the effect of sewage wastes on water and on the ecosystem. The wetlands may perform a valuable service as a filter in the purification of our domestic wastes.

The next item concerns the recovery of an ecosystem and very little, indeed, is known about the ability of the ecosystem to recover from stress or damage. It is clear that a filled wetland, covered with pavement or buildings, or penetrated by a deep dredged channel will not recover its original characteristics in our lifetime. On the other hand, the recovering from some types of insult may be more rapid, but it is incomplete under certain conditions. Scientists in our institution have been studying the oil spill which occurred in Buzzard's Bay over three years ago. There was a great deal of damage, a great deal of mortality of the organisms and the salt marsh. Only now, is the system beginning to return to its original status. Three years, and this was a small oil spill, not an enormous one, like Santa Barbara's or Torrey Canyon's.

A well managed ecosystem may be of the greatest value to mankind. This is amply demonstrated in the advances in agriculture which make it possible to grow an abundance of food on fewer and fewer acres of land. In the coastal zone, aquaculture techniques need to be developed if we are to achieve the maximum

productivity of those species which are desirable and useful for man. Aquaculture has a long history in many parts of the world, but is in its infancy in the United States. I expected Doctor Tabb to speak about aquaculture today, so I kept my remarks on the subject very brief. Finally, the workshop, recognizing the complexity of the management of the coastal zone, urged the further development of predictive models to aid in understanding the effects of man's activities and structures upon the coastal zone environment. What will be the effects, for example, of offshore deep water ports or power plants? As was pointed out earlier, how much of a coastal zone wetland do we need to protect to preserve the natural resources? A broad-based systems approach involving the best technical knowledge and sophisticated programming and computer equipment will be necessary in order to achieve the goals of management of the coastal zone. The systems approach must consider not only the environmental impact of activity, but also the social and economic impacts of decisions and the various legal approaches or constraints which exist for achieving a desired goal.

In summary, as I stated in the introduction, the philosophy of the Coastal Zone Workshop was to consider necessary steps for the wisest and best use of the coastal zone for the benefit of mankind. This clearly requires more planning and better information than is presently available. It requires cooperation at all levels of government, by the scientists and the engineers, by the sociologists, economists and lawyers if we are to achieve success.

The workshop did not prophesy impending doom for the coastal zone, even though this has become a popular publicity stunt on the part of many environmental groups. It was recognized, however, that many parts of our coastal zone are already degraded and deterioration will spread insidiously unless appropriate decisions are made and actions taken. The problems are urgent, as has been clearly recognized in the Coastal Zone Management Act of 1972 recently passed by

Congress and signed by President Nixon.

We hope that the publication of the proceedings of our Coastal Zone Workshop will provide a framework to help in the development of a program for the most intelligent use of our coastal zone and wetland areas.

RESEARCH NEEDS FOR WETLANDS PLANNING AND  
MANAGEMENT ENGINEERING/PHYSICAL LEVEL

Col. Robert R. Werner  
Assistant Director of Civil Works for Environmental Programs  
U. S. Army Corps of Engineers

Ladies and gentlemen, I am very pleased to be here. My topic today is research on the engineering-physical level. I want to speak to the topic partly as it relates to permits and dredging. I will work in a few remarks relating to some of the points that have been brought up previously. You know we, as you, are interested in research not only from the pure point of view, but from the point of view of how research helps us to do our job.

Our job changes over the years. I don't mean just from additional authorities due to legislation that passes from time to time. What we needed to know to do our job 10 years ago is not enough today, neither in terms of information nor approach, and this evolution is not going to stop. Less and less research is purely physical engineering research. We talk about sediments and what happens with sediments. We are not really interested only in terms of where the sediments form and settle. We are interested in what effects sediments have on organisms. We are talking about channel hydraulics and salinity gradients. This is interesting in a pure sense and in an abstract sense, but it becomes real when we talk about what effects they have on fish spawning.

More and more physical research is recognized to have environmental dimensions, and even social aspects are becoming increasingly apparent. This doesn't make research easier, and it certainly doesn't make application of research easier. Let me talk about application for a minute.

The Corps is an agency of government that is concerned with serving the public interest. If we don't serve the public interest, we have no basis for

existence. We have tried to be responsive to that idea through our entire history. Our perceptions of the public interest are constantly changing. It is a continuing process, an evolving process.

When the Corps first became involved in resource management activities 150 years ago, the Nation was concerned with economic viability. Today, we are concerned with ecological viability as well. It doesn't mean we have forgotten the economic side of it. Our state of knowledge and understanding of our needs keep changing.

I asked Dr. Ketchum, "What's the difference between a worthless swamp and a priceless wetland?" His answer was, "Very simple. About 15 years."

Our perceptions of wetlands were considerably different 15 years ago. I am not referring to the perceptions of the ecologists. I am talking about the general public, planners and, of course, the engineer.

Wetlands are valuable partly because they are diminishing. Overall, they are probably not diminishing much. We understand the problem and the function of wetlands, we appreciate their value more.

It has only been in the last five years that the Corps has had a real mandate to look at the broad public interest in permit evaluation. I am talking about the regulation that is the operative Federal authority: Section 10 of the 1899 River and Harbor Act.

This is one area where you and we have a common interest. I am speaking of you as planners for the two counties. You know far better than we what your interests are. We, the Federal government, in this sense, can only supply one perspective. Sondra Slade and Arthur Brownell brought out this point. If you have thought out and planned land use, and have effective zoning controls at the local or state level, you are in good shape. The Corps and the Federal

government probably have very little to do but serve as a backstop for you as we process permits. We look to you for a reading on whether what is being asked for is in accordance with your wishes and plans.

We were talking about wetlands. We have to know what we are talking about when we speak about a valuable wetland. They all can't be priceless. If they all are priceless, then there is no meaning in terms of trying to save certain areas because some are going to be lost. There are going to be other uses that they will be put to. You need a rating or scale. In any stretch of wetlands you are going to have to -- when I say you, I am talking to the profession -- you are going to have to say to us, "Under no circumstances, can this be lost. These are extremely valuable. These we would sure like to keep." or you might say, "This is very low in productivity at this time. If you are going to develop something; if you are going to put a factory or a housing development in, put it there." We must have this information because you are not going to be able to save it all. You have to know what must be saved. You also have to know how much you have to save to keep it viable. You can quote Odum and speak in terms of 50 percent. Maybe you need 75, but we have to have that information, too.

We are talking about permits and we are talking about change. You have to know what the effect is of any proposed change, be it a small boat harbor, a dock or a development the size of Mr. Troutman's. What is the effect and what is the cumulative effect of a series of this sort of action?

These are some of the problems we run into in the permit program, and we are not alone in trying to get answers. We look to the fish and wildlife people, we look to the marine fishery people, we look to the E.P.A., and we look to the Fish and Game Department of the States.

We have about 12,000 permit applications a year, and I am talking about Section 10 permits. Of those, there are about 7,000 that are processed and the

permits granted. Only a few of these are controversial enough to work their way up to Washington, and only a handful of them are "crunch" types where the secretary has to sit down with the Secretary of Interior to work them out.

There are those, of course, that never are actually sent to Washington, but on which there is a great deal of discussion between the field office and Washington. We know that there are many actions taken on which no permits are ever applied for. I don't know how we are going to get a grip on these, but if we do find a solution, it will also be with your help.

To throw in a word for research, one solution may be remote sensing. We have an idea that someday we are going to get pictures from the satellites; pictures every 18 days, to find out what's going on along our coast, and what has been permitted and what has not been permitted. I could go on and tell you some of the horrors that have been perpetrated by people moving ahead without a permit.

Court actions are always difficult and sometimes rather dramatic. I think Tom Olds mentioned Zabel versus Tabb. Incidentally, as an aside, the Tabb we are talking about is the District Engineer down in Jacksonville, and it is not Durbin Tabb, but we found out, interestingly enough, that Durbin and Payton are related. I would like to think they both wear white hats.

Zabel versus Tabb was a landmark case. The courts said for the first time that the Corps had a mandate to move in and apply the criterion of the total public interest in making a decision on a permit case.

There is another interesting case based on a suit that we presented against a man for an injunction to make him stop working. He would not apply for a permit, and the court told him to take his fill out and restore the land to its original form; another landmark case. Not all the landmark cases go the

way we would like to see -- a developer has been fined for construction without a permit and this is a rather bad situation -- we would rather not see him fined because it opens the possibility, I am afraid, of somebody thinking in terms of, "Let's go ahead and let them fine me." A fine is a slap on the wrist compared to the potential gains in developing an area. Injunction has worked beautifully in some cases. We have been able to stop apparently illegal developers in their tracks.

I am not "anti-developer." Do you know the difference between a conservationist and a developer? I am sure you all do, but a conservationist is, of course, the man who built his house last year, and the developer is the man who is planning on building his house next year.

We don't find ourselves in a very comfortable position when involved with back door management in certain areas. We found ourselves in that position in Florida. The Florida coast has been badly piecemealed by dredge and fill operations in recent years. We felt very strongly that the State should work out a zoning and planning system, and there was a great deal of discussion back and forth with state officials. Florida is working on controlling its shoreline now.

I hope that at some time in the future when we are talking about landmark cases, we are not talking about Lee versus Troutman. Lee is the new District Engineer in Jacksonville. I am sure Mr. Troutman has spoken to the District Engineer about his development. I certainly wouldn't want that discussion to come late in the action. It is embarrassing to all concerned.

Dr. Ketchum talked about predictive ecology, and we are interested in that, too, because that may tell us what's going to happen when certain changes are proposed. The physical or hydraulic model is one of the great tools for helping make decisions in major actions. We have saved millions of dollars with a



model of San Francisco Bay. We are in the process of building one for Chesapeake Bay. We try to model complete bays to find out what may happen in the event of a proposed action. For instance, where is the best place to have a power plant? It is a tremendous opportunity. We have a model of New York Harbor. In fact, it is going to be working within a week. There is talk about placing some fill on Swinburne and Hoffman Islands. We want to find out what happens; is this a good idea or a bad idea? We will be able to test this out and find out whether it is good hydraulically, and good ecologically, too.

There is one other thing we ought to mention when we talk about physical models. So often, we think in terms of nature always being right and nature always being healthy. I think, Dr. Ketchum mentioned that sometimes we find a bad situation. We get stagnation or any of a number of things that can be wrong in a situation. Through use of these physical models and other means, we might just be able to apply a bit of salve to nature, to help it along, to help it recover, or even give nature a boost so it becomes even more productive.

Wetlands are a valuable resource, and a diminishing resource and, yet, one of the few pieces of real estate that can be created.

We have dredging problems. The economic strength of this country, at the beginning, was based on its commerce. We are not marginal in an economic sense anymore, but our viability is still based on our ability to move goods. The Corps of Engineers has improved something like 22,000 miles of waterway. We have maintenance dredging on 19,000 miles of waterway right now, and 1,000 ports and harbors of all types are being maintained. We do about 300 million cubic yards of maintenance dredging to keep the channels open every year, and this is becoming a tremendous problem. What do we do with this material after we remove it from the bottom. It used to be very simple. In some cases, you could

take it and drop it 40 yards away. When you are talking in terms of having once dropped it 40 yards away and now having to take it 60 miles to sea, you have a tremendous problem.

If you are thinking in terms of 40 cents a cubic yard to handle this dredged material, and we have to do something drastic about disposing of the dredged material, the price of dredging comes to 150 million dollars a year. Think of what this means for dredging -- for what we have determined to be critical purposes -- if the price goes up one order of magnitude.

We are starting a study on the disposal of dredged material. It will probably run about five years and cost about 30 million dollars. Through this study, we are going to check into a lot of things that you can do with dredged material. I might mention something that Dr. Ketchum was talking about before. We can create wetlands and artificial islands; we can, of course, fill wetlands, perhaps, if they are biologically unproductive, and we can restore ecological viability to wetlands that might have been thought to be dead. With the help of the professional community and the other Federal agencies, we are going to try and turn something that's been sort of a millstone around our neck into something that can be useful to all concerned.

Thank you very much for this opportunity to talk with you. It is great to know that people who are actually faced with the problem are convinced that wetlands are valuable. I compliment you on what you have done here in these two counties. Organizations like this are going to show the way to others on how to do it.

I hope I convinced you that we are trying to do our job. We need a lot of help and, I think, we are likely to get it from those here in the audience and on the panel as we try to solve our problems. Thank you.



RESEARCH NEEDS FOR WETLANDS  
PLANNING AND MANAGEMENT-POLLUTION

Joel L. Fisher  
Environmental Protection Agency

Ladies and gentlemen, as the last formal speaker of the day, I shall try to be as brief as possible in discussing pollution.

Almost any use of wetland areas to exploit land and other resources is accompanied by some kind of pollution problem. Uses such as urbanization, development for recreational facilities, building of power plants and industrial complexes either remove areas of wetlands from use or they subject areas of wetlands that remain to various kinds of waste discharges and runoffs.

The pollution problem of wetlands can be thought of in terms of these discharges and runoffs. Thus, the pollution problems of wetlands are not different in type from pollution problems of aquatic, atmospheric and terrestrial resource areas. You have sewage, dredge spoils and siltation, heavy metals, pesticides, thermal discharges and a great variety of other things.

Probably, the most urgent research need for pollution problems of wetlands is to understand in quantitative terms the behavior of the communities of species in wetlands ecosystems under natural conditions and subject to pollution stresses. We must consider a total structure of the wetland ecosystem -- not just the aquatic portion, nor the terrestrial portion, but both, and the interface between them.

To accomplish this understanding, we must study, in great depth, the processes and mechanisms which control the inter-actions of various physical and biological components of the system. This will mean intensively investigating the baseline conditions in many systems, something we do not have now. We know a lot about the baseline conditions of very few systems and not enough about the

various kinds of systems and pollution stresses that we will need in order to develop national answers to problems of pollution control and management of wetland resources in the face of pollution problems. With such a quantitative description, it will be possible to examine and compare, on a uniform basis, the consequences of various management strategies for the use of wetlands and evaluate the effects that various kinds of pollutants will have as they accompany or interfere with these management strategies.

One of the ways of studying the dynamic behavior of wetlands is in terms of the flow of nutrients and energy through the ecosystems. This has been illustrated this morning in the material of John Clark.

At the base of food production are the algae and rooted plants which utilize nutrients to manufacture food during photosynthesis. While algae are important in wetlands, they carry out the bulk of the photosynthesis in rivers and the ocean; in wetlands, most of the food production is through the rooted plants like grasses and trees (mangrove swamps being a type of wetland consisting of trees). Very few species, notably some terrestrial insects, like grasshoppers, can utilize the living grass material directly for food. Some species of crabs, shrimps and mollusks can feed directly off the algae. The bulk of the food production becomes available through detritus. Here, dead plant and animal material is broken down by bacterial mineralization into small nutrient rich particles which form the basic food for most of the invertebrates in the community. These invertebrates, in turn, are the food for fishes, birds, reptiles and mammals.

Odum and Smalley have studied the food production in a Georgia salt marsh. While the growth of new marsh grass material was seasonally cyclic, the production of detritus was relatively uniform for the year. The time sequence in the growth and development of the invertebrates, fishes, birds and other animals

are cyclic and are regulated by environmental changes, but fortunately the available detritus food supply remains relatively constant.

Some of the pollution problems may be considered as disrupting these kinds of sequences; for example, during the season when birds utilize wetland areas for nesting and breeding, adult birds do not always engage in extensive food foraging activities. If you wish to assure the success of the bird breeding season, food for adult birds must be present in such excess quantities that foraging is minimal. If a pollutant is responsible for disrupting available food supply by drastic reduction or elimination of an important food species, the breeding season might be jeopardized for the bird.

The introduction of pollutants can disrupt the food production cycles in several ways. Heavy metals and pesticides may be absorbed to fine sediment material, which becomes part of the detritus. The toxicant may be directly absorbed by algae, enter the roots of marsh plants, or be part of the particulate material ingested by detritus feeders. Once it becomes part of the foodweb, it will be passed up the line through various trophic levels. Here you have a potential for continuous recycle and accumulation of the toxicant.

During the past several years, there have been many studies on the bioaccumulation and magnification of pesticides and heavy metals in crabs, mollusks, shrimps, fishes and birds. Some work has been done on vegetation, such as studies by Harriss at the University of Florida, on mercury in marsh plants, and work by Odum on DDT residues in marsh plants.

Much of this work remains incomplete in providing us with a quantitative picture of the key pathways, rates of uptake, transformation and translocation of these toxic materials. Furthermore, much work remains to be done in understanding the physiological effects of these materials once in the organism tissue. Doctor

Ketchum has outlined these needs very thoroughly.

At this point, I would like to leave the discussion of pollutant research needs related to the understanding of the behavior of species and the communities in wetlands, and go to a topic of a more applied nature -- waste management. We all realize that the increasing volumes and complexities of our wastes demand greater and more effective waste treatment systems; but beyond the urgent need to treat waste, we now have to look into the problems of managing waste.

As people concerned with the effectiveness of waste treatment plants, you are probably aware that waste discharges contain both desirable and undesirable constituents -- although "desirable" may be a relative concept to management. Effective waste treatment removes the undesirable constituents. What is left, although desirable, may not be optimal for some further use of the water. Some new research concepts are being explored for the management of materials left after extensive waste treatment. Since the upgrading and building of more efficient sewage treatment plants requires large amounts of money and municipalities may not have this kind of money or be able to raise it, some of these management techniques may upgrade existing treatment facilities with minimal expenses over a short period of time.

For example, several projects are being supported by the Environmental Protection Agency and the National Science Foundation, which examine the ability of wetlands species to act as a tertiary treatment system. Once toxic materials, some of the nutrient BOD, nitrogen and phosphate have been removed from the effluents, with or without subsequent disinfectant chlorination, the effluents are sent to special holding ponds which have been stocked with species of marsh vegetation. The ability of these ponds to further remove excess nutrients and change

the quality of the effluent to one more compatible with the ultimate receiving body of water is being studied.

The management of these ponds depends on harvesting the marsh species from the ponds. Remember, there are still undesirable materials which may be trapped in these marsh species that are being used for treatment purposes, and we might not want to pass these materials on as forage material to other species in the wetlands.

The coordination of the harvesting of species from these ponds with solid waste management practices is an area being investigated in a fresh water marshland project in the State of Michigan.

A second type of project involves balancing chemical components of the effluent after removal of toxic constituents and most of the nutrients present. The fertilizing value of secondary effluents and agricultural runoff is variable. Certain key trace elements may not be present; other elements may not have ratios that are needed by desirable plants, such as diatoms and certain green algae. For example, domestic sewage is typically low in sodium, magnesium, manganese, potassium cobalt, relative to quantities of phosphates, iron, carbon and nitrogen. Small additions of manganese to ponds containing the effluent from a can- nery operation in South Carolina have been successful in shifting species of algae present from the nuisance blue-green-algae, like Microcystis aeruginosa and Anabaena flos-aquae to diatoms, such as Fragellaria crotonensis and Cymbella affanis. By adding trace amounts of certain chemicals, it may be possible to allow desirable species to out-compete undesirable species. These desirable species become the food for various invertebrates and fishes allowing the development of a stabilized, viable, highly diversified ecosystem.

This technique offers potential in aqua-culture operations, as well as



providing a control of possible eutrophication in wetland waters. The changes in species would enhance food pressure to increase desirable fish production and could best be used to increase the desirable use of fisheries while, at the same time, minimizing the production of nuisance algae blooms -- and the dominance of species that formed them -- which are not usually subject to such predator pressures.

The third type of project is to try to match the chemical quality of treated effluents to the receiving waters of the wetlands to maintain a kind of chemically homeostatic environment in receiving wetland for species already present. For example, during the past few years, Hart has studied the sections of the Patuxent River, which receive secondary effluents. In a personal communication, he has noted that one region of the estuary had a salinity range of eight to eight to 15 percent. The large volumes of essentially fresh water from the waste effluents of nearby communities have lowered this salinity. He no longer found the typically estuarine species of crab, mussels and shrimps in the areas of reduced salinity. They were replaced by increasing numbers of fresh water insects as the marshland ecosystem shifted to a fresh water wetland.

Supposing that prior to discharge, the salinity of the effluent were adjusted in special ponds to maintain the required salinity of the region for crabs and shrimps. Conceivably, the estuarine zone would not have been disrupted with respect to salinity. The effectiveness of this type of method comes from a detailed knowledge of the environmental needs of the organisms being protected, such as regulation of feeding and foraging, and habitat utilization of the species.

At the present time, all three types of projects are on very small experimental or conceptual scale application. It is not known whether the tech-

niques are restricted or have widespread applicability. Research is aimed at evaluating their potential.

For all of their value as wildlife refuges and nursery grounds for fisheries, wetlands do possess a number of undesirable features. Foremost is the fact that wetlands are breeding grounds for mosquitos. Marsh vegetation acts as a frictional surface to reduce flow velocities through the wetlands and create regions of stagnant waters ideal for the habitats of mosquito larvae. Mosquito control is one of the most important health problems. Most of the methods used involve either oil or pesticide materials which adversely affect non-target species. Controlled inundation of wetland areas has been suggested. Such inundation depends on impounding waters and management of impoundments presents other water quality problems. From both an epidemiological as well as pollution control point of view, research in methods to control mosquitos, and which are not disruptive to ecosystems and non-target species, would appear to be an area that offers potential research.

Finally, I would like to say some brief words about what the Environmental Protection Agency programs are with regard to wetland management. The EPA is charged with development of scientific basis for water quality criteria which can be used to set legally defensible water quality standards. This is a problem where use of your wetlands provides an inter-action with the EPA. This needed scientific base comes from laboratory studies on the growth requirements of important aquatic species, physiological studies on the acute effects and sublethal effects of various pollutants on important fishes and shellfishes and their food organisms, studies on the chemical transformations of toxicants during breakdown.

These laboratory studies are integrated with field studies on various

kinds of water bodies, so that total effects on communities of species, the pathways, rates of uptake and transformation of pollutants are delineated. A mathematical analysis of the data and development of models of the behavior of species in single populations in communities round out the picture of predicting, on a quantitative basis, the impact of various pollutants on ecosystem dynamics, and the possible effects of manipulations and strategies in ecosystem management.

The modeling work is relatively new, and it offers research needs in its own right. In fact, in the modeling work is implicit the whole problem of pollution, how does one define pollution, and what are the parameters that are essential to the description of ecosystem dynamics and effects to its control in management.

## SUMMARY

David H. Wallace  
Associated Administrator for Marine Resources, NOAA

Friends, I know it is now 5:15 p.m. and I am sure you are all going to be late for dinner. I have this big mass of notes which I have been taking of the discussions. I would suggest, though, that I get rid of them. I think they are just too much. I would even suggest that you might stand up for just a moment because I am sure all of you are tired of sitting, but I don't want to open up the loophole that Doctor Bish talked about -- that you might escape out the open doors. You have got to hear me out.

Before I really try to summarize, I do want to take this opportunity in behalf of those of us in NOAA to thank the Nassau-Suffolk Regional Marine Resources Council for giving us the opportunity to be with them today. I particularly want to thank Ed Stephan and Lee Koppelman, who have worked very hard in making most of the arrangements, and I also want to express my appreciation to Mr. Lane and Chuck Chapman of my staff, who have done a great job in helping me put this program together. I think it is also great that we have had these experts who have been willing to devote their time to come here today and join with us as a panel to give us an expression of their views on this very complex problem of wetlands management.

It seems to me that John Klein, in setting the stage for this discussion, threw out a challenge about the relationship of scientists to local officials responsible for local action. I won't attempt to quote him precisely because I didn't have a copy of his speech in advance, but I will try to paraphrase -- he said something like this, "A dangerous gap exists between our scientists, who have the technical knowledge, and local government officials responsible for carrying

out local action." And then he made an appeal to the scientists to speak clearly, in simple language, so that they can present the basic facts and express their interpretations in a language which would be understandable to the appointed and elected officials who would then, he said, "Be willing to act, taking into consideration the political, economic and social implications." He also said, I believe, that Federal and Local authorities should be involved in the development of guidelines to assist local decision makers.

Now, how nearly have we, as the panel, come to hitting the mark that Mr. Klein set for us? I am not going to attempt to answer this question. Instead I am going to run through several items, the points of which, I believe, tend to bear on this overall discussion.

First, I think it becomes quite evident that there is considerable data on wetlands and their value, both in the natural state, as well as in their developed state. Many scientific and economic studies have been made which can be used to give guidance to decision makers. However, the language of the scientists is, in fact, difficult for the decision makers to understand, and should be converted into a readily understandable form for them.

In decision making, ecological and environmental information must be evaluated in relation to economic, social, and legal considerations. Many considerations, including such things as aesthetics, must be weighed. Many legal mechanisms already exist at Federal, State and local levels, but significant information gaps still need to be plugged.

I might mention just a few of the existing mechanisms for wetland management and protection that were identified by various speakers. These included acquisition, protective easements, control through use of permits, and zoning for development and flood plain use to mention a few.

The question was raised as to who should do the zoning and enforce the regulations. I believe that it was the general consensus that while it is essential to have local participation in managing and regulating wetlands, there are other reasons, maybe overriding ones, for State and National participation also, since happenings in one area can impact on other political jurisdictions.

Every avenue to deal with this problem of managing the wetlands and controlling them and preserving them should be used. I believe it was quite clear that there was no single panacea for this activity that was presented by the group. In terms of research, several speakers pointed out that descriptive modeling is needed to aid the decision makers.

Doctor Bish, I think, made the very strong point that wetlands planning and management was particularly complex because of the political system in which we work. Land control is primarily a responsibility of local government, but when we get down to the water, the Federal-Local interface became a very important factor.

The views were expressed that responsibility for coastal zone management should provide for the Federal government to develop policy guidelines, the State to plan and develop standards and regulations, and the local government to carry out their implementation and enforcement.

In terms of research needs for the future, we have a long list which was enumerated. In fact, it is a little frightening to see how much is needed because if you take this at face value, we might be faced with a situation where we couldn't do anything now because we need to know so much more. I don't really believe that this was the intention of the panel, but in some ways it might be interpreted. It was clearly enunciated however, that we do need more chemical, biological and physical studies. We need better enumeration of the wetlands and

their relative values. We need hydraulic models to give us a firmer idea of what will happen when the environment is modified. We need to better know what can be done when oil or toxic materials are spilled. We also need to know more about the disposal of spoil on wetlands and the effects of creating artificial islands. We need research to learn more about how organisms react under stress. And finally, we need a variety of studies about sewage disposal and treatment plants and with this I can't quarrel.

Fortunately, I believe we can say that all is not lost and we do have an opportunity to face up to the issues that are involved here. I believe it was a general consensus that our wetlands are valuable and that they are worth preserving. We should be taking positive steps to do this now and at the same time, carry on with the research that is needed.

Thank you very much.

SPEAKER INFORMATION

Dr. Robert Abel  
Director  
Office of Sea Grant  
NOAA  
Rockville, Md. 20852

Dr. Lee E. Koppelman  
Executive Director  
Nassau-Suffolk Regional Planning Board  
Veterans Memorial Highway  
Hauppauge, N. Y. 11787

Dr. William Aron  
Director  
Office of Ecology  
and Environmental Conservation-NOAA  
Rockville, Md. 20852

Mr. Warren T. Olds, Jr.  
Regional Supervisor  
Division of River Basin Studies  
Bureau of Sport Fisheries & Wildlife  
U.S. Post Office and Court House  
Boston, Mass. 02109

Dr. Robert Bish  
26 Packet Rd.  
Palos Verdes Peninsula  
California 90274

Sondra K. Slade, Esq.  
Crawford and Diamond  
123 West Lancaster Ave.  
Wayne, Penn. 19087

Mr. Arthur W. Brownell  
Commissioner  
Dept. of Natural Resources  
Leverett Saltonstal Bldg.  
100 Cambridge  
Boston, Mass. 02202

RAdm. Edward C. Stephan, USN (ret)  
5304 Elliott Road  
Washington, D. C. 20016

Mr. John R. Clark  
The Conservation Foundation  
1717 Massachusetts Ave. NW  
Washington, D. C. 20036

Dr. Durbin Tabb  
Institute of Marine & Atmospheric  
Sciences  
10 Rickenbacker Causeway  
Miami, Fla. 33149

Mr. Joel L. Fisher  
Environmental Protection Agency  
1901 North Ft. Myer Drive  
Arlington, Virginia 22209

Mr. Robert Troutman, Jr., Esq.  
c/o James D. Newton Co.  
Ft. Myers Beach, Florida 33931

Dr. Bostwick H. Ketchum  
Associate Director  
Woods Hole Oceanographic Institution  
Woods Hole, Mass. 02543

Mr. David H. Wallace  
Associate Administrator for Marine  
Resources - NOAA  
6010 Executive Blvd.  
Rockville, Md. 20852

Hon. John V. N. Klein  
Suffolk County Executive  
Suffolk County Center  
Veterans Memorial Highway  
Hauppauge, N. Y. 11787

Col. Robert R. Werner  
Assistant Director of Civilian Works  
in Environmental Programs  
Office of the Chief of Engineers  
Forrestal Bldg.  
Washington, D. C. 20134



