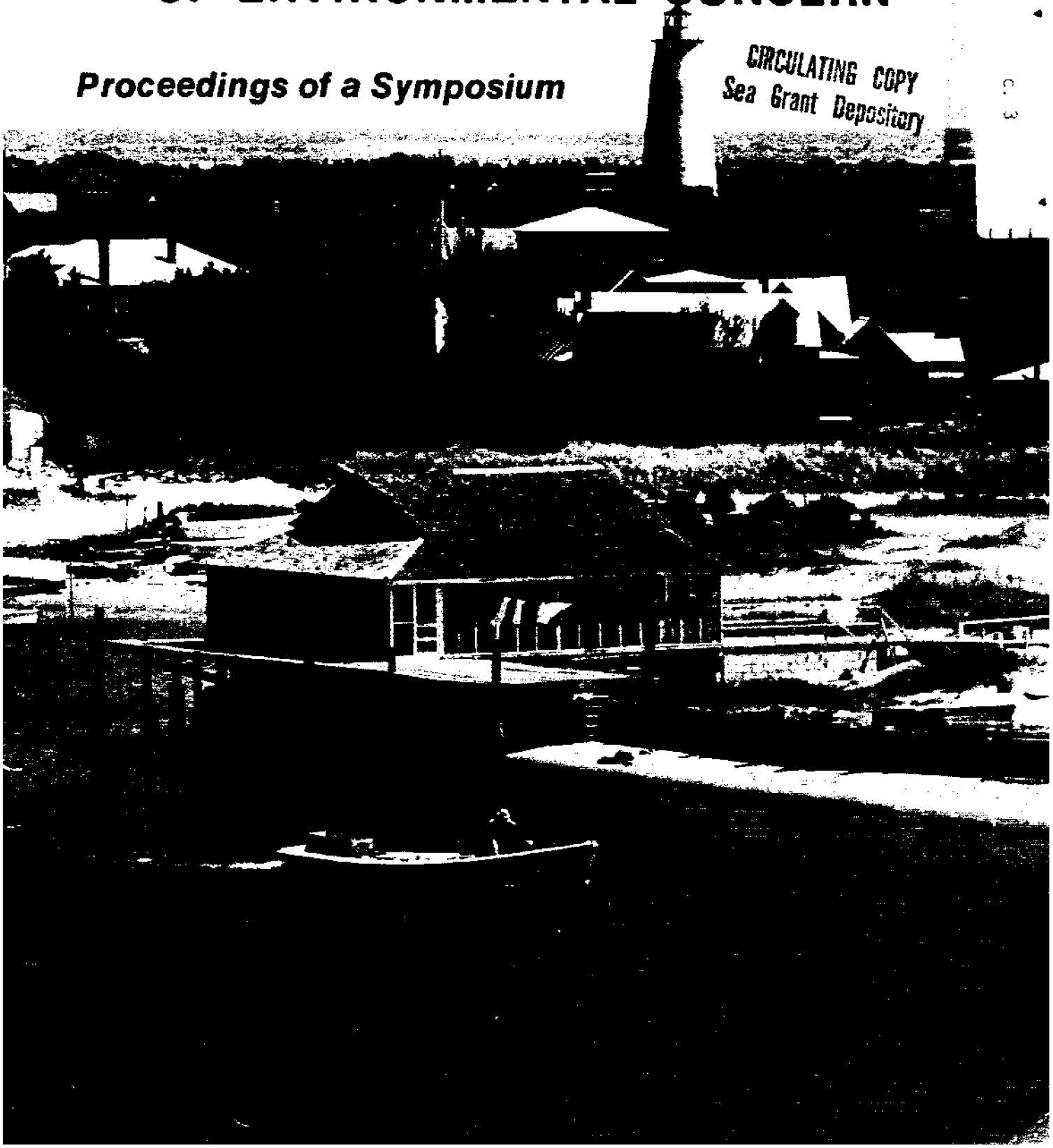
LOAN COPY ONLY

COASTAL DEVELOPMENT AND AREAS OF ENVIRONMENTAL CONCERN

Proceedings of a Symposium

CIRCULATING COPY
Sea Grant Depository

NCU-W-75-001
C. 3



COASTAL DEVELOPMENT AND AREAS OF ENVIRONMENTAL CONCERN

PROCEEDINGS OF A SYMPOSIUM

HELD AT EAST CAROLINA UNIVERSITY, GREENVILLE, NORTH CAROLINA

MARCH 5, 1975

Edited by

Simon Baker

University of North Carolina Sea Grant Advisory Services, North Carolina State University, Raleigh, North Carolina 27607

This conference was sponsored by the Office of Sea Grant, NOAA U. S. Department of Commerce under Grant Number 04-3158-40, and the North Carolina Department of Administration. The U. S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright that may appear hereon.

UNC-SG-75-18 September 1975

UNC Sea Grant Program. 1235 Burlington Laboratories, N. C. State University, Raleigh, North Carolina 27607

ACKNOWLEDGEMENTS

Neither this volume nor the conference which preceded it in March, 1975 could have come to pass without the cooperation and assistance of many people. The speakers took time from busy schedules to spend the day at East Carolina University making presentations and answering questions from the audience. They also prepared the written statements which comprise this volume. Each speaker's name and organization appears at the head of the contributed article.

The program on March 5th was divided into three parts and chaired as follows:

The Land and Its Edge by Dr. Jay Langfelder, Director, Center for Marine and Coastal Studies, North Carolina State University

The Wetlands and Waters by Dr. B. J. Copeland, Director, University of North Carolina Sea Grant Program, North Carolina State University

The Human Component by Mr. David Stick, Vice-Chairman, Coastal Resources Commission of North Carolina

The smooth flow of the meeting and exchange between the speakers and audience was due to the efforts of these three chairmen.

Our guest and first speaker, Mr. Glenn J. Akins was, at the time of the meeting, Chief Planner of the Oregon Coastal Conservation and Development Commission. On the day following the symposium he kindly consented to meet in Raleigh with people from various branches of the State Government of North Carolina to speak and exchange ideas on coastal zone planning problems.

Special thanks go to the following people at East Carolina University who assisted in the organization of the meeting: Dr. C. Q. Brown, Mrs. Betty Hardee, Mr. George Threewitts, Mr. James Rees, and Mrs. Margaret Sullivan.

The manuscript was typed by Glenda Barefoot, Debby Caldwell, Debbie Crisp, Susan Garrett, and Jane Hodge. The editor, however, must claim responsibility for typographical errors.

INTRODUCTION

The symposium on Coastal Development and Areas of Environmental Concern (AEC) was conceived and carried out as an educational effort to acquaint elected officials, planners, and the public with the reasons why certain locations require special consideration as Areas of Environmental Concern. The Coastal Area Management Act (CAMA) passed by the North Carolina Legislature in April 1974 contains a list of type areas to be considered by the Coastal Resources Commission (CRC) for designation as Areas of Environmental Concern. Discussion of these areas formed the basis for the meeting.

At the time of the publication of this volume the CRC had not yet designated any specific areas as either Interim Areas of Environmental Concern (IAEC) or as AEC's. The process of final designation of AEC's promises to be complex with considerable interaction between the CRC and the citizens and their elected officials in the twenty counties covered by the Act.

In its first year of operation the CRC has been deeply involved in efforts to explain the Act and encourage maximum public participation in the formulation of county and municipal plans mandated by the Act. Following the submission of county plans increasing attention will inevitably be given to the question of specific areas to be considered for designation as AEC's.

There is some apprehension and misunderstanding about the types of development that can take place within AEC's once they have been designated by the Commission. The CAMA does not preclude development from taking place within AEC's. Development must, however, be compatible with the fragile nature or special characteristics of the AEC's. Everyone involved in any way with development needs to know as much as possible about the special nature of the candidate areas which may be designated as AEC's. Only then will it be possible for those responsible to make decisions which balance human needs and desires with an understanding of limits to the alteration of the natural environment. We in North Carolina are seeking ways for a growing population to use the coastal zone and yet preserve its beauty, economic, and social values for those who will follow. It is also important that the users of land on the coast understand its dynamic nature and avoid development in areas where destruction of property and attendant monetary or human losses may occur.

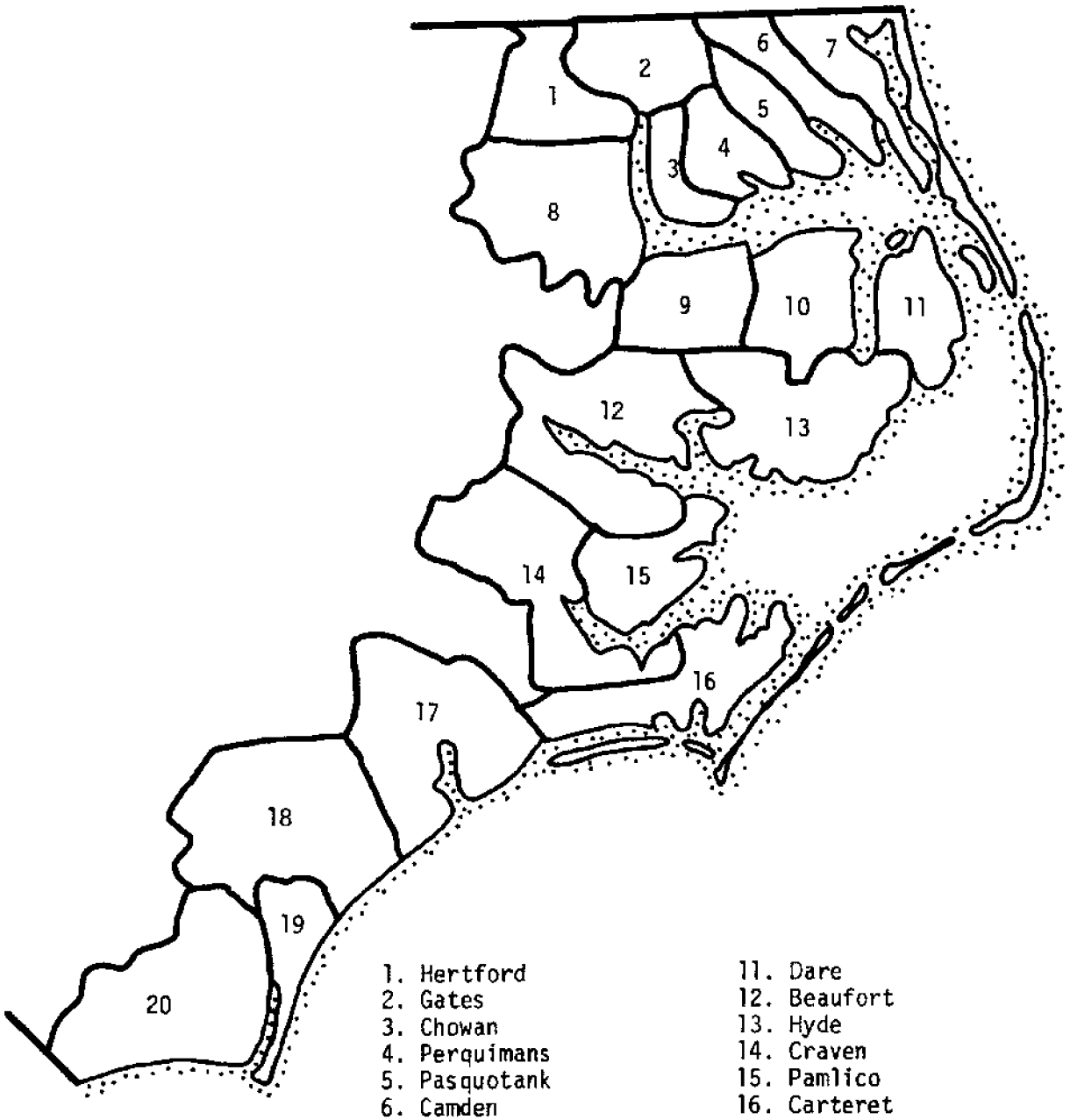
This volume and the meeting which preceded it did not cover all of the possible types of areas which are mentioned in the CAMA. It has become obvious to the University of North Carolina Sea Grant Advisory Services that the subject is a large one and the efforts of many groups and individuals will be required before all sides of the question of AEC's have been presented and understood by those concerned.

The symposium on Coastal Development and Areas of Environmental Concern was organized to bring together university researchers and State and Federal experts on the one hand with elected officials, planners, and citizens of the coastal counties on the other. Our guest speaker, Mr. Glenn J. Akins, Chief Planner of the Oregon Coastal Conservation and Development Commission was invited to speak about his state's activity in designating areas of critical concern. His talk provided the perspective of experiences of another state in the forefront in dealing with the issues of designation and selection of AEC's. Each speaker was free to address his topic and relate his interpretations to the audience based on his experience as a specialist. The only limitation placed on the speakers was that scientific and technical language be made as plain as possible for the audience of non-scientists. To foster further a free atmosphere of exchange, the audience was given the opportunity to respond to the speakers with questions or statements.

The speakers very kindly prepared their remarks in written form for inclusion in this volume. It is hoped that interested people who were unable to attend the symposium at East Carolina University will be sufficiently informed by reading what follows. The original plan for this publication called for the inclusion of the questions from the audience, but this was not possible because of a malfunction of the tape recorder during the meeting.

Readers with questions should feel free to contact University of North Carolina Sea Grant Advisory Services at North Carolina State University in Raleigh, North Carolina 27607. We will endeavor to provide answers, or failing that, refer inquiries to the appropriate specialists.

COUNTIES COVERED BY THE COASTAL AREA MANAGEMENT ACT OF 1974

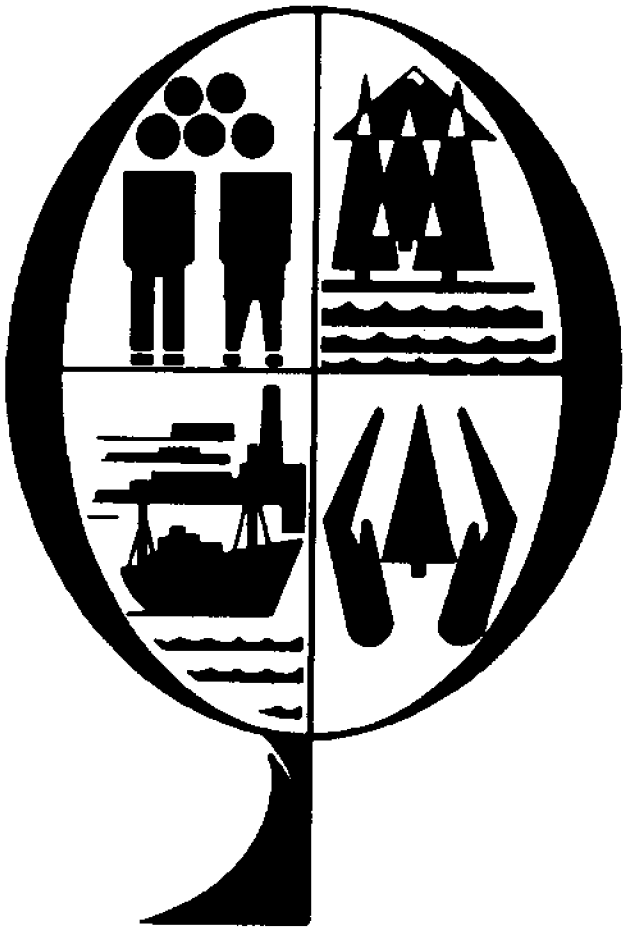


1. Hertford
2. Gates
3. Chowan
4. Perquimans
5. Pasquotank
6. Camden
7. Currituck
8. Bertie
9. Washington
10. Tyrrell
11. Dare
12. Beaufort
13. Hyde
14. Craven
15. Pamlico
16. Carteret
17. Onslow
18. Pender
19. New Hanover
20. Brunswick

Contents

DESIGNATION OF AREAS OF CRITICAL STATE CONCERN IN OREGON

Glenn J. Akins, Chief Planner
Oregon Coastal Conservation and Development Commission



INTRODUCTION

Areas of critical state concern are generally characterized as ". . . areas defined and designated by the state where uncontrolled or incompatible development could result in serious damage to the environment, life, or property, or the long term public interest which is of more than local significance."[1]

The emergence of the critical areas process in state planning efforts over the past several years is derived in part from two major sources: the Model Land Development Code of the American Law Institute;[2] and, the maturing of single-purpose environmental programs in various parts of the nation. In the first instance, the ALI code provides general guidance for the inclusion of critical area processes in state land use legislation. In the second instance, the development of these processes undoubtedly has been hastened by the recognition in the expanding environmental management programs of many states that certain areas simply are not properly managed under existing legislation. It has also become apparent that protection of the many types of areas which are considered significant would require a substantial body of new single-purpose legislation. It must be recognized that the general public support characteristic of early environmental laws is increasingly difficult to win. An important consideration, then, is a specific identification of what critical means within the state. This could mean either determining what is sacred to the general public, in terms of lands and resources, or, arriving at a working definition of critical which would allow for an incremental

evaluation of individual areas or resources. These choices are somewhat interrelated, of course.

Robert Jenkins, of Nature Conservancy, has stated that from the point of view of natural resources, each state should ". . . protect the full spectrum of biotic and genetic diversity native within its boundaries".[3] Inherent in the term "protect" is the recognition that many of these areas are currently being lost to development. The same concept of protecting that which we value, and are losing, may be applied to locations needed for power plant development, water storage, or national defense, or from a recent case, an old Jewish neighborhood in downtown Portland. Therefore, the term "critical area" in Oregon has increasingly become associated with protecting social benefits affected by impending change in an area of more than local significance. Statewide significance hopefully will be considered in terms of ecological, economic, historic, aesthetic, and cultural values. Because of the long history of citizen involvement in state activities in Oregon, the designation of critical areas will include extensive public involvement. It is recognized, therefore, that the answer to the question "what is critical" will change through time as the values described above change.[4]

It is fair to say that those of us involved in this process are walking in a strange neighborhood. One provoking question (and it will remain unanswered in this paper) is "do we really need a critical areas process"? In Oregon as elsewhere, the local comprehensive plan is considered the key element in the land use regulation process. There are those who feel that the local plan should be, and is, adequate for all land use decisions.

This paper presents the view that, if a regional or statewide interest exists in a particular area, the state should define and protect that interest. The critical areas process as it is presently evolving appears to be an eminently useful tool to get this job done. While it may be logical and proper for local units of government to provide the day-to-day regulation of an area of state concern, the state has the responsibility to make explicit whatever concern or issue in the area is of more than local significance; and, to assure that the greater public interest is provided for in management.

A final note of introduction; what is critical may be determined by frequently changing time and space factors. This means that a change in law, the decision-making process, or technology may reverse a previous judgement that an area is critical. Or, an area may be considered critical purely because of its proximity to another area or use. Of course for many ecologically important areas, we can only expect that they will become more rare, more critical. For others, it must be kept in mind that discussing critical area characteristics is truly shooting at a moving target.

The purpose of this paper is to describe the Oregon experience in critical area identification and designation. This will be accomplished by discussing (1) the history of the process, and (2) the details of identification and designation procedures. In reviewing this discussion, it should be kept in mind that the Oregon critical areas process is in an early state of development. It will be determined more by the future than the past.

HISTORY

The passage of the Oregon Land Use Law in 1973, including a critical areas section is a modern increment of a system that began in the early years of this century, when Oregon Governor Oswald West began setting aside beach areas for the enjoyment of all residents of the state. In later years, an extensive state park system was developed. Because half of Oregon is in federal ownership, designation of particular areas by Congress is an essential part of the system. In the National Forests major tracts of wilderness were set aside, a process that continues today. The vast marshes of Oregon's desert basins were acquired as wildlife refuges, and Crater Lake was set aside as a national park. A great area of the state's southern basin and range country became a national antelope refuge, to preserve the last wild herds of these animals from the barbed-wire noose.

In recent years, the state has passed legislation regulating all beaches as public recreation areas; established a program to acquire the lands along both sides of the Willamette River for public use; and began implementation of a state wild and scenic river program. The federal government has established a national recreation area in a 45-mile stretch of the Oregon coastal dunes. Two major estuarine areas have been incorporated into a national preservation system, one as a baseline environment under the Coastal Zone Management Act, and another as a scenic research area managed by the U. S. Forest Service. It would seem that with so many successful single-purpose programs in operation, there would be no thrust for an overall critical areas program. However, such was not the case.

In 1970, Governor Tom McCall began efforts to establish an overall program for the preservation and orderly development of the resources of the Oregon Coast. In 1971, the Legislature created the Oregon Coastal Conservation and Development Commission (OCC&DC) to prepare a coastal plan. The plan will be submitted to the Legislature in March of 1975. Although there was no specific requirement to identify "critical areas" in Oregon's coastal legislation, the entire thrust behind the bill was to provide for preservation and development of specific coastal resources.

In 1972, the Congress passed and President Nixon signed the Coastal Zone Management Act of 1972. One requirement of the Act is for states to identify "areas of particular concern" and to identify a "priority of uses" for these areas. When Oregon became one of the first three states to receive a planning grant from the federal Office of Coastal Zone Management, the staff of the coastal commission began to prepare guidelines for the designation of critical areas.

At approximately the same time, a number of persons in the Willamette Valley were preparing legislation for both the preservation of farm land, and a state land use program. The land use bill was introduced as Senate Bill 100 in the 1973 session of the Legislature. The bill had two main characteristics: the naming of specific areas of state concern (the entire coast, for example, was designated as a critical area); and, the designation of regional councils of government as the implementing authorities for the state planning program. The bill encountered stiff opposition. To assure that a land use measure would pass, a committee of lobbyists was appointed to redesign the bill into a form acceptable to the major pressure groups. What emerged was a law requiring the state to adopt goals for land use planning, and to enforce these goals primarily through local comprehensive plans. Counties were designated as the key unit for coordination and enforcement. Specific critical areas were not named in the final bill. Rather, the law allows the State Land Conservation and Development Commission (LCDC) to recommend the designation of critical areas to the Legislature. The bill (and its drafters) provided no criteria for the identification of these areas. In that task, the LCDC would go it alone.

In April of 1973, the Executive Department of the State of Oregon published a document entitled An Inventory and Evaluation of Areas of Concern in Oregon.[5] The report was prepared by the Battelle Pacific Northwest Laboratories, working with

the natural resource agencies of Oregon. The report contained the following identification of areas of environmental concern:

(1) Critical Priority Items

Development of Estuarine Management Guidelines
Identification and Protection of Tidal Marsh Wetlands
Protection of Beaches and Dunes
Protection of Freshwater Lakes
Expansion of Designated Wilderness Areas
Expansion of Designated Research Natural Areas
Identification and Protection of Outstanding Scenic Areas and Waterways
Identification and Protection of Outstanding Potential Recreation Areas
Identification and Protection of Critical Wildlife Habitats

(2) Second Priority Areas

Determination of Land-Use Suitability Characteristics
Identification of Geologic Hazards
Development of Flood Plain Management Plans
Retention of Prime Agricultural Land for Agricultural Use
Expansion of Fire Protection Areas
Identification of Smoke Hazards Region
Continued Allocation of Water Resources for Environmental Purposes
Identification and Classification of Back Country Areas
Enhancement of Important Wildlife Habitats
Enhancement of Important Fish Habitats

(3) Third Priority Areas

Continued Improvement in Forest Management Practices
Continued Improvement of Range Management Practices
Continued Improvement in Cropland Management Practices
Identification and Protection of Important Geological Areas
Identification and Protection of Important Historical, Archaeological, and Cultural Areas

The report was prepared to assist in the discussion of the original Senate Bill 100. After the critical area definitions were deleted, the demand for the report subsided, and it has never been adopted by the State of Oregon, although it provides a useful classification and prioritization of critical area types in the state.

The first designation of a critical area in Oregon was on March 29, 1974. The action did not have the effect of law however, because it came from an advisory body, the Oregon Coastal Conservation and Development Commission. The OCC&DC voted to designate eight estuarine areas as "tentative areas of critical state concern" on the recommendation of the Commission's estuarine sanctuary committee. The committee, made up of local elected officials, natural resource agency and university staff members, had evaluated a number of estuarine areas for consideration as an estuarine sanctuary under the Coastal Zone Management Act. Nine areas were identi-

fied as meeting the criteria for sanctuaries. The committee finally selected the South Slough of Coos Bay as the sanctuary candidate, and recommended that OCC&DC designate the other eight areas as critical. After lengthy and intense discussion, the Commission voted to accept the committee's recommendation, partly on the strength of Commissioner Don Knapp's charge that OCC&DC had to state clearly what areas were considered significant.

On May 10, 1974, a Memorandum of Understanding between the OCC&DC and the Land Conservation and Development Commission was adopted. This agreement included a provision that areas of critical state concern identified by OCC&DC would be provided to LCDC for adoption and recommendation to the Legislature.

In August of 1974, the OCC&DC formally adopted a designation process for critical areas. And in December, 1974, the LCDC adopted statewide planning goals and two critical areas for recommendation to the Legislature.

PROCESS

At present, there are two separate processes in Oregon for identifying and designating critical areas: the LCDC method for identifying areas throughout the state; and, the OCC&DC method for identifying areas in the coastal zone. The LCDC method may be described as a case-by-case approach based on a recommendation procedure. The OCC&DC approach is based on an identification of resource characteristics and values in individual inventory documents, and an evaluation of relationships between the social benefit factors which may occur in a given candidate critical area. It is hoped the process eventually used in Oregon will contain the strong points of both systems.

The Land Conservation and Development Commission Method

The legislation establishing the LCDC and a state planning function in Oregon provides little, if any, criteria for the designation of areas of state concern. That job is left to the LCDC. To fulfill the critical area responsibilities of the legislation, LCDC included (in the extensive public involvement program conducted to develop statewide planning goals) questions regarding what areas Oregonians felt should be singled out for state attention in management. Two questions were asked: the first requested an identification of areas the citizen considered critical in his home area; the second requested identification of areas in other parts of Oregon.

The details of this survey, which provides little basis for evaluation, are contained in the LCDC publication A Report on the People and the Land Public Workshops. Basically, the survey shows that Oregonians value that which is close and familiar, or resources commonly regarded as aesthetically or economically important, such as forest and agricultural lands. Classes of resources (such as estuaries) were identified as critical much more readily than were specific geographic areas. For example, a distant marsh area visited by only a few Oregonians would not rate highly in the survey, although the area might be of statewide or national significance. Robert Northshield of NBC News (and the author of The People's Birds) identifies the Klamath marshes as the most spectacular, and perhaps most significant concentration area of migratory waterfowl in the world. In the LCDC survey, the Upper Klamath Marsh was mentioned once, and the heart of the area, the Lower Klamath Marsh, was not mentioned.

Based on this survey, and also on nominations from individuals, the LCDC discussed a list of potential critical areas, and decided to designate four in their initial round of recommendations. These were (1) the Columbia River Gorge; (2) the Metolius River Deer Winter Range; (3) all federal lands in the State of Oregon; and (4) the Willamette River Greenway. Prior to the adoption of statewide planning goals in December of 1974, the LCDC eliminated two of these areas, and finally adopted the designation of the Metolius River mule deer range and the Columbia River gorge as critical areas. These areas will (presumably) be referred to the Joint Committee on Land Use of the Oregon Legislature for final action.

The Oregon Coastal Conservation and Development Commission Method

In the early months after the formation of the Coastal Commission, OCC&DC commissioners engaged in several meetings to decide upon the major problems, issues, and areas which should be addressed by the coastal management program. The Commissioners eventually agreed upon 18 categories of problems and issues which they considered to be the heart of the coastal planning program. These 18 categories were named "areas of critical concern in the coastal zone". In May of 1974, the OCC&DC adopted a set of goals and objectives which included a reorganization of these 18 categories into 11 categories in three main groups: (1) coastal natural resources; (2) coastal values; and (3) constraints on coastal zone management. Individual categories will be discussed subsequently.

By the spring of 1974, the OCC&DC had adopted the designation of several areas of tentative critical statewide concern on the recommendation of the Commission's Estuarine Sanctuary Committee; the Commission had been informed that the LCDC would be anticipating the designation of critical areas on the coast; and inventories of coastal resources were becoming available in draft form, providing information to support the designation of individual critical areas. By August, the Commission had reviewed the process adequately to adopt it for selecting areas to be recommended to LCDC and the Legislature. The adopted process is as follows:

Basically, areas of critical state concern on the coast should be designated by OCC&DC totally within the existing planning process. This means the area designations should be consistent with Commission goals, based on the natural resource and economic inventories, and implemented using adopted management policies. In addition, OCC&DC should include with each designation a discussion of:

(1) the criteria developed and the reason for the proposed designation;
(2) the damages that would result from uncontrolled development within the area;
(3) the reasons for the implementation of state regulations for the proposed area; and
(4) suggested state regulations to be applied within the designated area.

The process involves two major steps: consideration of areas identified as suitable for preservation or development within each resource inventory (as completed for each resource category, such as estuaries); and, evaluation of areas using the complete set of inventories, in order to develop a detailed understanding of particular areas. Evaluation of particular areas using the complete inventory system shall be consistent with the OCC&DC legislative charge and the Coastal Zone Management Act of 1972. Specifically, areas of critical state concern should be of the following types:

(1) those areas of significant natural value or importance (relating to the OCC&DC responsibility to provide for the preservation of the natural resources of the coastal zone); and

(2) those areas of significant importance for use, particularly areas necessary and suitable for intensive development (relating to the OCC&DC responsibility to provide for the restoration, reclamation, public access, and development of the natural resources of the coastal zone).

Specific designations of coastal critical areas should be within the following general classifications:

Natural Resource Areas

(Derived from inventories of estuaries, wetlands, freshwater and shorelands, uplands, continental shelf, beaches and dunes, and the coastal economy):

(1) areas of high natural productivity or essential habitat for living resources, including fish, wildlife, and the various trophic levels in the food web critical to their well-being;

(2) areas of substantial recreational value and/or opportunity;

(3) areas where developments and facilities are dependent upon the utilization of, or access to, coastal waters;

(4) areas of unique geologic or topographic significance to industrial or commercial development;

(5) areas needed to protect, maintain or replenish coastal lands or resources, such areas including coastal floodplains, aquifer recharge areas, sand dunes, reefs, offshort deposits, and other areas;

Coastal Values

(Derived from inventories of visual resources, fish and wildlife, historical and archaeological sites and scientific natural areas):

(1) areas of unique, scarce, fragile, or vulnerable natural habitat physical features, historical significance, cultural value and scenic importance.

Constraints on Coastal Zone Management

(Derived from inventories of geological hazards and development pressures and status of planning in the coastal zone):

(1) areas of urban concentration where shortline utilization and water uses are highly competitive, and

(2) areas of significant hazard if developed, due to storms, slides, floods, erosion, and settlement.

At the present time, approximately 75 potential critical areas have been identified within individual OCC&DC inventories. These include the eight estuarine areas identified by the Estuarine Sanctuaries Committee, 36 separate estuary and wetland areas (mostly tidal marsh islands), 15 freshwater lakes, and a major dune area adjacent to a national recreation area. Detailed analysis has been completed only for two areas. These recommendations and analyses will be included within the final report of the Coastal Commission to the LCDC and the State Legislature.

CRITICAL AREAS

The Oregon Coastal Conservation and Development Commission will present a critical areas chapter, within the final report, to the Legislature and the LCDC, which will contain three main elements: a recommended process for designation of areas; a list of potential critical areas in the coastal zone; and a detailed evaluation of two areas, to indicate how each candidate area should be evaluated by the LCDC and the Legislature to determine if it is critical.

CONCLUSIONS AND RECOMMENDATIONS

Today, those of us in state planning have little experience to draw on in identifying and designating critical areas. It is extremely important, then, that we learn from, and rely upon, each other. The U. S. Department of the Interior will release a study this spring indicating that, while a few states (such as Florida and North Carolina) have taken some dramatic steps in identifying and

designating critical areas, most are proceeding slowly, awaiting developments elsewhere (particularly in Washington, D. C.). In Oregon, the experience to date is not conclusive, perhaps not even instructive. Because of the relatively new legislation, lack of experience, and the absence of techniques and methods studies from other states to draw on, the Oregon effort has been experimental, self-generated, and somewhat incremental. The state has not yet formally established a critical area; and, the identification and designation process is still being developed. However, the future appears fairly bright. Single purpose programs continue to provide for certain types of areas; the OCC&DC will provide some reasonably solid suggestions on process to the LCDC and the Legislature; and, new LCDC designations will arrive in the Legislature coincidentally with a new bill to formalize a designation process. While it may be risky to evaluate a critical area program early in its development, such may be helpful. Therefore, the following conclusions and recommendations are offered for the benefit of those who seek to avoid unnecessary mistakes. It is hoped that a review of the Oregon experience, however preliminary, will aid the strengthening of the critical areas process, both in Oregon and in other states walking the same path.

Legislation

The original land use bill in Oregon not only established a critical area process, it also named a majority of the critical areas. The bill which emerged as law contained much less. It merely authorized the state land use agency (LCDC) to recommend critical areas back to the legislature. There was no declaration of policy or establishment of criteria by which the LCDC could determine, at least in general terms, what was thought to be critical and what was not. The legislature did establish priority areas for the setting of statewide planning goals. By inference, LCDC could consider these areas as having a priority for designation. As identified in the bill, these areas are:

(1) the planning and siting of public transportation facilities;
(2) the planning and siting of public sewerage systems, water supply systems and solid waste disposal sites and facilities;
(3) the planning and siting of public schools;
(4) lands adjacent to freeway interchanges;
(5) estuarine areas;
(6) tide, marsh and wetland areas;
(7) lakes and lakeshore areas;
(8) wilderness, recreational and outstanding scenic areas;
(9) beaches, dunes, coastal headlands and related areas;
(10) wild and scenic rivers and related lands;
(11) flood plains, and areas of geologic hazards;
(12) unique wildlife habitats; and
(13) agricultural land.

It should be recognized that some of these areas are the subject of regulation by specific single-purpose laws in Oregon. Others, such as the siting of public schools, are designated as "activities of statewide significance" in the Oregon land use bill, and may be regulated by LCDC through a permit process. This is, in effect, a "Development of Regional Impact" process, but is not as inclusive as some in Oregon would like it to be. For example, control of transmission lines was lobbyed out in the 1973 session.

The state land use agency should have a clear sense of direction from the legislation which establishes the critical areas process. The legislature should make clear what problems are to be addressed, and/or the type of areas to be considered. Another approach would be to outline an objective process for the land use agency to identify and designate areas, using an inventory or open nomination system.

Information Systems

Oregon does not have an information system such as that being developed in New York, Minnesota, Virginia, and elsewhere, to identify and evaluate major natural resources and land uses. Such a system provides a method to evaluate what is, and is not, critical, on a state-wide basis. The critical area designations of LCDC have not been based on any specific inventory system, although certainly, technical information and expertise was involved in the selection process. The question remains, however, as to how a specific deer range compares to other deer winter areas, and to those of the Roosevelt elk, the antelope, and the coastal black-tail deer. LCDC designations have resulted from an open nomination process, and an extensive system of public participation. For certain types of areas (such as scenic or recreational lands) such a process is probably desirable.

The OCC&DC inventory process provides for the identification of many areas on a more objective basis. More importantly, the information contained in the inventories gives an indication of "what is critical" on a regional (in many cases, statewide) basis. There has not been adequate public review of the process to date, however. The combination of technical evaluation and public participation outlined in the Wisconsin CRIP[6] Program would have been more desirable. Also, the OCC&DC inventories were completed on a limited budget, and in a restricted time period. At present, the inventories are not part of a system which is updated and improved as new information becomes available. Of course, the OCC&DC information could serve as the

starting point for a state natural resources/land use information system.

The OCC&DC experience indicates that, at a minimum, state critical area designations should be supported by a state data base which includes:

(1) a state-wide (overview) inventory[7] which would provide an estimate of the extent, location and major characteristics of natural and cultural resources and land use;

(2) a topical, or problem-oriented inventory of key, critical, or target resources and land areas which are the subject of frequent conflicts and decision; and

(3) a file of scientific research, and scientific and technical personnel available to provide information and testimony on issues and decisions too localized or complex to be included within a systematic inventory.

Designation Process

Oregon has been more successful in identifying and preserving critical areas than in outlining a process for such actions on a comprehensive basis.

The OCC&DC final report to the Legislature will include a recommendation for a more systematic process for critical area designations. The Oregon Environmental Council is preparing a bill for this session of the Legislature which will, presumably, provide the same thing.

Areas of critical state concern, based on the experience of OCC&DC to date, should be identified and designated using a process which includes (1) public involvement (because concepts of what is critical change, often rapidly); (2) the evaluation of scientific, legal, and other information stored in a state land use/natural resources data base which is kept current; (3) preliminary approval by the state planning or natural resources agency (to justify further detailed study at state expense); (4) review of the site, issue, and pertinent information by a resource specialist team composed of state agency, university, industry, local government and public interest group representatives; and (5) final review and adoption by the Legislature or the Governor.

An important element of the identification and designation process is that the initial impetus for establishing a critical area should come from either (or both) an inventory process or the recommendation of citizens or another public group. A petition of nomination for critical area designation may be submitted to the state

land use agency for review; or, the agency may identify a potential critical area through technical analysis of scientific information. It is important to combine popular concern and technical analysis in the process, because what is critical depends on both technical and social factors, in many cases. And, state officials facing the responsibility of final designation should have available to them an accurate estimate of public concern for the issue, as well as all appropriate technical information.

Management

The state must assure that the purposes for which a critical area was designated are provided for in management. The first step in achieving this is taken by the state agency which first gives preliminary approval to the suggested designation of a particular area. At that time, the agency would complete a summary report on the reasons for designation. The next step (after agreement to proceed on the designation process is received from the policy body which oversees the land use agency) is a detailed inventory of the site (from existing data) by a team of state resources specialists and others as described previously. The establishment of management alternatives for the South Slough of Coos Bay, Oregon (the nation's first designated estuarine sanctuary) could be considered as a model for this process. The goals for the management of South Slough are set in the Coastal Zone Management Act of 1972, and in the adopted sanctuary guidelines agreed to by the federal government and the State of Oregon. The sanctuary is a "research area which may include any or all of an estuary, adjoining transitional areas, and adjacent uplands, constituting to the extent feasible a natural unit, set aside to provide scientists and students the opportunity to examine over a period of time the ecological relationships within the area." After the initial designation, the State of Oregon established a management team for the area, which consisted of specialists from the state resource agencies, Nature's Conservancy, the Oregon State University remote sensing laboratory, private industry, and local units of government. The team developed an inventory of the sanctuary area which included the following:

(1) fish and wildlife in the estuary and its tributary streams;
(2) the boundaries and ownership of parcels of land in the proposed sanctuary area;
(3) proposed planning and zoning designations in the area;
(4) residence and access locations;
(5) slope;
(6) visual resource qualities;
(7) an analysis of the vegetation and characteristics; and
(8) the environmental geology of the area.

Subsequent analysis of the data base and team discussions led to the identification of existing and potential management problems, such as the control of sedimentation from logging and other land development practices, and the limits to be placed on recreational use of the area. The next step was to identify the alternatives for area management, and to select that alternative which seemed most consistent with the purposes of designation. The final step, of course, is to assure that the state will have the authority and means to provide for proper management through time.

SUMMARY

The State of Oregon is presently about half as far into a critical areas process as it should be. Some basic elements of the process have been established, but the firm leadership necessary to make a critical areas process work is not yet evident. The coming year, however, should bring some major advances. The OCC&DC will present a recommended designation process to the legislature, which will also have to deal with a bill developed by the Oregon Environmental Council. The LCDC will undertake a more active review of other potential areas in the State. And, citizens throughout Oregon will undoubtedly begin forwarding requests for the designation of areas for a variety of reasons. By next year at this time, our perspective should be based more on experience, and less on speculation, than it is today. And perhaps at that time we can provide a more assured and explicit view on what, indeed, is critical in Oregon.

REFERENCES AND FOOTNOTES

1. Adopted definition of the Oregon Coastal Conservation and Development Commission; as derived from the proposed National Land Use Bill (S. 268, 1974).

2. The American Law Institute, A Model Land Development Code, Philadelphia, Pennsylvania: April 15, 1974.

3. Robert Jenkins, Areas of Critical State Concern: What is Critical. Arlington, Virginia: The Nature's Conservancy (discussion report).

4. For a more detailed discussion of social benefits in the Oregon Coastal Conservation and Development Commission process, see S. Lance Zaklan's December 3, 1974 Memorandum to OCC&DC entitled A System of Preferences.

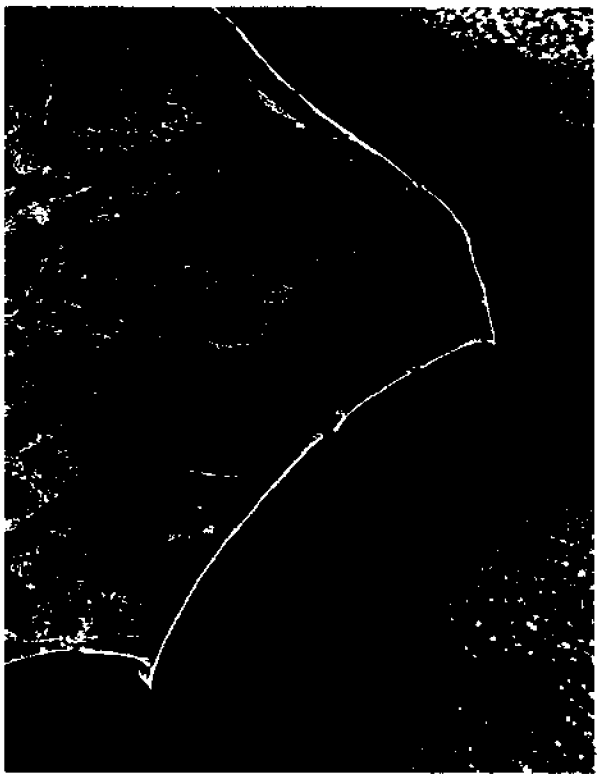
5. Battelle Pacific Northwest Laboratories, An Inventory and Evaluation of Areas of Environmental Concern in Oregon. Salem, Oregon: State of Oregon, Executive Department, April, 1973.

6. Chi, Judy C., Critical Resources Information Program, Madison, Wisconsin: The Bureau of Planning and Budget, State of Wisconsin, 1974.

7. The use of ERTS or other remotely-sensed information is often used for this type of low resolution, high level of perspective data base.

EXTENT AND DISTRIBUTION OF AREAS OF ENVIRONMENTAL CONCERN IN NORTH CAROLINA

Arthur W. Cooper, Assistant Secretary
North Carolina Department of Natural and Economic Resources



The Coastal Area Management Act of 1974 (G.S. 113A, Article 7) establishes a comprehensive program of land use planning and management for the twenty coastal counties of North Carolina. The basic responsibility for planning rests with local government. One key feature of the act involves definition of areas of environmental concern, and approval of standards and supervision of permits for development within such areas. These responsibilities are vested in the state and their implementation is supervised by the Coastal Resources Commission. Areas of environmental concern are areas where environmental conditions are such that special care needs to be exercised when such areas are altered or developed.

The criteria upon which the Coastal Resources Commission can define areas of environmental concern are spelled out rather precisely in section b of G.S. 113A-113. The following comments summarize these criteria and suggest where such areas occur in the twenty coastal counties.

Coastal Wetlands G.S. 113A-113(b)(1). Coastal wetlands are defined (G.S. 113-230/a/) as "any salt marsh or other marsh subject to regular or occasional flooding by tides, including wind tides (whether or not the tide waters reach the marshland areas through natural or artificial watercourses), provided this shall not include hurricane or tropical storm tides. Salt marshland or other marsh shall be those areas upon which grow some, but not necessarily all, of the following salt marsh and marsh plant species: Smooth or salt water Cordgrass (Spartina

alterniflora); Black Needlerush (Juncus roemarianus); Glasswort (Salicornia spp.); Salt Grass (Distichlis spicata); Sea Lavender (Limonium spp.); Bulrush (Scirpus spp.); Saw Grass (Cladium jamaicense); Cat-Tail (Typha spp.); Salt Meadow Grass (Spartina patens); and Salt Reed Grass (Spartina cynosuroides)." Included in this statutory definition of wetlands is "such contiguous land as the Secretary of NER reasonably deems necessary to affect by any such order in carrying out the purposes of this Section."

Two types of coastal wetlands occur in North Carolina. Low tidal marshes, dominated by smooth cordgrass, are the dominant type of coastal wetland from the South Carolina line to Cape Lookout. These marshes are usually subject to regular inundation by lunar tides and typically are soft and muddy. Between 40,000 and 50,000 acres of these marshes still exist. Other coastal wetlands include marshes often called high tidal marsh and brackish marsh. Such marshes are dominated by black needlerush, sawgrass and cat-tail and occur in vast expanses behind the Outer Banks, along the entire fringes of the coastal sounds and in Currituck Sound. Although 150,000 acres of these marshes once existed, many have been modified by ditching and filling.

Estuarine Waters (G.S. 113A-113(b)(2). Estuarine waters are defined in G.S. 113-229(n)(2) as, "all the water of the Atlantic Ocean within the boundary of North Carolina and all the waters of the bays, sounds, rivers, and tributaries thereto seaward of the dividing line between coastal fishing waters and inland fishing waters, as set forth in an agreement adopted by the Wildlife Resources Commission and the Department of Conservation and Development filed with the Secretary of State entitled 'Boundary Lines, North Carolina Commercial Fishing - Inland Fishing Waters, revised March 1, 1965,'" or as it may be subsequently revised by the Legislature. It is important to note that estuarine waters, as defined above, include the waters of the Atlantic Ocean out to the territorial limits (three miles) of North Carolina jurisdiction. As is clear from the definition, all coastal sounds and their tributary rivers and streams up to the prescribed dividing line as also included. There are perhaps 2.2 million acres of estuarine waters (exclusive of the waters of the Atlantic Ocean) in North Carolina.

Renewable Resource Areas (G.S. 113A-113(b)(3). These areas are defined as areas "where uncontrolled or incompatible development" that "results in the loss or reduction of continued long-range productivity could jeopardize future water,

food or fiber requirements." The intent of this section plainly is to provide a means for protecting certain productive natural resource areas and to provide a means to limit their degradation or conversion to incompatible uses.

Three specific sorts of areas are mentioned. Watersheds and aquifers presently serving as public water supplies are included because of the fragile nature of such areas in our coastal counties. The villages of Hatteras and Buxton, for example, depend upon relatively shallow well fields and it is important that quantity and quality of yield from such wells not be jeopardized. Capacity use and related areas are also included because of their importance to the water resources of the coastal area. At present, the only declared capacity use area occurs in Beaufort and surrounding counties and was defined to assist in limiting adverse impacts from phosphate mining in the area. One other area, in the northeastern counties along the Virginia line, is under study. The third renewable resource area, prime forestry land is very widely distributed over the entire coastal area.

Fragile, Historic or Natural Resource Areas (G.S. 113A-113(b)(4). These are natural or historic areas that contain natural resources or environmental conditions where uncontrolled or incompatible development could result in major or irreversible damage to important historic, cultural, scientific or scenic values or natural systems. A number of specific examples of such areas are cited in the act.

One major category includes existing national or state forests, parks, wildlife refuges, preserves or management areas owned by the State of North Carolina or the federal government, present sections of the natural and scenic rivers system and stream segments classified for scientific or research uses. Examples of the first three categories are the Croatan National Forest, Cape Hatteras and Cape Lookout National Seashores, Fort Macon, Carolina Beach, Hammocks Beach, Goose Creek, Dismal Swamp and Merchants Millpond State Parks and Holly Shelter Wildlife Management area. No natural or scenic rivers or research stream segments have yet been designated in the coastal area.

Three categories are included to permit designation of biologically or geologically unique areas. These include complex natural areas, areas that sustain remnant species and areas containing unique geological formations.

Complex natural areas support native plant and animal communities and provide habitat conditions or characteristics that have remained essentially unchanged by human activity. Such areas are surrounded by landscapes that have been modified but that do not drastically alter the conditions within the natural areas or their scientific or educational value. Areas that sustain remnant species are those places that support native plants or animals, rare or endangered, within the coastal area. Such places provide habitat conditions necessary for the survival of existing populations or communities of rare or endangered species within the county. Unique geological formations are places that contain surface or near surface formations that are either themselves unique or are especially unusual or notable examples of geological formations or processes in the coastal area. Such formations may be unique because of their intrinsic scientific value or because of their economic significance. Although these areas are difficult to define in quantitative terms, excellent examples occur throughout the coastal area. Remnant stands of Atlantic white cedar, scattered throughout the Dismal and similar swamps are excellent examples of natural areas whereas open areas on the transition from pocosins to sandy uplands in the southern coastal area, represent the habitat of remnant species when they support Venus'fly trap. Jockey's Ridge on the Outer Banks is an excellent example of a unique geological area.

Areas with historic significance generally and registered natural landmarks are the final class in the category of fragile, historic and natural resource areas. Areas with historic significance to be included are historic places listed, or approved for listing, in the National Register of Historic Places, historical, archaeological and other places and properties owned, managed, or assisted by the State of North Carolina, and properties or areas that are or may be designated by the Secretary of the Interior as National Historic Landmarks. Natural Landmarks are properties or areas that are, or may be designated by the Secretary of Interior, and which represent true, accurate, essentially unspoiled examples of natural areas which possess exceptional value or quality in illustrating or interpreting the natural heritage of our nation. These areas encourage the preservation of sites illustrating the geological and ecological character of the United States. Numerous historic areas such as Baldhead Lighthouse, New Bern Historic District and numerous historic residences are examples of historic areas and places whereas Jockey's Ridge and the interior of the Green Swamp in Brunswick County are registered National Landmarks.

Public Trust Waters (G.S. 113A-113(b)(5). The waters of the ocean and estuaries plus those of coastal streams, tributaries and lakes in which the public may have rights of navigation, access or other public trust rights are a broad but vitally important category of AEC. Although these waters include estuarine waters as defined in G.S. 113A-113(b)(2) they cover a much broader area and actually include all waters of the coastal area in which there are public rights of use, navigation or access. Thus, this category includes all waters of the coastal area from the Atlantic Ocean three-mile limit to the inland boundaries of the coastal counties. The fact that this category broadens the statutory definition of estuarine waters is important because it provides an extra regulatory tool that can assist in maintaining water quality and fish and wildlife habitat in these valuable waters.

Natural Hazard Areas (G.S. 113A-113(b)(6). These are places where uncontrolled or incompatible development could unreasonably endanger life or property, and other areas especially vulnerable to erosion, flooding or other adverse effects of sand, wind and water. They include sand dunes along the Outer Banks, ocean and estuarine beaches and shorelines, floodways and flood-plains, areas subject to excessive erosion or seismic activity and areas with significant potential for air inversions.

Sand dunes are barren, partly vegetated or vegetated deposits of windblown sand. Although the largest, so-called barrier dunes, occur immediately inland from the ocean beach, dunelands (lands influenced by windblown sand deposition) extend from the inland base of the barrier dunes to the line of estuarine water on the sound side. Dunes and dunelands comprise a major portion of the Outer Banks and barrier islands and constitute a protective barrier between the ocean and the sounds, marshes and mainland. Although dunes and dunelands are found along the entire coast, the largest dunes occur in Dare and Currituck Counties. Ocean and estuarine beaches and shorelines occur along the entire coast. These are land areas without vegetation, consisting of unconsolidated soil material that extends landward from the mean low tide to a point where vegetation occurs or there is a distinct change in predominant soil particle size or there is a change in slope or elevation which alters the physiographic land form, and thus constitutes the transition into dunes or wetlands.

Floodways and floodplains are physiographic areas subject to frequent hazards from flood water. A floodway is defined as the channel and that portion of the floodplain of a stream determined to provide passage for the 100-year flood without increasing the elevation of that flood at any point by more than one foot. A floodway serves as the main channel for the passage of flood waters. Coastal floodplains are those lands adjacent to coastal sounds, estuaries, the ocean and rivers that are subject to flooding and wave action from severe storms or hurricanes. For purposes of convenience, they can be defined as land areas prone to flooding from storms with an annual probability of one percent or greater (100 year storm). Such areas occur along the entire North Carolina coast and along all rivers and streams tributory to the ocean and the sounds.

Areas characterized by excessive erosion occur all along North Carolina's ocean and estuarine beaches. Such areas are places where geologic or soil conditions are such that material is being removed from the shore by action of water and/or wind and is being deposited elsewhere. The result is a shoreline that exhibits a pattern of retreat over a period of years. Although erosion is the general rule along North Carolina's ocean and estuarine shores, areas generally characterized by severe erosion patterns occur around inlets (Bogue, Lockwoods Folly and Topsail Inlets are excellent examples), along certain well-defined stretches of ocean beach (the Outer Banks generally) and at localized places along the shores of the coastal sounds.

Although general environmental conditions (subdued topographic and frequent winds) do not favor the existence of air inversion areas in the coastal area, their presence cannot be discounted. Low lying areas along bodies of water that are sheltered from strong winds constitute likely locations for such areas. When there is a high level of air pollution, as along the Cape Fear River in New Hanover and Brunswick Counties, it may become important to recognize air inversion areas. As yet, none have been defined in the coastal area.

Areas Impacted by Key Facilities (G.S. 113A-113(b)(7). Key facilities are defined in the Coastal Area Management Act as including "the site location and the location of major improvement and major access features and public facilities and major facilities on non-federal lands for generation and transmission of energy." Examples of key facilities are airports, power plants,

highway interchanges, and energy refining facilities. These areas are of great importance to the planning process because such facilities generally require a very specific set of environmental and social conditions. For example, studies of the coastal area indicate that there are a limited number of sites that can support an oil refinery and that these are generally located south and west of Cape Lookout. If these sites are not correctly identified at an early time in the planning process then they might well be utilized for other purposes and thus be unavailable should location of such a facility prove to be in the public interest.

COASTAL SAND DUNES

Ernest D. Seneca
Departments of Botany and Soil Science
North Carolina State University, Raleigh

Coastal dunes are naturally occurring features long the sandy coastline of the mid-Atlantic states. An understanding of the formation, stabilization, functions of, and factors that affect these constantly changing structures is fundamental to the proper management of areas where they occur. The flexible and exceptionally fragile nature of dunes has been poorly appreciated in the past as evidenced by insufficient protection from animals, traffic and construction activities. Based on findings along our coast during the last 10 to 15 years, we have a better understanding of where dunes can and cannot afford reasonable protection, how to build and stabilize them, and how much protection they require to maintain them.

Although almost any structure that impedes the movement of blowing sand can cause it to accumulate, dunes result primarily from the sand-trapping properties of vegetation. Normally the mild summer waves add sand to the beach (berm) and under favorable conditions during early fall the prevailing onshore winds move the sand onto the dunes. Where vegetation in the form of perennial grasses occurs in the path of wind-blown sand, it causes the sand to settle out. The high energy waves of winter and during storms often reclaim (erode) this sand from the beach and dune system and deposit it in the form of shallow offshore sand bars. The nearshore underwater sediments of sand, gravel, and shell material together with the beach and foredunes form a dynamic integrated unit.

Vegetated dunes are integral features of our barrier islands and serve to protect valuable estuaries from the direct influence of the open ocean. There is no question that these barrier islands would migrate toward the mainland at a more

rapid rate if the maritime vegetation were not protected from outside (livestock, vehicles, and man) influences. Vegetation is very much a part of the natural dynamic equilibrium conditions of these barrier islands.

Vegetated dunes are very effective structures against the forces of wind erosion and can often protect roads and other structures from being covered by blowing sand. When dune vegetation is destroyed there is nothing left to intercept the waves of blowing sand and migrating sand dunes as they move inland. Large unvegetated dunes such as those on Currituck Banks migrate with the prevailing winds and smother anything in their path. Dunes are fragile structures that require protection and repair from time to time and vegetation is usually the only practical means of achieving stabilization.

Dunes can be constructed by several different techniques; mechanically with a bulldozer, hydraulically by a pipeline dredge, and by trapping sand with fences and vegetation. Regardless how a dune is built, it must be stabilized to be effective against the forces of wind erosion and, as indicated earlier, vegetation is usually the only practical means of achieving stabilization. Consequently, when possible dunes should be built with vegetation, that is, by planting grasses either alone or with a short (2-foot) sand fence and letting the vegetation do the work of building the dunes.

Three perennial dune grasses are recommended for dune building and sand stabilization along our coast; namely, American beachgrass (Ammophila breviligulata), running beachgrass (Panicum amarum), and sea oats (Uniola paniculata). Based on over a decade of experience, it is advisable to plant a mixutre of at least two of these three grasses. Currently, Hatteras beachgrass, a locally adapted variety of American beachgrass, and running beachgrass are available from commercial sources in our state. These grasses are recommended not only for dune building, but for stabilizing sand dunes on the coast. Techniques are available for both hand and machine planting of these grasses.

Dunes function as flexible barriers against storm tides and waves. They are not permanent structures either as naturally occurring features or when constructed by man. Vegetated dunes can greatly diminish the forces of wind erosion and occasional storm tides but even the most completely vegetated dune cannot withstand

the constant onslaught of wave attack from an extratropical storm that grinds away at the barrier for days at a time. Because of their much higher frequency, these extratropical storms or northeasters as they are generally called, are usually considered to be more influential than hurricanes as agents of shoreline change. This statement is not meant to imply that hurricanes cannot be devastating, they can, but many people tend to associate coastal erosion with hurricanes alone. Evidence of this impression can be inferred from these same people's general lack of interest in coastline erosion during relatively hurricane-free periods. Dunes can act as temporary protective barriers but they should not be considered permanent structures which can be expected to "hold off the ocean."

Dunes can serve as reservoirs of sand to nourish the beach during storm attack. An appreciation of this concept again emphasizes the ever changing nature of dunes. Under natural conditions, foredunes continually undergo cycles of erosion and rebuilding, but not necessarily within the time spans man is accustomed to thinking in--a few years or a decade at most. Nature usually works slowly and these processes of erosion and rebuilding may extend over decades, centuries, or even longer. When man becomes involved in management of foredunes he can lend a hand to nature in the rebuilding process in certain cases by reestablishing vegetation and by rebuilding and restabilizing dunes. Where man has made a mistake in the past is in thinking of dunes as rather permanent structures that afford lasting protection. When placed too close to the ocean or when the ocean has advanced to the foredune, continual attempts at rebuilding and restabilization are usually exercises in futility or at best just buying a little time before the inevitable fate claims the barrier.

Dunes are not effective against day-to-day erosion and beach recession which is accentuated when sea level is rising or the coastline is subsiding. In this connection, it follows that under periods of rising sea level, which is generally accepted to have been at the rate of from 0.5 to 1.0 feet per century during the last century along our coastline, dunes would naturally retreat away from the ocean without man's interference. Consequently, dunes should not be constructed too close to the ocean if they are to be effective in their protective role.

Dunes are fragile and as such are vulnerable to abuse by man and his animals and machines. The vegetation that stabilizes most of our coastal dunes is intolerant of either foot-traffic or vehicle traffic. Many coastal scientists feel

that grazing by livestock was a major factor responsible for deterioration of barrier dune systems in the past. The last grazing animals were removed from our National Seashores in the late 1950's. Since that time, the vegetation on areas such as Portsmouth and Core Banks has spread considerably.

Because of their flexible and fragile nature, man should never build structures on the barrier foredunes. Further, only structures on pilings should be allowed within the dune complex where grasses, herbs, and scattered low shrubs constitute the vegetation. These plants indicate the relative unstable nature of the area. Man should never build structures in this fragile zone that he cannot afford to lose. He should not cry for disaster relief should losses be incurred. This statement is not meant to imply that those who built in a given location when the ocean was further eastward than at present should not be compensated in certain instances. But we should certainly not encourage further development in such environmentally unstable areas. Permanent structures should only be built where the features indicate a more stable situation, such as an elevated area, behind secondary barrier dunes, and in natural openings in maritime shrub thicket or forest vegetation.

There are two broad categories of land use in areas occupied by dunes along the North Carolina coast: (1) relatively undeveloped areas and (2) developed areas. Along relatively undeveloped stretches of coastline vegetated dunes can offer a practical, economical, flexible barrier which retards wind erosion and affords protection to those areas lying behind them. They are not permanent structures, however, and people charged with land management responsibility should be cautious not to overrate the protective role of dunes.

Where space allows, dunes serve very well for hurricane and storm tide protection, even in developed areas. However, in developed areas when erosion and beach recession are prevalent, dunes cannot be expected to serve as permanent protective barriers and techniques designed to "hold the line" on beach recession, such as beach nourishment, probably are the best solution at present. When erosion and beach recession are severe in developed areas, economics may often dictate a more sophisticated approach to shoreline stability than can be achieved by dunes alone. In many developed areas man has already violated the laws of natural trespass by building permanent structures too close to the ocean.

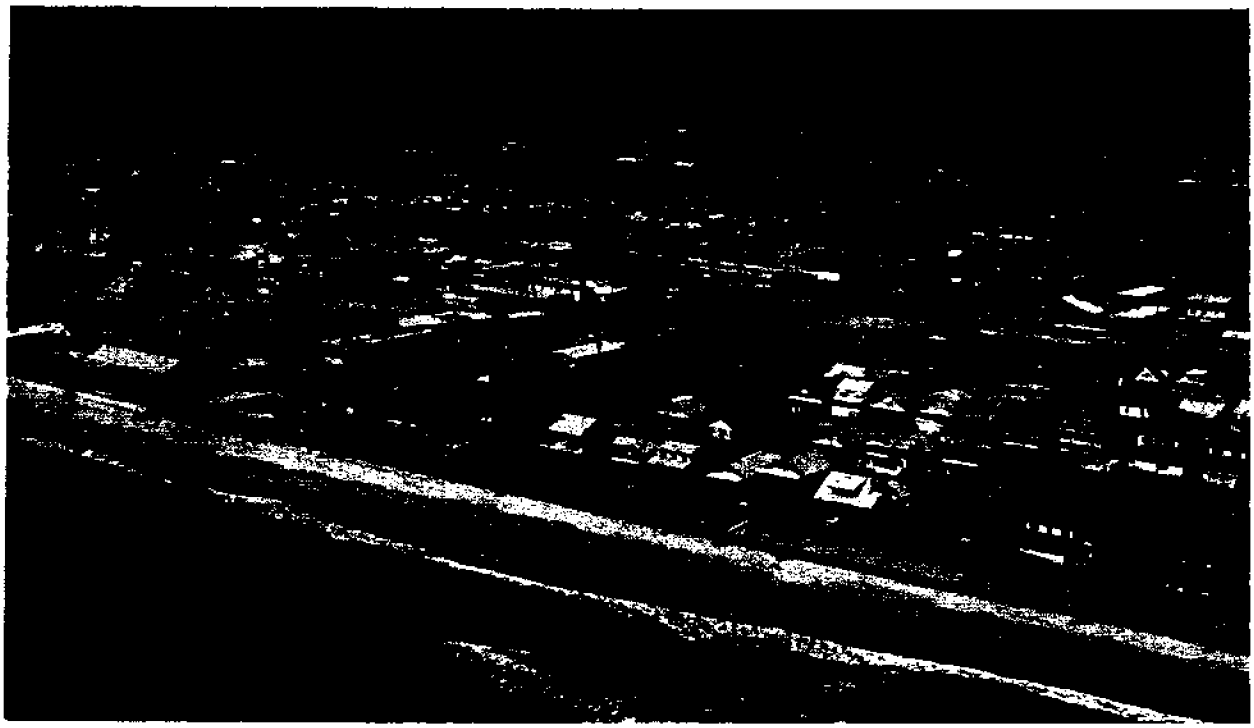
In summary, vegetated coastal dunes are an integral part of our barrier

islands and can serve to protect estuaries, roads, and structures from the effects of the open ocean on a temporary basis. We must understand, however, that dunes are flexible and fragile structures that require protection and repair to continue their normal function as a part of the nearshore-beach-foredune system.

SCENERY FOR SALE

An illustrated statement on the science, scenery, and selling of a barrier island system like the Outer Banks of North Carolina.

A. Conrad Neumann
Marine Sciences Curriculum
University of North Carolina - Chapel Hill



That may seem an odd title for a subject that will deal with how nature builds and maintains her barrier island systems. However, it is not so obscure when taken in the context of the Coastal Zone Management Act and the subsequent search for "areas of environmental concern." Man himself has become a dominant factor in the growth, erosion and maintenance of these delicate bulwarks which are called "barrier island coastlines" in general and "The Outer Banks" here at home. Man is so much a factor here that he must be considered as one of the dominant forces that now affects the shape, appearance and stability of these barrier islands. They are barriers to hurricanes and tempests, to the ravages of wind and waves and coursing tide...but at the hand of man they can crumble.

Man is a part of the natural scene on these islands now, and no discussion of conservation should exclude or discourage the "people" part of the picture. We should be as concerned with the preservation of a way of life as with the conservation of a piece of land. Any man's search for an honest living is laudable, and the natives of the Outer Banks have created a valuable and unique culture by living in harmony with nature and on its bounty. Now they find they must rely on tourism. Almost total isolation has suddenly given way to an influx of tourists, summer residents, cars and highway commerce that rivals any crossroad of America's busiest highways. No wonder there are problems.

Tourism on these islands is basically the selling or renting of scenery. Most people seek the beauty, wildness and privacy of the beach; so many people in fact that all three are being rapidly destroyed. Controls are needed, or else the scenery we sell or rent will be ruined by the very business of selling and renting. Urbanization enters when man becomes the dominant element of the scenery, and beauty, wildness and privacy leave. If scenery is what we have for sale we should jealously guard it, not sell it out cheaply and quickly. If kept beautiful, it is one of the few things, in fact, that can be sold year after year and still be there to leave as a natural heritage for our children. It is their birth right.

A natural, open sweep of beach is not only the healthiest in terms of renourishing itself with sand, but it is the most beautiful. As the most beautiful it is also the most valuable. Its value can be reaped year after year <u>if</u> we learn to use the natural system and live in harmony with it. We must also realize that the beach itself does not exist alone, it is but one small part of a larger interdependent arrangement of shifting real estate that starts with the wave capped sand bars offshore, is only briefly a beach, then becomes a sloping berm, then a rolling field of dunes, then a forest, perhaps, and finally a sweep of golden marsh facing and interfingering with a broad and quiet lagoon. The silence of the lagoon contrasts with the wildness of the sea beach. Nature has built a complex wall of sand between them, a barrier to the ocean's energy; hence the name, barrier island. There is no point in this system to cut it, to segment it or to barricade it; nor is there any need to if we can only design our structure to conform with nature gracefully rather than constantly confront nature head on. We need a change of attitude first and a change of technology next. We have the natural resources to change our technology; do we have the human resources to change our attitudes?

I've arranged by presentation around some sketches which hopefully express my ideas in a simpler fashion than would a wordy harangue. A picture may be worth a thousand words. There are already millions of words that have been and will be written on this subject. We should stop the words and start the action. The Coastal Area Management Act is only a beginning. There is no ending, only constant vigilance based on good laws derived from common consent. We must provide and enact those controls on barrier islands; and the best people to do it are the people who live there. These people will ensure that the best is done if they have had a hand in fashioning what is best.

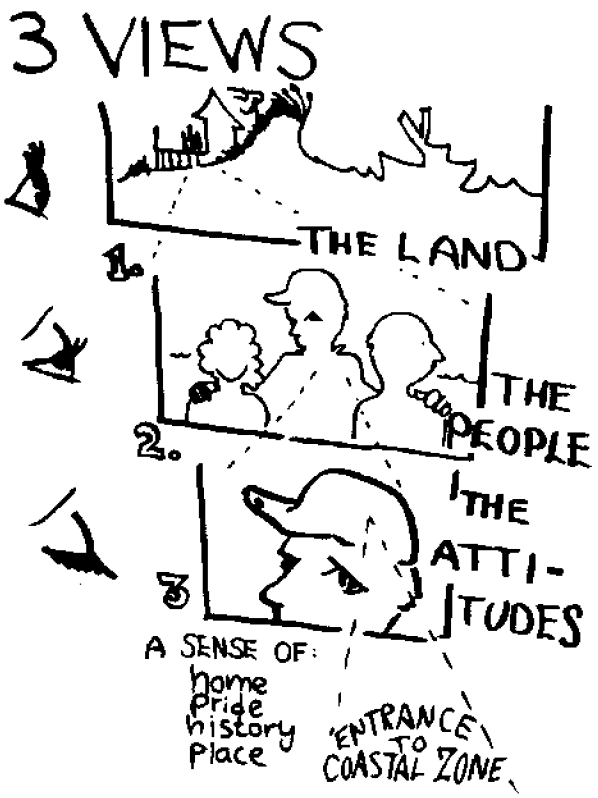


Figure 1

There are three ways to "see" the Outer Banks. (Figure 1) Seen most is the land, the external scenery, the vistas that lend themselves to snapshots, the views on postcards. Beyond that outer view, and seen less, is another "vista", that of the people, the resident population. Lucky is the tourist who takes the time and has the opportunity to meet the people who are so much a part of the beauty of the scenery. Even so, the outsider often only gets to know the native on a cordial basis. There is a third, more personal, level that is seldom revealed easily, and when it is, too many close their eyes to it. It is the attitudes within the people. It is how these people feel about themselves and their land. These resident attitudes are the crux of the matter, especially when we consider introducing and implementing a coastal zone bill as a framework of controls, a blueprint for the preservation of the value of the land and of a way of life. The real entrance to the Outer Banks in this context is not over the bridge or via the ferry; it is via the acceptance, the participation and the active support of the local resident. His sense of pride in the land will help protect the beauty of that land and the saleability of its scenery; but he will need help. The pressures from both outside and inside are too complex and too strong to resolve themselves without the aid of some decent plan derived from some common goals.

Consider these pressures upon the coastal resident. (Figure 2) In my over-simplified cartoon, I have made them all appear to emanate from the "Mainland"; in reality many are "home grown". Fishing and agriculture no longer support a large fraction of the resident population. Scenery is the natural product now merchandized. How it can be kept natural and kept valuable is my theme, and why I chose the message on the billboard as the title of this talk.

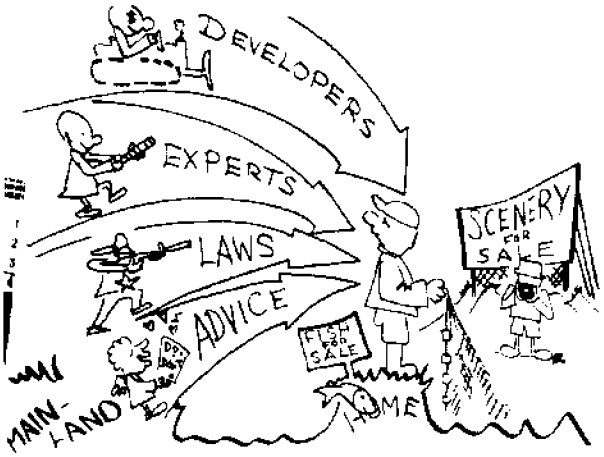


Figure 2

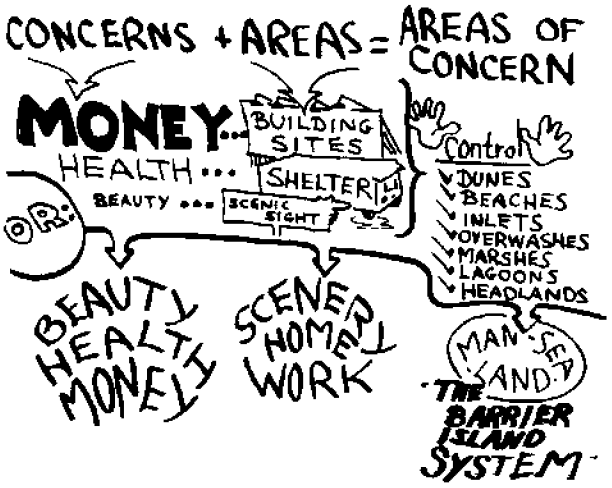


Figure 3

If to be scientific I need to present an equation, then let it be this: In considering "Areas of Environmental Concern" we must consider the sum of both the area and the nature of the concern, and we must consider what it appears to be now and what it could or should be in the future. (Figure 3) Right now, and nationwide, we seem to be concerned with money first and health and beauty only if we can accommodate them at little or no extra cost. There's no need to debate this point, the conflict between the "energy" crisis and the "environmental" crisis is documentation enough. On uncontrolled barrier islands the areas that appear to represent man's main concerns right now are: first, commercial building sites and highways; next homes; and finally, scenic spots - be they parks or public beaches. I grant that this order of priorities is influenced by the percentage of land already set aside as parks.

In our consideration of these areas of human concern relative to their location within various natural settings, we too often try to segment the natural setting into a variety of categories such as beaches, dunes, marshes, etc., and set up concerns and controls specific to each. My point, as a scientist, is the same as

my point as a humanist, and that is that in a barrier island system these natural categories are as much vital parts of a greater and more meaningful whole as are the various concerns of man part of a greater quest for a better, more rewarding life. The sense of this I guess depends upon what each of us considers to constitute a reward. Beauty, health and money are all part of a rewarding life, and considered as such all help to reinforce the other. A good life and a good job in a pretty setting isn't too much to ask for, but often it's awfully hard to find. When we see it eroding, either by actual erosion of the beach or by degradation of the scenery, we should all be concerned for each other. Man, land and the sea must be in harmony on a barrier island. If not, something will lose and it won't be the sea. At present we see the relationship between man and the land degrading with each new badly designed development. On a recent trip to Bogue Bank I noticed that the last remaining unbroken stretch of beautiful dunes on the west end of the island had succumbed to the developer's bulldozer and was laced with dune-severing roads. The scenery there will now be one of houses not dunes.

What can we do? The road out of this fix will not be as easy as the route that so rapidly led us here.

Let us look briefly at what a barrier island appears to be doing in its natural state. There are bookshelves on this topic, and I can only take from the top of this heap of knowledge and controversy.

Sea "level" is nowhere, and at no time, level. Our attempts to measure its movements are often frustrated because nothing will stand still. (Figure 4) There is no simple datum, no yardstick, against which to watch the sea rise or fall. On the east coast of the U. S. the sea is rising because of the melting of the remnants of the last big Ice Age glaciers in Greenland and Antarctica. But how fast it is rising depends upon who you talk to and how he got his data. Radioactive dating of buried peat and logs suggest a long steady rise of about one inch per century, yet tide gauge records from a variety of nearby stations suggest a rate more like one foot per century. Both seem to be right; perhaps we are on a cycle within a cycle. Either way, this means that the sea is rising against the land and that the land, especially if it is shifting sand, must respond to and accommodate this rise. On a barrier island coastline, a rise of sea level means that the sand bank that was once built in response to a lower sea level must now shift to accommodate a newer, higher level. That shift is backward if the supply of sand is not enough to constantly rebuild or "out build" the barrier against the force of the rising sea.

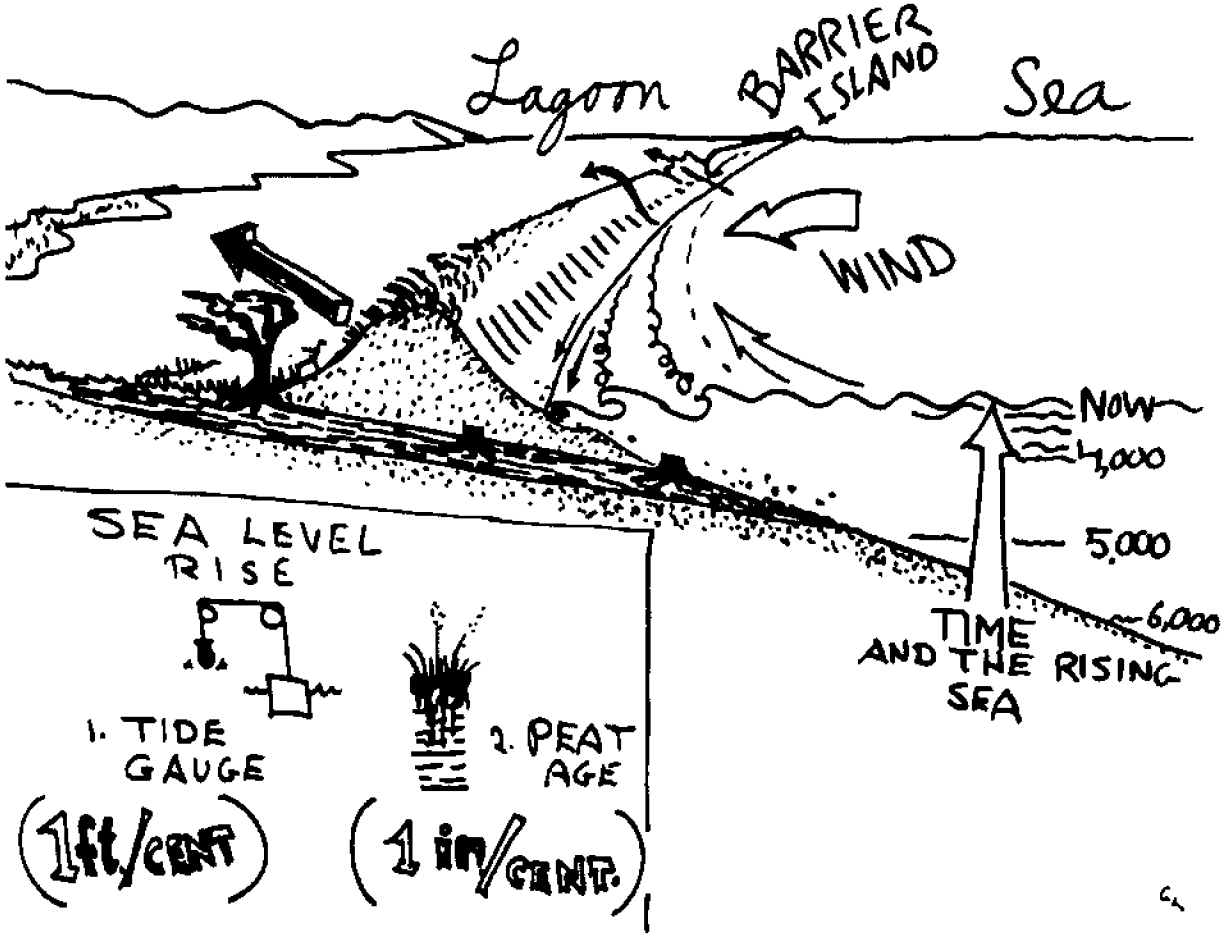


Figure 4

Old stumps along the ocean beach means that the island has retreated over its own lagoonal marsh, and the buried back-island forest is now being exhumed by the sea on the ocean side. To stop this process of retreat we would have to stop the rising of the sea!

Another factor that causes or hastens erosion is a sudden cut-off of the natural flow of sand along the beach. This "river of sand", driven by the waves, is naturally slowed by headlands, washovers and inlets but is never dammed by nature - only man. Left alone, inlets will shift, sand will bypass headlands, and washover deposits as well as sand stored in dunes will be recycled into the system.

The directional network of forces then is "up" for sea level, "along" for the longshore drift of sand and water, and "across" for the windblown drift of dune sand

and the sudden rush of overwash. Any effect on any of these processes, or any change in the bulk of sand in the system will often drastically change the product, which is the barrier island itself.

Figure 5 depicts a healthy barrier island as it was when it was "born" thousands of years ago. Sand is supplied from eroding headlands or from the inner continental shelf offshore. Waves striking the land at an angle drive the water and the sand along the beach: south in the winter and north in the summer. Inlets form to accommodate the flow of tides into and out of the protected body of water created behind the island chain. Weak places break through by overwash during storms and marsh grass then anchors this sandy apron in the lagoon. Onshore winds build up the dunes which store the excess sand. Dune grass helps keep the storehouse stocked. Storm waves chew into the seaward base of these dunes and replenish the system when more sand is needed. Within the shelter of the dunes, live oaks and other trees and bushes grow, often knarled and trimmed by the salt sea spray into otherworldly shapes, and thus the maritime forest with its magic stillness is created in a setting where all else is violence and change.

Into this delicate equilibrium between gigantic and/or relentless forces comes man, first as a red man to hunt and to hide, then as a fisherman so that he and his ship can be nearer the sea. These early alliances of man and island were harmonious. The Indian didn't build, and the fisherman, being sea-wary by nature, built behind the dune ridge in the lee.

The next step came barely fifty years ago only one percent of five thousand years of human habitation of the barrier islands - yet it has had the most devastating impact. Roads were built to and along the barrier island chain. The stable road bed was alien to the shifting surface of the sandy barrier island. The roads needed to be protected. Steps needed to be taken. It is at this point that man's unfortunate attempt at dominance of the barrier island system began. Our sins are only 50 years old. Can we repair the damage in another 50? More crucial to consider is whether we can within the next 50 years disembark from our present course of action. This course is rapidly and completely assimilating the barrier islands into a scenery of sameness that is convenient for commerce and known as "highway culture." It has laced the states and girdled the world with the same signs, the same designs, the same scenery. It is spiritless.

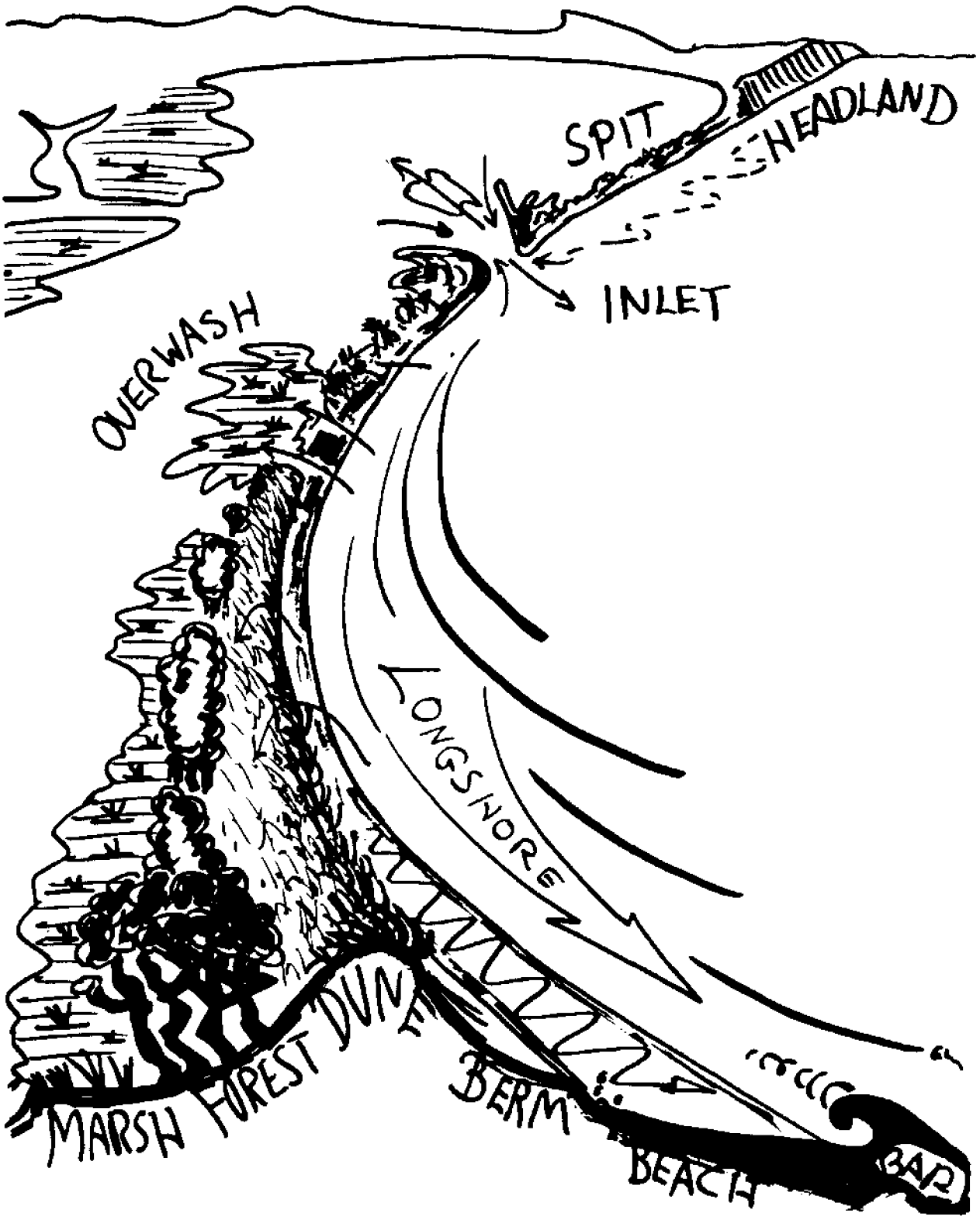

SPIT
HEADLAND
INLET
OVERWASH
LONGSHORE
MARSH
FOREST
DUNE
BERM
BEACH
BAR

Figure 5

This unfunny cartoon depicts the "end of the road" for a barrier island. (Figure 6) The highway culture has overgrown the entire island, as it will do if left unchecked. Of all aspects of coastal zone management, none is more significant nor more sensitive than the control of highways -- their network, rate of development and size.

Follow the road along our own east coast and the trend becomes obvious. Shackleford Banks would become like Bogue Bank if a road is cut. Bogue Bank becomes like New Jersey's barrier islands if the road is enlarged, and then total urban engulfment follows as, for instance, Miami Beach. The last stop may be economic decline such as that suffered by Atlantic City. Superimpose upon this swelling habitation the hazard of hurricanes, and life as well as property becomes endangered on an overloaded barrier island.

The trend to over-development is a fact, not a gloomy threat of ardent conservationists. Follow the brief history of island road building. The dunes on Ocracoke were "remodelled" to protect the road. Now we see how this single man-made dune ridge weakened the island and is about to be destroyed. Once the road is in, the houses, the motels and the stores spread out along it, then seaward to the beach; then lagoonward to the marsh. With the road at their front and the beach at their back there is no room for flexibility; and on a shifting barrier island, this means trouble. Beach erosion now becomes a crucial problem when measured by the nearness of a nervous dweller's structure. The beach must be made to move back again, not the cornered dweller. Thus, beach erosion becomes the misguided cry of coastal interests. It should have been overall barrier island husbandry in the first place. Why can't we give our dwelling lands and scenic lands the same attention we give our fields?

At any rate, erosion is not only noticed relative to coastal construction, it is often a result of it. To halt erosion sea walls are built which reflect wave energy and concentrate it on a shortened beach. This rapidly destroys the beach. Furthermore a sea wall locks the door to the storm's storehouse of dune sand held behind, but storms easily pick this lock and leave a shattered wall. When inlets need to be stabilized to permit shipping access to coastal ports; jetties are built and channels are dredged, both of which interupt the flow of longshore sand. Hopper dradges take the sand from the channel and dump it offshore, out of the system. This "starves" the downdrift span of beach. The sand that does move is not replaced by

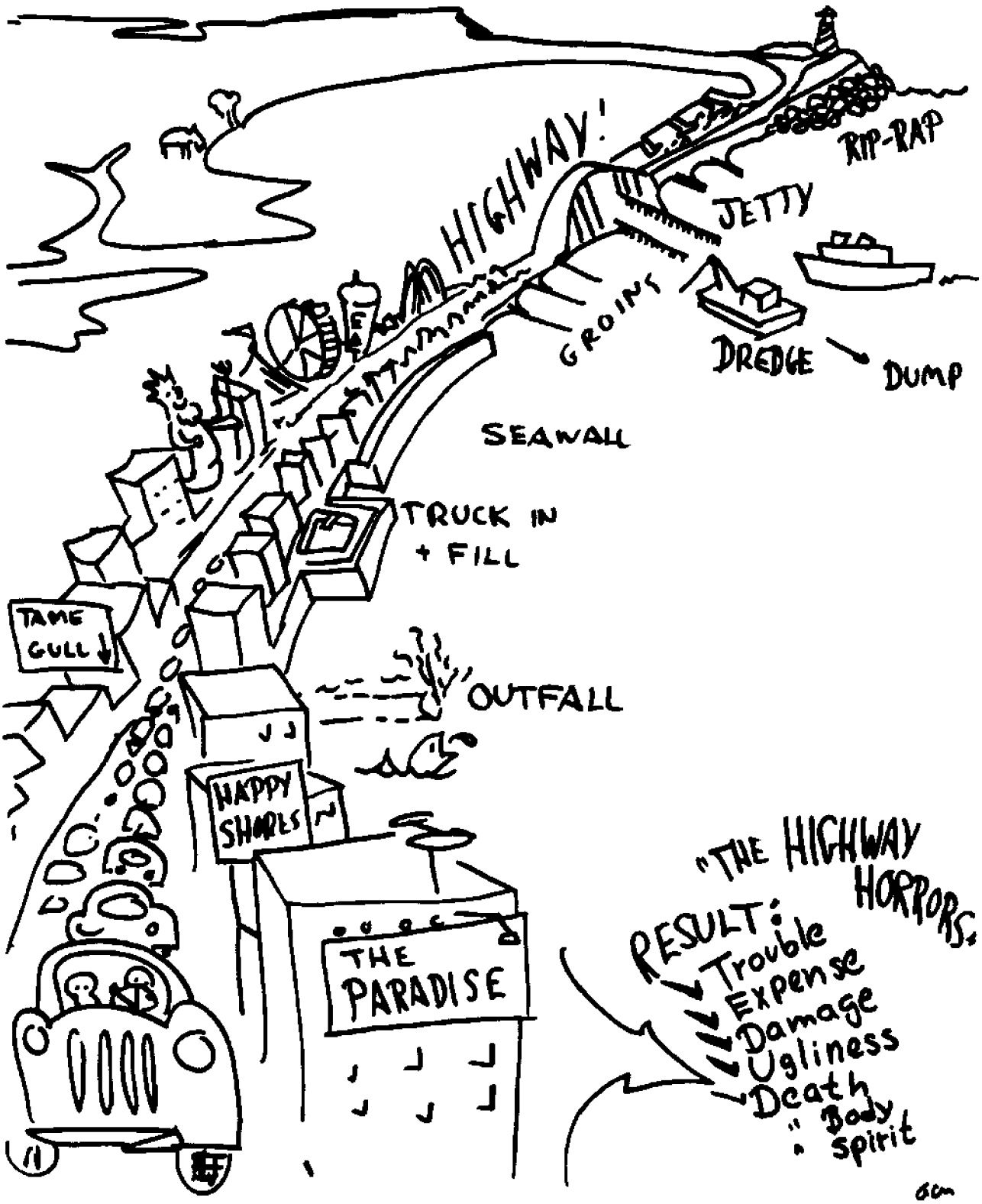

HIGHWAY!
RIP-RAP
JETTY
GROINS
DREDGE
DUMP
SEAWALL
TRUCK IN
+ FILL
TAME
GULL
OUTFALL
HAPPY
SHARKS
THE
PARADISE
"THE HIGHWAY
HORRORS"
RESULT:
Trouble
Expense
Damage
Ugliness
Death
" Body
" spirit

Figure 6

more from up the beach. Groins are then built to arrest the flow of sand altogether. The "river of sand" then moves offshore and runs in front of the groins and the sand left between the groins is plucked out by the diverted flow. Groins almost always guarantee erosion. With the beach gone to seawalls and the dunes gone to building sites, there is no place to swim or sun, so swimming pools are built and also sundecks with rows of "tanning racks" on which the tourists like codfish can be set out in the sun.

Furthermore, the density of population causes problems in both obtaining fresh water and disposing of waste water. Thus, not only is the scenery spoiled, but the environment is poisoned. Where is beauty, wildness and privacy now?

This is not an absurd prognosticiation; it is the story of places like Miami Beach. Under its concrete lies the remains of a barrier island. It is also the "natural" end of a trend which starts with a highway built along the length of a barrier island and left to develop without controls. It is what I have called, "the highway horrors", and they await any barrier island open to the flow of concrete and the shove of bulldozers.

Is there an alternative? We are here to discuss one, the Coastal Area Management Act. But that at best will only be a statement of intent if it is without the proper controls set upon the most sensitive and significant elements. The factor most alien to the natural barrier island, as I see it, is the highway. This does not mean we must go back to boats and beachwalking to save the islands. Those less hurried days are over, but it does mean that we should reexamine the whole transportation system on barrier islands.

The islands form in response to forces largely perpendicular to them. These are the cross-island forces of overwash, dune migration, and beach/berm buildup. These, in turn, are supplied by sand from the long-island forces such as littoral drift, both on the beach face and near to shore. The formation and migration of inlets is also important, and both cross and long-island forces are at work there. It is adding to the complexity of the system to build a road along the island so that it is always athwart the general direction of the forces that tend to destroy it. No wonder road maintenance and protection require such drastic changes to the system. It would be better to build the roads parallel to the dominant onshore/ offshore force directions. This means tying the islands to the mainland with

causeways across the lagoon rather than stringing the road out along the high energy fringe of the outer islands like a washline in a high wind.

The result of the reorientation of the roads is to redirect and redistribute the clustering of population. (Figure 7) The largest cities should be encouraged to grow on the landward side of the lagoon where the coastal plain can better bear their environmental demands; the smaller communities built to serve the direct needs of the barrier island should grow with care at the point where the causeway meets the islands. Dwelling should cluster there and thin out quickly along the island in either direction. As soon as possible open island should remain, not only for the scenic value, but to ensure the supply of sand and the natural maintenance of the rest of the system. Inlets should not be built up. They should be left alone to migrate unless they are needed for shipping. Then they should be stabilized, but the sand built up on the updrift side should be bypassed to the downdrift side and re-enter the system. Ferries could take people to parks and to the wilder parts of the islands. Certain islands, like Shackleford and Core Banks, should be left entirely undeveloped for scenery and recreation, for storage of sand and for posterity.

Where then is the area of environmental concern here? Each part is linked to the other and dependent upon the system working as a whole. The area of environmental concern is, and must be, the <u>whole</u> barrier island system from the offshore banks to the marsh fringed lagoon. This system can be developed and protected. The beauty of its scenery is a result of a healthy system working naturally, storing sand in dunes, moving it along beaches and in and out of inlets. We can live and build with this system rather than against it. Beauty, safety, privacy, and wildness could be regained. It is possible. We are less than 50 years (one generation) into the wrong direction of development; we can back up and turn around in order to insure a future of several 50's of years of both beauty and business for our children and our children's children.


CITY
CLUSTER
BYPASS
PARK
FARM
WHICH IS THE AREA OF ENVIRONMENTAL CONCERN?
ans: ALL OF IT
"THANKS"

Figure 7

Postscript

This is not a scientific paper; there are no specific references to all the work of others from which this is derived, nor is there any presentation of data of my own or anyone else. It is a statement of opinion and outlook based upon my own feelings as an island native, based on my experience as a professional oceanographer and geologist, based on my understanding of how many of my island friends think and feel about their situation and also based upon my admiration and conern for my new home and new state. I am neither a conservationist nor a developer; I believe we can develop conservatively. These views are not necessarily those of the Sea Grant organization, nor any other organization. They are my own. I hope they are shared.

UTILIZATION OF SOILS INFORMATION IN COASTAL AREA MANAGEMENT

Stephen W. Broome
Department of Soil Science
North Carolina State University, Raleigh

The coastal zone is the broad interface between land and sea in which land use affects the ecology of the ocean and vice versa (Ketchum, 1972). It's an area of great biological activity and significance, and is one of the nation's most valuable resources. The seaward and landward boundaries are necessarily vague and for management purposes they must eventually be politically determined. In North Carolina, 20 counties were designated by the governor as the coastal management area. The seaward limit extends offshore to the limit of State jurisdiction (but not less than 3 miles).

The most important feature of the coastal zone is its estuaries. Estuaries are productive ecosystems in which the mixing of fresh and salt water occurs, creating a nutrient trap where nutrients cycle between organisms, water and sediments (Odum, 1961). The primary producers in this nutrient rich system are the phytoplankton, benthic plants, mud algae and salt marsh grass. These production units form the base of a food web which supports a variety of organisms including those with subtle biological roles and those of economic importance. It has been estimated that about 90% of North Carolina's commercial finfish and shellfish harvest is estuarine dependent at some stage in their life cycle (National Estuary Study, 1970). Birds and mammals also utilize the abundant food of the estuarine area. The most important wildlife to sportsmen are the waterfowl. Birds of aesthetic and ecological importance (terns, gulls, etc.) are

present in great variety and numbers.

The biological importance of the estuaries is well documented and the economic importance of commercial fishery products and the income generated by sport fishing and hunting is obvious. This natural productivity is dependent on maintaining a viable system through proper management. Other recreational uses such as boating, swimming and camping are dependent on preservation of the estuaries. Unwise development can destroy the unspoiled areas which are the primary attraction for tourists and residents.

Of course, man utilizes the coastal zone in ways other than fisheries and recreation. Ketchum (1972) lists other categories of use as living space, industrial and commercial activities, industrial and domestic waste disposal, natural preserves, and military installations. Transportation should be added because of the importance of shipping, as should agriculture which is particularly important in North Carolina's coastal zone. It is because of this multiplicity of uses that conflicts arise making planning and management necessary for proper allocation of resources, and to avoid destroying the values which make the area attractive in the first place. The need for comprehensive planning is more critical in the coastal zone than in most inland areas because of several unique characteristics (McBroom, 1969). First, a large portion of the coastal zone is held in public trust by the State for use by all citizens. The submerged land, water, wildlife, and fishery resources are publicly owned and are natural attractions which add to the value of the adjacent privately-owned land. A second characteristic is the extent to which activity in one area of the coastal zone affects uses at great distance. For example, filling a marsh may reduce fish populations many miles away, perhaps even in other states. Land uses which produce pollutants often cause destruction of publicly owned resources of the estuaries. A third unique characteristic of the coastal zone is that lines between private and public property are difficult to determine (where land and water meet). Basically the conflict in the coastal zone is between the right of ownership and development of private property, which may affect adjacent public waters, and the right of preservation of public trust resources. It is necessary to resolve these conflicts through proper planning and implementation of the plans through legislation and enforcement.

In order to make intelligent management decisions, technical information is

needed on which to base those decisions. Existing pertinent information must be compiled and utilized and research should be initiated to provide new information. A critical need for land use planning in the coastal zone is an environmental inventory which includes the resources which make up the physical, biological and cultural environment (Ketchum, 1972). To properly manage and allocate resources it is necessary to have a thorough understanding of their location quantity and quality.

Soil Maps and Interpretations

Soil maps and soil scientists with knowledge of soil mapping and interpretations can be of assistance to coastal planners. The soil resource must be considered in any land-use plan since it determines agricultural and biological production, and its engineering properties determine the potential for urban and industrial development at a particular location. Soil maps are useful in establishing criteria for developing coastal zoning categories which delineate ecologically sensitive areas (e.g. areas of environmental concern) and those areas suitable for development in a manner compatible with natural systems.

The soil is one of the basic resources of the coastal management area. Soil properties greatly influence the way that land is used by man. There are probably no soils in the coastal area which could not be modified to accommodate any selected use, but in many cases the costs (environmental, social, or monetary) would be excessive. Since misuse can lead to severe environmental problems, the cost of excessive modification is often borne not only by the developer, but also by the public. Therefore, it is desirable to recognize the limitations of certain soils and to evaluate their potential or suitability to accept technology. It is important for planners to know what the limitations of soils are for uses such as agriculture, woodland, septic tanks, land fills, animal waste disposal, urban development, industrial development, recreation, and highways.

Agricultural use of soils in the coastal planning area is an example of a use which has limitations, but great potential. Two important limitations are acidity and low fertility levels, but this can be corrected by liming and fertilization. Many of the soils are also too wet to grow crops, but are productive when drained. An example of such a soil is the Portsmouth series. Without modifications it is acid, infertile and too wet to produce corn, but when limed, fertilized, and drained 200 bushels of corn per acre can be produced.

On-site disposal of septic tank effluent is an example of an urban use of soils which creates problems in the coastal area. Utilizing existing septic tank technology many wet and/or impermeable soils in the area have severe limitations. In some dry sandy soils, such as dune sand, the soil is too permeable and pollution of ground water and adjacent estuarine water is a problem. With current technology it is difficult to overcome these limitations in a way that is not damaging to the environment. When planners know these problems exist, requirements for development such as minimum lot size or a municipal sewerage system may be imposed. Proper technical innovations can often make development environmentally acceptable.

These are two examples of the kinds of limitations that exist for soils in the coastal area. Comprehensive regional planning should utilize soils information to decide how land can best be used and managed. This requires a soil survey of the area which maps the various soil types, identifies their physical and chemical properties and interprets the properties in terms of land-use planning.

Status of Soils Information in the North Carolina Coastal Management Area

Soil surveys are provided by the Soil Conservation Service in cooperation with the North Carolina Agricultural Experiment Station. The Agricultural Extension Service is responsible for providing educational programs on the need and use of the soil survey.

In North Carolina there are four levels of soils information which are available to coastal area planners. The least detailed map is the general soils map of North Carolina. It is useful only for defining the general soil areas of the coastal zone and putting these areas in perspective with the rest of the state.

A second level of soils information is general soil maps of individual counties which depict soil associations. A Soil Association is a landscape that has a distinctive proportional pattern of soils and is named for the major soil or soils which occur in the mapping unit. These maps are useful as general guides in regional planning. County general soil maps or soil association maps were used extensively by the Florida Coastal Coordinating Council for preparing a coastal zoning plan. Soil associations were rated according to their

suitability for residential, industrial and transportation, recreational, and agricultural uses by evaluating the combined suitability of all the soil series found in an association. A zoning map was then prepared with soil associations evaluated as very good or good rated as suitable for intensive development (green map color); those associations evaluated as fair were designated suitable for intensive development with corrections (yellow color); and those rated poor or very poor were designated as unsuitable for development (red color). Other features such as wetlands and the hurricane flood line were then added to the map.

General soil maps are available for all 20 counties in the North Carolina coastal management area. However, these maps were made at different times by different people and, consequently, are on different scales and the mapping units are not correlated. This makes them difficult to use as a unit. To make them more usable for coastal planners, the Soil Conservation Service and the extension land-use specialists of the Soil Science Department at North Carolina State are updating the general soil maps of the 20-county coastal area at a scale of 1:126,720 (1 inch = 2 miles). Interpretations of the mapping units will also be published.

More detailed soils information in the form of county soil maps is the third level of information. These maps are usually at a scale of 1:15,840 (4 inches = 1 mile) and are adequate for planning areas down to about 2.5 acres. In making these maps, Soil Scientists examine soil profiles and the landscape and plot the boundaries of soil series or soil phases on aerial photographs. The soil series are classified and named according to a uniform nationwide system. Soil series are divided into phases on the basis of such differences as surface texture, slope, stoniness, etc. The maps are published in a soil survey report which explains the mapping units and interprets the information for specific uses. Charts are presented listing the degree of limitations for specific uses of each mapping unit. The degree of limitation is expressed as slight, moderate, severe, or very severe. Using the soil maps and interpretations, interpretive maps showing the limitation of soils for specific uses can be prepared. Ratings are shown visibly by coloring maps or overlays. For example green might indicate slight limitations; yellow, moderate limitations; and red, severe limitations. The completed map makes the patterns of soil limitations readily apparent.

Soil surveys are valuable aids in comprehensive planning programs. However, there is only one published modern soil survey in the 20-county coastal area (Pasquotank, 1957). There is a published special report of the Outer Banks of Currituck County. Mapping has been completed in New Hanover but it has not been published. A special advanced report has been assembled by the SCS. Surveys are in progress in Craven, Carteret and part of Pender counties. Old soil surveys (circa 1917-1938) are available for all the coastal area counties except Dare and Hyde. Although soil series criteria have changed since that time, these maps would probably be of some use in planning. There is a need to accelerate soil surveys in the coastal counties. This can be done with the cooperation of county governments. When county funds are made available to hire additional soil scientists (such as in Craven and Carteret), soil surveys can be greatly accelerated.

A fourth level of soil survey information is that provided by onsite inspection and interpretation for specific uses. This should be done for tracts of land less than 2.5 acres even when a soil survey report is available.

Summary

Soil maps and interpretations provide valuable information which can help solve the interdisciplinary problems of coastal zone management. Soil mapping in the North Carolina coastal management area is rather incomplete, but there is information available that would be helpful if adequately compiled, organized and interpreted.

REFERENCES

Ketchum, B. H. (ed.) 1972. The Waters edge: critical problems of the coastal zone. The MIT Press, Cambridge, Massachusetts.

McBroom, J. T. 1969. Multiple use of the coastal zone. pp. 8-10. In Jackson T. (ed.) Estuarine Resources. N. C. Wildlife Resources Commission, Raleigh, N. C.

National Estuary Study. 1970. U.S. Dept. of the Interior Fish and Wildlife Service, Washington, D.C. Volume 3, pp. 113-126.

Odum, E. P. 1961. The role of tidal marshes in estuarine production. The Conservationist 15 (6):12-15.

DREDGING AND BIRDS IN THE NORTH CAROLINA ESTUARY

James F. Parnell
Department of Biology
University of North Carolina at Wilmington

Robert F. Soots
Department of Biology
Campbell College, Buies Creek

Dredging on a massive scale began in North Carolina estuaries in the early 1900's with the beginning of construction of the Intracoastal Waterway. This waterway was completed in the late 1930's, and since that time regular maintenance dredging has continued. As boat traffic has increased there has also been demand for better channels in and around inlets, and dredging has become a regular activity wherever such channels tend to fill.

Dredging involves the removal of materials from the bottom of waterways and its subsequent deposition elsewhere, usually adjacent to the channel being constructed or maintained. Such deposits of dredged material may be in water, on

marsh, or on high land. When in water or on marsh, new islands have often resulted. If deposits were on existing land the elevation has been raised.

As the Intracoastal Waterway was dug through the estuary, especially in southeastern North Carolina, a series of islands was constructed usually to the seaward side of the waterway. As boat channels have been maintained around inlets and through the open sounds, series of small isolated islands, generally not associated with the mainland, have been established. These islands may have been dumped on repeatedly over the years, with the timing depending on how often the channels filled. If a channel filled every three or four years, nearby islands were dumped on regularly. If silting back into the channels did not occur, islands may be 30 to 40 years old having been constructed and never touched again.

Dredging in North Carolina is by a variety of methods. Hopper dredges, side caster dredges, or pipeline dredges may be used. Most dredging is by pipeline dredges. That is hydraulic dredges pump the dredged material by pipelines from the channel to adjacent sites. The material sorts itself out as it flows down the slope thus creating islands resembling wide inverted cones with sandy domes and slopes running to the water. The substrate varies, but generally in eastern North Carolina it is primarily sand, although some silt is often present. In river channels or along the Intracoastal Waterway from the Cape Fear River south finer materials dominate.

Much spoil is now being placed behind dikes. This helps to prevent the loss of fine materials back into the channels or marshes. It also changes the topography of islands and may adversely affect bird usage.

What has this engineering process to do with birds? The construction of these new sandy islands in the estuaries has paralleled in time the development and increased human use of the ocean beaches--beaches that were the natural nesting habitat of most of North Carolina's gulls, terns, and shorebirds. One hundred years ago there were miles of beaches in North Carolina that saw only an occasional fisherman during the summer. As people "discovered" the beaches, communities such as Nags Head, Atlantic Beach, and Wrightsville Beach have developed along our coast, and now the beaches are thronged with people throughout the summer. Add to this the advent of the beach buggy, and you can readily visualize that there

are now no really remote beaches in North Carolina.

In the face of this human pressure most beach nesting birds have been forced away from their regular nesting sites. In addition to nesting on natural beaches, these birds have always utilized the natural, low, sandy islands that developed around inlets, but such islands have apparently always been limited in number, even as they are today.

A chance fortuitous meshing of events, however, has occurred. Many of the islands created by the dredging process are similar to natural islands or natural beaches. These islands have proved acceptable to the birds, and are now regularly used as nesting sites.

For the past four years we have been studying the pattern of community succession on these dredge islands. Our study was designed to indicate the pattern of plant succession that occurred following the deposition of new dredge spoil and the pattern of use by vertebrates as the plant communities evolved.

Given a new dredge island deposited in an estuary with some tidal range, two things happen that are significant and very characteristic. Two drift lines form, one at the spring tide mark and one above this at the storm tide mark. These ridges will consist primarily of dead plant stems and debris; but mixed in with drift material will be the seeds of pioneer plants. Sea rocket (Cakile harperi), salt grass (Distichlis spicata), three-square (Scirpus americanus), seabeach orach (Atriplex arenaria), the panic grass (Panicum amarulum), beach pea (Strophostyles helvola), and saltmeadow cordgrass (Spartina patens) all are pioneers. Their seeds appear to be water transported, and all become quickly established on the drift ridges.

Soon the swale between the drift ridges begins to fill in, primarily by runners from the plants growing on the drift ridges. In three or four years a rather dense band of vegetation becomes established around the perimeter of the island.

At the same time other kinds of plants are becoming established on the sandy slopes above the drift ridges. Their seeds are apparently primarily wind borne. Horseweed (Erigeron canadensis), seaside spurge (Euphorbia polygonifolia), sand

grass (Triplasis purpurea), camphorweed (Heterotheca subaxallaris), American beach grass (Ammophila breviligulata), and one of the evening primroses (Oenothera humifusa) are important pioneers on the upper slopes.

As time passes permanent grasses, with saltmeadow cordgrass usually dominant, move up slope replacing the herbaceous vegetation.

Shrubs first appear as seedlings scattered through the dense grasses in the swale between the drift ridges. They grow very rapidly and the development of a border of wax myrtle (Myrica cerifera), sea myrtle (Baccharis halimifolia), and marsh elder (Iva frutescens) begins along the drift lines. The shrubs also slowly move upslope, shading out the grasses and eventually producing dense thickets.

Many things can modify the sequence of this successional pattern, but without interference an island will normally become covered by shrub thickets fifteen to thirty years after the initial deposit.

Very closely associated with the succession of plants on dredge islands will be a successional pattern of animals. These islands often are particularly heavily used during the nesting season by birds. The habitat requirements of these birds vary considerably and relate quite well to the pattern of plant succession that we have been discussing.

A new dredge island completely without vegetation may be utilized by colonially nesting Royal Terns (Thalasseus maximus), Sandwich Terns (Thalasseus sandvicensis), Least Terns (Sterna albifrons), and the solitary nesting American Oystercatcher (Haematopus palliatus).

As plants become established Royal and Sandwich Terns generally abandon the island in favor of other bare or nearly bare sites if such are available. Least Terns may linger to be joined by Common Terns (Sterna hirundo), Gull-billed Terns (Gelochelidon nilotica), Black Skimmers (Rynchops nigra), Wilson's Plovers (Charadrius wilsonia), and Willets (Cataptrophorus semipalmatus), all species which prefer light vegetative cover.

As the density of grasses increases the Least and Gull-billed Terns, Black

Skimmers, and Wilson's Plovers leave. Common Terns and Willets may linger until the grasses become relatively dense. With increasing vegetative density islands become suitable for Laughing Gulls (Larus atricilla) which prefer dense stands of grasses and herbaceous plants as nesting cover.

As shrubs begin to emerge above the grasses they are immediately utilized as nesting sites by Red-winged Blackbirds (Agelaius phoeniceus) and colonies of Boat-tailed Grackles (Cassidix mexicanus) and Common Grackles (Quiscalus quiscula). These thickets of marsh elder and wax myrtle may also be used as nesting sites for up to ten species of wading birds (herons, egrets, and ibises). These birds congregate in nesting colonies of from a few dozen to several hundred pairs. Such colonies may persist for many years, as this vegetative stage is long lasting if man does not interfere.

Thus from bare new islands to old forested islands there may be constant use by a variety of birds. No single island is likely to be utilized by all species during its succession, but all successional stages are used. Certain stages may be abundant while others may be scarce or absent.

These islands represent the last opportunity for adequate nesting sites for many coastal birds. The natural beaches are no longer available and natural islands are too few. Without dredge islands they can exist only in much reduced numbers or not at all. At present over 80% of all of gulls and terns nesting in North Carolina nest on man-made dredge islands. Most wading birds also use these sites, as they have been evicted from traditional mainland nesting sites by increased human pressures.

If we wish to maintain our coastal estuaries in relatively natural conditions, we must maintain the bird life. Much of this bird life now depends on dredge islands. A major concern is that all stages of succession are required. This necessitates maintaining bare islands as well as forested ones. Thus we must manage the islands, either by periodic deposition of dredge spoil or by some other means. If the islands are simply left alone we will have plenty of habitat for herons and egrets but no habitat for gulls, terns, and shorebirds.

A basic step is to provide many of these dredge islands the protection of inclusion as areas of environmental concern. I know of no other coastal areas

more important to bird life. Thousands of birds may nest on one small island, and this makes them very much subject to man's interference.

These islands also need the further protection of State ownership or control. At present ownership is varied and not always clear. The U. S. Army Corps of Engineers has an easement to dump spoil but does not have ownership.

Finally, a State agency must assume the responsibility for protection and limited management. At present, dredge spoil deposition occurs all summer with no official regard for the nesting birds. In the past colonies have been destroyed by having dredged material dumped on the nests. The Corps of Engineers has informally worked with us to prevent this, but no official safegards exist, other than the migratory bird law; and I know of no case where this law has been used to prevent the destruction of bird colonies in North Carolina. Guidance is also necessary in the face of changing dredging policy and increased human activity in the estuaries.

These birds exist in North Carolina today largely due to a happy set of concidences. We can not leave their future to chance. We must provide safeguards for their continued existence as important components of the estuarine systems.

SALT MARSHES

Dirk Frankenberg, Director
Marine Sciences Program
University of North Carolina - Chapel Hill

As one of the first steps in administering the North Carolina Coastal Area Management Act, the Secretary of the Department of Natural and Economic Resources has proposed that coastal wetlands be designated as interim areas of environmental concern. The Coastal Area Management Act defines coastal wetlands as "any salt marsh or other marsh subject to regular or occasional flooding by tides, including wind tides (whether or not the tidewaters reach the marshland areas through natural or artificial watercourses), provided this shall not include hurricane or tropical storm tides. Salt marshland or other marsh shall be those areas upon which grow some, but not necessarily all, of the following salt marsh and marsh plant species: Smooth or salt water Cordgrass (Spartina alterniflora), Glasswort (Salicornia spp.), Bulrush (Scirpus spp.), Saw Grass (Cladium jamaicense), Cattail (Typha spp.), Saltmeadow Grass (Spartina patens), and Salt Reed Grass (Spartina cynosuroides)." The objectives of this paper are to describe:

1. the geographic extent of salt marshes in North Carolina,
2. the reasons why these areas are of environmental concern, and
3. the issues that should underlie decisions to develop salt marshes.

1. The geographic extent of salt marshes in North Carolina

Kenneth A. Wilson provided a useful general assessment of North Carolina salt marshes as part of a report entitled "North Carolina Wetlands: Their Distribution and Management." In this report Mr. Wilson separates salt marshes into two categories, those that are regularly flooded by the tides, and those that are only irregularly flooded. The 58,400 acres of regularly flooded salt marshes mostly occur behind barrier beaches and islands from Oregon Inlet to Ocracoke and from

Beaufort to the South Carolina border. The most abundant plants are salt water cordgrass, (Spartina alterniflora) and needlerush (Juncus roemerianus) with glasswort (Salicornia) and salt meadow cordgrass (Spartina patens) occurring in lesser densities. The 100,450 acres of irregularly flooded salt marshes occur predominantly from Roanoke Island to Atlantic, but also in patches all along the coastal zone. The most abundant plants are needlerush, saltmeadow cordgrass, sawgrass (Cladium jamaicense) and salt reed grass (Spartina cynosuroides). The general distribution of these two types of salt marshes in the coastal counties is summarized in Table 1 taken from Wilson, 1962. Zeros usually indicate areas of salt marshes too small for Wilson to include in his report.

2. Salt marshes as areas of environmental concern

There are two major reasons why salt marshes have been designated as interim areas of environmental concern: 1, salt marshes are utilized as nursery areas by many animals that are harvested in important commercial and sports fisheries; and, 2, salt marshes are productive natural areas upon which many animals depend for food.

Many investigators have studied the distribution of animals in and around the salt marshes of the eastern United States. As a result, scientists estimate that about 65% of the total commercial catch in the coastal waters is made up of species that depend on salt marshes and estuaries during some phase of their life cycle (McHugh, J. L., 1966. Management of estuarine fisheries in Symposium on Estuarine Fisheries. Amer. Fish. Soc. Spec. Publ. 3: 133-154). Some of the species that show such dependence are shrimp, oysters, blue crabs, menhaden, shad, mullet, spotted seatrout, weakfish, kingfish, spot and croaker. The type of dependence varies in different species, but includes both physical shelter from predators and access to abundant food supplies. You can quickly learn to appreciate the importance of salt marshes as nursery areas simply by walking across flooded marshes on a warm spring day and watching the abundance of small fish and shrimp that scatter ahead of your footsteps.

The basic productivity of salt marshes is also apparent by simple observation. The areas of tall green grass look like rich meadows, and, upon careful study, turn out to be more productive than practically all meadows, and all but the most productive of cultivated crops. The food produced in these marshes is not eaten by herds of cows, but rather by the marine and estuarine animals that provide the

fisherman's catch. A quantitative comparison of salt marsh production with the production of other natural and cultivated ecological systems is presented in Table 2.

3. Issues and development decisions

The issues upon which development decisions should be based follow from knowledge of the environmental characteristics and extent of salt marshes. First, it should be clear that salt marshes have justifiably been designated as areas of environmental concern. The fisheries and ecological systems that define the coastal region depend upon the physical structure and productivity of the salt marshes. Second, it must also be clear that we need not preserve every blade of grass on every marsh. The benefits of marshes depend upon the aggregate acreage - one should be able to reduce the acreage by a negligible amount and reduce the benefits of that acreage by an equally negligible amount. Thus we must not absolutely preclude all salt marsh development. On the other hand, if we accept a 10% reduction in salt marshes each year, we will have no marshes in only a decade. Thus in considerations of salt marsh development, as in most things, there are no simple solutions, only intelligent choices. Insofar as we can understand the complexities of salt marsh ecology and the social benefits derived from its unimpeded functioning, we can wisely plan development to foster the greatest good for the greatest number. To fail to gain and apply this understanding is to shirk our responsibility to those that follow us. The coast of North Carolina is too magnificent a resource to squander by thoughtless development or to leave totally undeveloped. It will take our best minds and efforts to steer the thoughtful middle course between these extremes.

Table 1. Distribution of Salt Marshes by Counties*

County	Irregularly Flooded (approximate acreage)	Regularly Flooded (approximate acreage)
Beaufort	450	0
Bertie	0	0
Brunswick	0	18,000
Camden	0	0
Carteret	38,600	10,000
Chowan	0	0
Craven	0	0
Currituck	0	0
Dare	15,500	500
Gates	0	0
Hertford	0	0
Hyde	29,900	1,600
New Hanover	0	7,850
Onslow	1,000	11,350
Pamlico	15,000	0
Pasquotank	0	0
Pender	0	9,100
Perquimans	0	0
Tyrell	0	0
Washington	0	0

*From Wilson, K.A., 1962. North Carolina Wetlands: Their Distribution and Management. N.C. Wildlife Resources Commission, Raleigh: 169 pp.

Table 2. Production Rate of Various Ecological Systems*

System	Net Primary Production Rate Pounds per acre per year
Hay - U.S. Average	3,738
Highest (California)	8,366
Wheat - World Average	3,497
Highest (Netherlands)	11,867
Corn - World Average	6,102
Highest (U.S.)	11,442
Rice - World Average	5,686
Highest (Japan)	13,597
North Carolina Salt Marshes	
Salt water Cordgrass (Spartina alterniflora)	
regularly flooded	11,570
irregularly flooded	5,429
Needlerush (Juncus roemarianus)	
regularly flooded	9,834
irregularly flooded	6,034
Saltmeadow Grass (Spartina patens)	
regularly flooded	11,534
irregularly flooded	8,837

*From: Odum, E. P., 1959. Fundamentals of Ecology. Saunders

Keefe, D. W., 1972. Marsh Production: A summary of the literature. Contributions in Marine Science 16:163-179.

THE ESTUARY - AN AREA OF ENVIRONMENTAL CONCERN

Gordon W. Thayer
National Marine Fisheries Service, Beaufort

The State of North Carolina, in its Dredge and Fill Law of 1970 (G. S. 113-229 (n) (2)), defined estuarine waters as "all waters of the bays, sounds, rivers, and tributaries thereto seaward of the dividing line between coastal fishing waters and inland waters, as set forth in an agreement adopted by the Wildlife Resources Commission and the Department of Conservation and Development filed with the Secretary of State, entitled 'Boundary Lines, North Carolina Commercial Fishing-Inland Fishing Waters, revised March 1, 1965'." In other words, estuaries are semi-enclosed coastal water bodies having free connection with the open sea and within which seawater is measurably diluted with fresh water drained from the adjacent land.

According to the National Estuarine Pollution Study, there are 10 distinct estuarine regions of the United States which contain 884 separate estuarine systems encompassing 29.3 million surface acres of water (Chapman 1973). The South Atlantic

Estuarine Region, stretching approximately 800 miles from Cape Hatteras to Fort Lauderdale, contains 83 separate estuarine systems (9% of the total) and 4 million surface acres (14% of the total). Of this, North Carolina has an estuarine area of roughly 2.2 million acres or approximately 55% of that in the South Atlantic Estuarine Region (Shalowitz 1964); and in size it is exceeded only by the systems of Alaska and Louisiana.

Estuaries have developed and evolved over geological time, and the plant and animal communities dependent upon these systems have evolved to high levels of productivity and diversity in response to the relatively large changes in the natural environment. Man is a newcomer, geologically, to estuaries, and since our country was first settled the Nation's estuaries have served him well. Man has placed a multiplicity of demands upon estuarine and coastal environment as producers of food, as avenues of transportation, as receptacles of wastes, as living space, and as sources of recreational or esthetic pleasure.

One of the simplest, yet most elegant statements on the uses of estuaries, including their adjacent marshes, is in the National Estuary Study, which begins "an estuary is wings whispering over marsh-fringed waters; a camouflaged nimrod anticipating duck dinner; muskrats scurrying through reed, sedge, and grass; shorebirds feeding busily on a tidal flat; brant noisily foraging in eelgrass; oystermen silently tonging the bars on a misty morning; a rod fisherman jubilating over a prized striper; sea oats bending in the ocean's breath on a lonely dune headland against fleecy clouds and ocean surf; sailboats winding through gentle swells, stark in the sunset. Yes, it is all of these and many more...And it is beauty and solace; yet a scientist's laboratory.

"...Each aspect of an estuary has value to someone. Some of the values are reflected simply in the richness of Man's life; others are reflected in the market place to assess goods and services." (Davidson 1973).

Because of the multiplicity of demands made by both man and the organisms dependent upon these systems, it is imperative that we evaluate properly the respective roles of the various parts of the system so that we can manage this

environment wisely and derive the maximum user benefits from each of the component parts.

Man uses the biological productivity of estuaries for human and animal food, clothing, fertilizers, chemicals, and for a variety of industrial and construction materials, to name a few. The biological productivity of any system is determined by the availability and transfer of nutrients or energy within the system, availability and uptake of elements, the genetic and species diversity, and the stability of the system. Under stable conditions, large amounts of nutrients and energy are in equilibrium. Increased efficiency of the system results in an increase in the total yield of living organisms. The source of this increase in efficiency is genetic diversity of species which results from the evolutionary process.

The availability and transfer of nutrients and energy may be disturbed by many of man's activities, and this can lead to a simplification of the system by the reduction in the diversity of life in the system and the stability of the system. Thus, the ability of man to use the yield of the system depends upon maintaining the diversity of the system even though all of this production is not of direct value to man (Teal, Jameson and Bader 1972).

Because of crowding and development resulting in the destruction of valuable resources, man has recently realized that the coastal region of the United States has limitations. From 1930-1960, the population in the coastal counties grew 78% while the National population grew 45%; these coastal counties represent only 15% of the land area of the contiguous U. S. By the year 2000, it is estimated that 70% of the Nation's population will reside in this coastal region. Presently, 40% of all industrial plants are located along the coast. As our population increases so will the demands for fish and shellfish and uses of estuaries also will increase.

Why do we cluster in such a small geographic area? The reasons are many. The high biological productivity leads to a large concentration of organisms, including people; transportation centers; good fishing; the presence of the sea provides a large water resource for removal of wastes; a favorable climate; and for just plain esthetic reasons.

All of these provide revenue for the coastal counties and the Nation. In 1969 the reported landings of commercial fishery species was 4.3 billion pounds with a dockside value of $519 million (Table 1). Approximately 70% of these values were from estuarine-dependent species. In 1973 the dockside value rose to approximately $900 million. Of this, eight of the ten most valuable species were directly dependent on estuaries and represented $660 million in dockside revenue (Tihansky and Meade 1974). According to university economists, through processing a raw product, value can be expanded six or seven times in determining total economic realization (Brown 1974). This would increase the 1973 dockside value to an economic realization of $5 to $6 billion and the revenue from estuarine-dependent species to $4-5 billion.

In the state of North Carolina the 1973 commercial fishery harvest brought a dockside value to fishermen of about $16 million. Since less than one-half of the dockside landings were processed in the State, the economic value was about $50 million while the potential was over $100 million.

Recreational activities in and around estuarine areas also provide a significant revenue to coastal regions. For example, in 1968 an estimated 112 million people spent approximately $14 billion seeking recreation in the coastal strand. In 1975 it has been projected that approximately $5.4 billion will be spent on sport fishing alone. About 16 million people will engage in sport fishing in 1975 and this number is growing at a rate of one-half million per year (Teal, Jameson and Bader 1972).

To bring this home, James Brown, Chief of the Estuarine Studies Section of the North Carolina Department of Natural and Economic Resources, has estimated that there are approximately 500,000 North Carolina residents, spending an average of $150 per person annually, fishing in coastal waters of the State. This provides an economic revenue of around $75 million annually. In addition, out-of-state fishermen increase this revenue to about $100 million.

Seasonal visitors to the estuarine zone also include waterfowl hunters and vacationers; those who come for boating, canoeing, water skiing, and swimming. Many business enterprises, large and small, cater to all of these recreational

seekers, such as hotels, beach cottages, restaurants, sporting goods shops, marinas, bait and tackle dealers, and others. And, many seasonal visitors, entranced with the beauty and loneliness of the estuarine area, buy property there and build upon it.

What makes these estuaries so important? The most important biological characteristic of estuaries, which forms a basis for much of our economy, is the high productivity. In the most general sense the estuary can be compared to other typical ecosystems of the world (Table 2). It is obvious that estuarine areas may be one to two orders of magnitude more productive than most other systems, and are rivaled in plant production only by highly mechanized agriculture and tropical and subtropical rainforests.

This high plant production, upon which animals in the estuary are dependent, results from a number of factors. First, there are at least three types of food producers present: marsh grass or cordgrass; phytoplankton or microscopic plants suspended in the water; algae near or attached to the bottom sediments; and in many areas, submerged grasses or seagrasses. For example, in the estuarine system extending from Atlantic to Swansboro, North Carolina, it has been estimated that approximately 60% of the total production by plants is contributed by eelgrass, and phytoplankton and cordgrass supply 30% and 10%, respectively (Williams 1973; Thayer, Wolfe and Williams 1975).

Second, the mixing of ocean and freshwater results in estuaries being "nutrient traps," i.e. nutrients, upon which the plants are partially dependent, are not flushed out to sea but rather move up and down and cycle between organisms, water and bottom sediments. Third, the sloshing back and forth of estuarine waters results in a continual supply of food, nutrients and oxygen. Fourth, there is a year-around production of crops (Odum 1961).

The high plant production has resulted in a very diverse estuarine animal assemblage. The plants and animals die and during their decomposition nutrient elements and dead tissue fragments are liberated into the water. Tidal action and currents spread the nutrients which in turn are utilized by the plants.

Other organisms feed upon the plants and dead debris and in turn are consumed by still larger species (Figure 1). This is a self-sustaining process but one which is very susceptible to intervention by man.

The great majority of fishes and waterfowl that depend upon the estuarine area for their existence are migratory. Many adult fish spawn offshore; the eggs and larvae drift inshore and the young migrate into estuaries which provide protection and an abundance of rich food. Therefore, the environmental conditions in the estuarine nursery grounds will influence their survival, and these conditions fluctuate greatly. Events which affect survival of estuarine-dependent organisms in one region will have an influence which reaches far beyond that particular estuary and into the future.

One example of a physical measurement that fluctuates greatly under natural conditions in estuaries is salinity, and the distribution of many organisms is influenced by the salinity patterns of the estuary. For example, some aquatic organisms are tolerant to large salinity ranges from almost fresh water to oceanic water. Others, however, can live and reproduce within only a narrow salinity range, while still others require different salinity concentrations during difficult stages of their development. Therefore, any modification of freshwater inflow volume, quality or discharge cycles and circulation patterns will be reflected directly in the functioning of the estuary and this in turn will control its plant and animal populations in the systems.

Thus, our estuaries and their associated transition zones-salt marshes, sounds, intertidal areas, etc. form a valuable natural resource. These estuaries, which play an important life-support function have lost more than 7% of their fish and wildlife habitat to commercial and housing development over the past few decades (Tihansky and Meade 1974), and are being lost for fishery production at a rate of about 1% per year. Because these estuaries are located between the oceans and the land and because a high percentage of our population lives near the coast, a majority of the estuarine destruction is a direct result of man's activities. Pollution, land-fill and dredging, building, draining of marshes, and increasing use of fresh water have all taken their toll of estuarine areas.

Figure 1. A diagram of the value of the salt marsh estuarine system. This complex provides nursery ground, the source of shellfish, and protection from flood and storm damage. One of the most productive systems known, it is the vital refuge for life on our highly developed coastlines.

To document some of this loss, during 1950-1969, 640 thousand acres of estuarine area were destroyed through dredging and filling, 77 thousand acres of which was in the Middle Atlantic Estuarine Region (Table 3). In 1964, 27 thousand acres of North Carolina estuaries were closed to shellfishing whereas in 1974 this loss had jumped to nearly 700 thousand acres (Brown 1974). This 1974 closing represents a shellfishing area loss which approximates 30% of the total estuarine water area in the State. Brown (1974) states "Although not presently substantiated due to the absence of field data, I am personally convinced that three elements of our present society are mainly responsible: (1) improperly functioning septic tanks, (2) lack of a "closed head policy" - in other words, boats flushing their toilets directly into the surrounding waters, and (3) runoff from the many small cattle and swine producing farms adjacent to our estuaries."

The biological degradation of estuaries by man's activities are well documented, whereas economic losses are rarely published. Some of these economic losses are shown in Table 4. National estimates of dockside dollar loss are in the neighborhood of $12 million annually for clams and oysters alone, and $63 million per year including clams, oysters, lobsters, shrimp and crabs (Tihansky and Meade 1974). An average probably is in the neighborhood of $40 million, and this is based on a constant rather than a changing cost. This estimated shellfish loss represents 6% of total dockside revenue from all estuarine-dependent finfish and shellfish. If we consider that processing increases the economic revenue by a factor of 6, this would amount to an annual loss of revenue in the neighborhood of $240 million, and it must be remembered that the Nation is continuing to lose estuarine fishery resource areas at a rate of 1% annually. The total loss to the national economy would be far greater if recreational and esthetic values were added.

The complete and total preservation of our estuaries is obviously not possible. Some will be lost or altered by port facilities, navigation channels, etc., because of the greater national benefits to be derived. However, it seems likely that careful planning of proposed uses of the estuaries and evaluation of the changes that would occur in the national estuarine environment could minimize destruction in the fishery habitat. To obtain this optimal balance between uses we need much more knowledge than we presently have about the ecology of estuaries,

for even now we are unable to make accurate predictions about the effects of changes in an estuary due to our lack of knowledge concerning the significant processes and the complexity of interrelations within an estuary.

There are no alternatives that would give the knowledge that is gained from estuarine research. There are, however, other courses of action that could be pursued in relation to the management of estuaries. (1) Prohibit all uses of remaining estuarine areas. Total conservation of some estuarine areas as wilderness areas is essential to provide ecological baselines, preserve a major type of unmodified habitat for research and education, and to provide continuing opportunities for estuarine wilderness recreation. In view of the overall demand and need for these areas, however, it is unrealistic to consider keeping them all in the status quo. (2) Allow unrestricted use of estuarine areas. This has been proposed seriously by some who feel that the economic benefits that would be derived would more than compensate for any losses. They also believe that some fishery resources would manage to exist. (3) Continue the present policies of estuarine use. Under this we would continue to lose our estuarine areas and eventually would be faced with problems that need immediate answers.

Obviously, none of the above are alternatives. The management of our estuarine areas for the greatest national benefit means that decisions must be made and compromises reached between users of these areas when their aims are not compatible. Before such decisions can be reached, we must understand the dynamic processes and interrelations that occur in estuarine zones, and research is the only way to acquire the necessary knowledge.

Table 1. Importance and dockside values of estuarine-dependent species to the United States commercial fishery in 1969 (values in thousands of pounds and dollars). Taken from Chapman (1973).

Fishery	Volume caught	Value	Estuarine dependent
Menhaden	1,547,700	$ 22,900	yes
Tuna	323,041	54,310	no
Shrimp (Estuarine)	225,800	115,900	yes
Shrimp (Offshore)	91,300	7,000	no
Crabs (Estuarine)	179,000	22,700	yes
Crabs (Offshore)	55,200	16,700	no
Salmon	246,200	54,700	yes
Anchovies	135,300	1,400	no
Flounder	117,500	16,100	yes
Alewives	85,200	1,400	yes
Herring	82,700	1,700	no
Clams	75,500	23,900	yes
Other	1,107,459	179,790	yes and no
Total	4,271,900	$518,500	
Percent estuarine dependent of total	75	71	

Table 2. Estimated annual gross production of the biosphere among major ecosystems. Taken from Odum (1971).

Ecosystem	Area ($10^6 km^2$)	Productivity ($kcal/m^2/yr$)
Marine		
Open Ocean	326.0	1,000
Coastal zones	34.0	2,000
Upwelling zones	0.4	6,000
Estuaries and reefs	2.0	20,000
Subtotal	362.4	
Terrestrial		
Deserts and tundras	40.0	200
Grasslands and pastures	42.0	2,500
Dry forests	9.4	2,500
Boreal coniferous forests	10.0	3,000
Cultivated lands	10.0	3,000
Moist temperature forests	4.9	8,000
Wet subsidized agriculture	4.0	12,000
Wet tropical and subtropical forest	14.7	20,000
Subtotal	135.0	
Total for biosphere	500.0	2,000

Table 3. Estuarine area destroyed by dredging and filling, 1950-1969 (in thousands of acres). Taken from Chapman (1973).

Estuarine Region	Acres Destroyed
North Atlantic	2.5
Middle Atlantic	77.0
Chesapeake Bay	5.0
South Atlantic	42.3
Caribbean	21.1
Gulf of Mexico	426.1
Southeast Pacific	46.2
Northwest Pacific	21.0
Total United States (Excluding Alaska and Pacific Islands)	641.2

Table 4. Estuarine fish losses from water pollution, 1970. Taken from Tihansky and Meade (1974).

Area	Damage (in thousands of dollars)	Species Affected
Boston Harbor, Massachusetts	5,000	Clam
Chesapeake Bay	8,000	Menhaden
	1,860	Other finfish
	1,090	Shellfish
Columbia River mouth	865	Salmon
Galveston Bay	1,930	Finfish*
	15	Oyster
Long Island Sound	1,000	Oyster
	225	Clam
Maine Coast	5,000	Clam
Narragansett Bay	1,000	Oyster
Portsmouth, New Hampshire	2,600	Clam
	125	Oyster
Puget Sound	1,200	Oyster
Raritan Bay, New Jersey	8,500	Shellfish
San Francisco Bay	2,600	Shrimp
	2,250	Oyster
	170	Clam
	6,750	Bass, Shad, Salmon**
Tampa Bay	2,650	Finfish

*Potential loss from oil spills.

**Potential loss from inland drainage.

REFERENCES

Brown, J. T. 1974. North Carolina coastal zone management. Interstate Seafood Seminar, Atlantic Beach, North Carolina.

Chapman, C. R. 1973. The impact on estuaries and marshes of modifying tributary run-off, p. 235-258. In R. H. Chabreck (ed.) Proc. Coastal Marsh and Estuary Management Symp., Louisiana State University, Baton Rouge.

Davidson, G. 1973. Meeting the needs for recreation opportunity in marsh and estuarine areas, p. 295-306. In R. H. Chabreck (ed.) Proc. Coastal Marsh and Estuary Management Symp., Louisiana State University, Baton Rouge.

Odum, E. P. 1961. The role of tidal marshes in estuarine production. The Conservationist (New York State Conservation Dept., Albany), 15:12-15.

Odum, E. P. 1971. Fundamentals of ecology. W. B. Saunders Co., Philadelphia. 574 p.

Shalowitz, A. L. 1964. Shore and sea boundaries. Vol. 2. U. S. Dept. Comm., Coast and Geodetic Survey, Publ. 10-1. Washington, D. C.

Teal, J. M., D. L. Jameson, and R. G. Bader. 1972. Living resources, p. 37-62. In B. H. Ketchum (ed.). The water's edge: Critical problems of the coastal zone. M.I.T. Press, Cambridge.

Thayer, G. W., D. A. Wolfe, and R. B. Williams. In Press. Impact of man's activities on seagrass systems, with special reference to Zostera marina communities. American Scientist.

Tihansky, D. P., and N. F. Meade. 1974. Estimating the economic value of estuaries to U. S. commercial fisheries. Preprint of chapter in the National Estuary Study. 47 p.

Williams, R. B. 1973. Nutrient levels and phytoplankton productivity in the estuary, p. 59-89. In R. H. Chabreck (eds). Proc. Coastal Marsh and Estuary Management Symp., Louisiana State University, Baton Rouge.

ARCHAEOLOGICAL SITES AS INTERIM AREAS OF ENVIRONMENTAL CONCERN

David Sutton Phelps
Department of Sociology and Anthropology
East Carolina University, Greenville

Archaeological and historical sites are, in a very real sense, the most important areas of environmental concern in the naturally complex and relatively fragile coastal zone of North Carolina. These sites are our only record of human adaptation to the coastal environment through most of the past, the understanding of which will permit more logical decision-making for future utilization of this natural area.

The present crisis in the coastal zone dates from the period 1920-30, and is directly related to the development of complex transportation systems, increasing affluence, and an underlying assumption in American culture that our advanced technology can do anything. That assumption is belied by the passage of the Coastal Area Management Act of 1974 by the North Carolina General Assembly, and actions taken by other agencies in the past two years. We have found that nature will not be permanently altered by cultural technology, that affluence leads to over-population and mismanagement, and that we are faced with the destruction of our most important natural resource - the coastal zone. Whether or not man should change the natural environment through his culture is a moot question: the fact remains that man has modified the environment to varying degrees through a long period of time. The question to be answered here is the extent of future modification we can or should allow. One of the most important facets of this question is whether we shall continue the myopic type of planning which benefits only

the present generation, or take advantage of past experience to adequately plan for the future. Past experience shows us that men, both Indian and, more recent American, lived in relative harmony in the coastal area up to approximately A.D. 1930, changing only what was necessary; our problem arises from the events of the past 45 years.

Knowledge of the past, which provides such valuable and frequently ignored "hindsight", comes from the study of prehistoric and historic cultural resources. Prehistory refers, in our case, to the native American Indian cultures which produced no written records, have left few if any survivors, and must be studied primarily through the techniques of archaeology. History refers to past cultures, in this case our own, which left behind at first rudimentary, but later more elaborate written records. The prehistoric and historic remains below ground, above ground, and in documentary form constitute the total "history" of the North Carolina coastal area for the past 10,000 years, or more.

Any place where humans have lived and left physical evidence of their activities in an identifiably limited space is called a "site" for recording and research purposes. The term "historic site" in the Coastal Management Act, the National Register of Historic Places, Chapter 121 of the General Statutes of North Carolina, and with reference to National Historical Landmarks, includes both prehistoric (archaeological) and historic sites. It is the distribution of such sites in space, time and environment which provides the basic framework for understanding the cultures which produced them.

The public is generally familiar with the historic sites in the coastal area which are National Landmarks or State Historic Sites. These include, among others, Fort Raleigh, Wright Brothers Memorial, Moore's Creek Military Park in the former category, and Somerset Place, Brunswick Town, and Fort Macon in the latter; there are approximately 11 such sites and areas in the 20 coastal counties. Not only is this a meager sample of important sites from the historic period, but a complete disregard of the prehistoric cultures which contributed significantly to our own brand of North Carolina coastal culture.

Our earliest knowledge of native American cultures in the coastal area comes from the period between 8000 - 10,000 B.C. The evidence is in the form of

distinctively shaped spear points utilized in the hunting of large animals during the waning phases of the Pleistocene glacial epoch. Surface finds of these points are recorded for sites in Pasquotank, Bertie, Tyrrell, and Onslow counties, among others. The sites were small hunting camps with little left behind upon abandonment, and many of them now lie hidden or obliterated below the coastal waters which have continually risen since the end of the Pleistocene around 8000 B.C.

Climate changes following the Pleistocene resulted in changing fauna and floral populations up to approximately 2000 B.C. when our modern climate cycle began. This 6000-year period is known archaeologically as the Archaic Stage, a time in which the coastal inhabitants came to rely on the Virginia deer and native bear, discovered the benefits of the oyster and other marine and fresh-water shell fish, took up fishing in earnest, and foraged for edible plants, fruits and nuts. Archaic sites are relatively well represented on higher elevations back from the coast and around the estuarine systems. The larger size of the sites attests to population increase and at least semi-sedentariness, with small bands settling in large seasonal camps. It was a time of maximum human utilization of the natural environment for food resources. More efficient hunting tools, the axe, and probably boats, appeared during this time, and man did little to change the natural environment which supported him in abundance. On the Outer Banks, only the last 1000 years of this period is evident, but the scarcity of artifacts from that time argues that the Banks as we know them were just forming at that time.

The period from 2000 B.C. to A.D. 1 is poorly known at present in the coastal area. There is evidence of extreme change in the cultures, with new influences, perhaps new people, from both north and south. The northern culture brought distinctive cord-marked ceramics and probably introduced the bow and arrow; from the south, slightly earlier, a completely different type of ceramic container was introduced along with other traits found as far north as the Tar-Pamlico drainage. It was during this period, also, that smoking pipes became popular, implying the ceremonial use of tobacco. There are intriguing problems from this period which will only be solved by better knowledge of the coastal area.

The most profound changes in the native cultures occurred between A.D. 1 and A.D. 500. It was during this time that domesticated plants appear to have been introduced, gradually converting former hunters and fishers into agriculturalists. The plants were maize (corn), a number of bean varieties, and members of the squash family, all domesticated earlier to the south in Mexico and Central America. Upon introduction to eastern North America, they spread northward to the climatic limits of production over a period of time. From the time of their introduction until the period of European contact, there was a continual improvement through hybridization, and sufficient surplus existed at contact to feed most of the early European colonists from Florida to Massachusetts. We still celebrate this feat at our "strictly American" Thanksgiving holiday.

The period from A.D. 1000 to A.D. 1650 is known best in the North Carolina coastal area, not only because more sites are recorded, but also because excavations have been primarily in sites of this period. Also unique in all of North America are the familiar John White maps and watercolor paintings, done in A.D. 1585-86, which illustrate various aspects of the coastal Indians, their culture and environment. From the paintings, from archaeology, and from the valuable, but brief English descriptions, the Algonkian-speaking tribes from the Pamlico Sound northward emerge as a complex society based on agricultural subsistence supplemented with hunting and fishing, retaining older northern religious patterns but gradually changing to a religion more amenable to agricultural production, not aggressive but willing to fight for tribal territory, and sufficiently friendly to the English intruders to support them in emergencies.

South of the Pamlico our knowledge is less secure, although sites are recorded in the southern counties. Apparently the primary language along the south coast was Siouan, and among other differences, these people erected conical or rounded earthen mounds over their dead. The south coast suffers from the lack of archaeological research and the absence of colonial records concerning the native people.

From A.D. 1650 to 1750, permanent settlement of the coastal area by Europeans resulted in decimation and finally extinction of the native people through disease, starvation and war; our history had a gory beginning but

managed to borrow traditional items such as corn, tobacco, pipes, succotash, turkey, the location of a majority of our towns, and a considerable list of place names.

The foregoing would lead you to believe that sufficient information exists for archaeological sites in the coastal area, but this is not the case. What has been presented is a summary based in large part upon analegous information drawn from surrounding areas in eastern North America, from each of which comes a fragment of pertinent knowledge. The unfortunate truth is that the coastal area of North Carolina is one of the least known areas along the Atlantic seaboard. This is primarily due to previous lack of interest among professional archaeologists on the one hand, and the lack of institutional facilities to accommodate such research until quite recently. Our coastal area may well be one of the most interesting because of the particular prehistoric problems which require solutions here, and you have the unique opportunity to make it the "Showcase" of the Atlantic coast by careful planning and development of the historic resources.

I have previously alluded to the eleven or so recognized and maintained historic sites which span a period of our own culture from A.D. 1584 to A.D. 1903. There are many others which probably warrant research and protection, but they are presently unknown. The situation concerning the prehistoric sites is even worse; none are maintained or reconstructed and the large majority are currently unknown. There are some counties which have less than 5 sites on record, and the highest number for any county is less than 200. Even the highest figure is far from the reality of suspected site distribution, thus our survey data are completely inadequate. Sites that have been adequately excavated in the coastal area number less than 10, and the number of sites tested for potential probably does not exceed 25. It is impossible to accurately declare historic areas of environmental concern without the numbers, types, location, and potential of such areas. Obviously, the first step in planned coastal management is one of information gathering, not only for archaeological-historical purposes, but also for those disciplines concerned with other areas. With a sufficient data base, logical choices of maximum benefit to the coastal area may be made.

For archaeological purposes, a recently completed survey of the Currituck peninsula supported by a grant from the University of North Carolina Marine Science Council will serve as an example. Utilizing aerial photography, topographic and soil maps, and finally a ground inspection of most of the peninsula, approximately 28 prehistoric sites were recorded. Test excavations to determine potential for information were conducted where necessary, and one site sustained major excavations. Most of the sites are located on the eastern shore adjacent to Currituck Sound, while a few were recorded on ridges in the interior and along the southwestern shore. The earliest sites are those in the interior, obviously selected for dryness and proximity to excellent hunting habitats. After 3000 B.C., the majority of the sites were established on the Sound shore, increasing in number through time until they form an almost continuous line along the eastern side of the peninsula. The earlier of these were located to take advantage of the dual terrestial - marine environment, but later equal consideration was given to loamy sand ridges suitable for agriculture. Utilization of seafood resources remained constant over a 5000-year span. From one of these sites we reclaimed the remains of some of the people who may have been visited by John White and Ralph Lane on their expedition up Currituck Sound in A.D. 1586. The settlements of Barco, Waterlilly, Poplar Branch, Powells Point, and others, were established over previous Indian sites, chosen because of already cleared agricultural lands, proximity to water for transport, and elevations relatively high above storm tides; the same choices were made by the original inhabitants. This study is an example of what is needed for each county in the coastal area before we get to the point of assigning permanent areas of concern. Only one or two of these Currituck sites will be submitted for National Registry, permanent protection and possible reconstruction, but many of them require excavation to salvage information prior to destruction by man and natural erosion. It is not the intent to save every recorded archaeological site, but to reclaim all available information from as many as possible. Those few which do have the potential for "landmark" status should be carefully selected after a thorough study of the entire area.

Site loss by natural forces and human agencies is accelerating in the coastal area; the last remaining Indian site in Hatteras Village is staked for cottage lots, one at Wanchese is eroding from the rise in sea level, the Chowanoke

capital on the Chowan has been built upon, and another site has been plowed into oblivion. It is normal for human culture to change the environment, but if we are to save any vestige of our heritage it must be now. The long-term gains in knowledge and economics will far outweigh what may be considered short-term losses.

HISTORIC SITES

Janet K. Seapker
North Carolina Department of Cultural Resources

As authorized by the General Assembly, historic sites are among the categories of fragile properties which the Coastal Resources Commission could designate as interim areas of environmental concern (IAEC's). In defining the categories of historic sites, three already established programs were used: the National Register of Historic Places; National Historic Landmarks; and the state historic site and grant-in-aid programs.

The National Historic Preservation Act of 1966 established the National Register of Historic Places. The National Register is the official list of the nation's irreplaceable cultural resources. It is maintained by the National Park Service, Department of the Interior. Properties having national, state or local significance can be nominated by the state historic preservation officer for listing in the National Register. Each state is responsible for making an inventory of its cultural properties according to the following criteria, designed to guide the states and the secretary of the interior in evaluating nominations to the National Register:

> The quality of significance in American history, architecture, archaeology and culture is present in districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> (A) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (B) that are associated with the lives of persons significant in our past; or
>
> (C) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and

distinguishable entity whose components may lack individual distinction; or

(D) that have yielded, or may be likely to yield, information important in pre-history or history.

The Coastal Area Management Act (CAMA) was written so as to allow not only National Register properties to be designated IAEC's, but also those properties approved by the State Professional Review Committee for future nomination to the Register. This group, composed of the North Carolina Historical Commission, and additional experts in architecture, history and archaeology, must review and approve each historic property before the property can be nominated by the state historic preservation officer, after intensive research by professional staff. Approval by the North Carolina Historical Commission is the first step in nominating a property to the National Register; therefore, all properties approved, but not yet nominated are eligible under the terms of the Coastal Area Management Act for consideration as IAEC's.

National Register historic properties are of several types: districts, buildings, structures, objects and sites. A district is defined as a geographical area, urban or rural, possessing a significant concentration, linkage, or continuity of sites, buildings, structures, or objects which are united by past events or aesthetically by plan or physical development. In coastal North Carolina several towns (Wilmington, New Bern, Edenton, Bath, and Murfreesboro) are National Register historic districts.

A building is defined to be a structure created to shelter any form of human activity, for instance a dwelling, barn, church, hotel, etc. Most of the coastal National Register properties qualify under this category and are represented by the Newbold-White House near Hertford, Christ Episcopal Church in New Bern, the Beaufort County Courthouse in Washington.

A structure is defined as a work made up of interdependent and interrelated parts in a definite pattern of organization; it is constructed by man and is often an engineering project large in scale. The majority of National Register structures in the coastal area are lighthouses, for instance, Baldhead Island Lighthouse, Currituck Lighthouse and Cape Lookout Lighthouse.

An object is described as a material thing of functional, aesthetic, cultural, historical, or scientific value that may be, by nature or design, movable yet related to a specific setting or environment. North Carolina has only one object on the National Register in the coastal area--the Baxter Clock in New Bern.

A site, the last category of National Register listings, is the location of a significant event, activity, building, structure, or archaeological resource where the significance of the location and any archaeological remains outweighs the significance of any existing structures. Two coastal properties have so far been found to meet these criteria: Fort Fisher and Brunswick Town.

All historic properties entered on the National Register of Historic Places and those approved by the State Professional Review Committee for nomination to the Register, under the Coastal Area Management Act, are allowed to be considered as IAEC's.

Also permitted under the CAMA to be considered as interim areas of environmental concern are National Historic Landmarks. These include historic sites and buildings that are found by the secretary of the interior to be nationally significant and are automatically listed on the National Register. National Historic Landmarks are not necessarily owned by the Federal government; in fact, most are owned by the private sector and by the state. Hayes Plantation, Fort Fisher, and the Chowan County Courthouse are examples of National Historic Landmarks in North Carolina's coastal counties.

The third category of historic properties eligible for consideration as interim areas of environmental concern includes properties owned, managed, or assisted by the state of North Carolina under Chapter 121 of the General Statutes. Essentially, Chapter 121 authorizes the Department of Cultural Resources to acquire and operate State Historic Sites for the benefit of the citizens of North Carolina. Properties which qualify for designation as interim areas of environmental concern under this category are represented by Fort Fisher, Somerset Place, Brunswick Town and the historic area in Bath. (All of this type property in the coastal area are also on or approved for nomination to the National Register, but this overlap is not always the case.)

One of the stated goals of the CAMA is "to insure the orderly and balanced use and preservation of our coastal resources on behalf of the people of North Carolina and the nation." There is no question that historic properties are among North Carolina's coastal resources--our irreplaceable resources. We no longer have the materials nor the craftsmanship to duplicate that which produced our historic and cultural resources; indeed, there is no need to produce new ones when the original items are extant. The goal is to protect the historic and cultural properties from "uncontrolled or incompatible development [that] could result in major or irreversible damage to important historic, cultural, scientific or scenic values."

IMPLEMENTATION OF THE COASTAL AREA MANAGEMENT ACT

David J. Brower, Director of Urban Services
Center for Urban and Regional Studies
University of North Carolina - Chapel Hill

The General Assembly enacted the Coastal Area Management Act of 1974 not to stop development in the coastal area but to insure that development that does take place is in harmony with the coastal environment and the ecological processes that govern it. The contents of the Act have been thoroughly discussed elsewhere[1] so there is no need to do that here.

In brief, the Act requires that the local jurisdictions in the coastal areas prepare comprehensive plans for the use of land and water. It creates a Coastal Resources Commission (CRC) which is to, among other things, prepare guidelines for the local planning efforts and designate areas of environmental concern (AEC) within which development is to be regulated. Areas that may be so designated include: coastal wetlands, estuarine lands and waters, renewable resource areas such as watersheds, aquifers and forest lands, natural and historic areas such as state parks and forests, scenic rivers, stream segments classified for scientific or research purposes, wildlife areas, areas to which the public may have special rights under the public trust doctrine, areas prone to hurricanes or flooding and areas subject to development pressure because of public expenditures such as highways, airports and presumably park lands. The plans prepared locally are reviewed by the Coastal Resources Commission and must adequately reflect the CRC planning guidelines and their designation of areas of environmental concern. Once the plans have been approved by the CRC their implementation is left to the local jurisdictions. In areas of environmental concern the Act requires that the local jurisdictions adopt regulations governing land and water use that will achieve the objectives of the Act. If they do not do this, the CRC can do it themselves. The Act does not extend this requirement beyond the areas of environmental concern however.

Peter Glenn has addressed the major constitutional issues that may be raised about the act itself in his excellent article in the December, 1974 issue of the NORTH CAROLINA LAW REVIEW. I would like to address a few of the problems that may arise in efforts to implement the Coastal Area Management Act that have occured to me during a relatively casual reading of the Act. Others are bound to come up when it is closely studied by attorneys for land owners who feel their rights have been impinged.

The three potential problems I will discuss arise out of the relationship between the Coastal Resource Commission's position as an agency of state government presumably reflecting a state perspective and the local jurisdictions who must adopt implementing regulations which, presumably, will reflect a local perspective. The extent to which these two perspectives can be melded into a solid working statement of policy will, in large measure, control the extent to which the Act is successful in achieving its objectives and in withstanding legal assault. The Act was passed by the General Assembly because they recognized the importance of the coastal area and that unless it were treated as a whole it would probably be ruined. Indeed this is the basic argument made by Professor Glenn when he defends the Act against constructed allegation that the Act is an unconstitutional local act. It is valid, he says, because there is a rational relationship between the area designated by the Act and the purposes it serves. But in the political reality of the legislative process the means used to accomplish the purposes of the Act are essentially local...with the untested caveat that the local means are filtered through the CRC. The importance of this filtration is made evident by the following example. The CRC will be designating areas of environmental concern and presumably they will designate all of a class of areas...that is they will designate all estuaries of a certain type because if they don't, they would be subject to an attack that to designate one and not another one just like it would violate the equal protection clause of the federal constitution. But assuming that they escape this pitfall and do designate all similar areas there are still equal protection problems to be faced if similar areas are not regulated in similar ways. Thus if an estuary in County A is designated as an area of environmental concern it will be the responsibility of County A to plan for the preservation of that area and to adopt implementing regulations for the plan. As was noted earlier, it is the responsibility of the CRC to review the plan and implementing ordinances against the Act and their own guidelines but in addition it would appear that they must, in order to escape

equal protection attacks, also compare the regulations of County A with those of County B which contains a similar estuary because if the two counties do not control similar areas in similar ways the result might well be that a given development would be permitted in an estuary designated as an area of environmental concern in County A whereas the same development in a similar estuary also designated as an area of environmental concern would be denied in County B. If this were to occur, the frustrated developer could challenge the Act and the implementing ordinance since it would be virtually impossible to show a rational reason for treating similar areas of environmental concern designated under the same Act to achieve the same legislative objectives in different ways. Thus the review function of the CRC is of critical importance. This does not necessarily mean that the plans be identical or that the implementing devices be the same; their effects must be similar however. Different jurisdictions may use different means to accomplish the desired ends but those ends must be sufficiently similar to avoid equal protection challenges.

Another problem which has been much discussed is the "taking issue" which is short hand for asking the question: to what extent can the public regulate the use of land before a court will hold that the land, or at least some part of it, has been taken by the public from the private owner and consequently the private owner must be compensated for the value of the land taken. The Act has incorporated a test to be used to determine when this line has been crossed. The Act says that the line has been crossed when the land owner has been deprived of the "practical uses thereof." This less than illuminating phrase has been interpreted in a very helpful way by Professor Glenn who says that this phrase refers back to or codifies the current stance of the North Carolina Supreme Court on the taking issue which, according to Glenn, is one of "balancing" the public good achieved against the diminution in value sustained by the land owner. Thus if the regulation can be shown to accomplish something of real value for the public it can go further in restricting private usage than if something of relatively minor value is to be accomplished. Hence it is of utmost importance that the implementation devices chosen by the local jurisdictions be designed very carefully to achieve precise provable objectives. The traditional methods of land use control, zoning and subdivision control, will probably not be adequate. Objectives will have to be clearly stated relying heavily on conclusions gleaned from the literature of marine scientists and then causal relationships shown between the objectives and the ordinance used. Thus one example, grossly abbreviated,

might be: the overall objective is to preserve an estuary designated as a AEC. The literature shows that one thing that needs to be done is control the flow of untreated sewage into the estuary. A proven means of doing this is to require that all new developments hook up to a public sewerage system. One specific means to accomplish this is an adequate public facilities ordinance which precludes development until adequate facilities are available. A process like this, based on scientific data, with skillfully drawn implementing ordinances carefully linking scientific knowledge with public policy would result in a sound management program.

But this sort of analysis leads to a third issue which will be more difficult to resolve. It deals with the overall adequacy of the Act to deal with objectives it has set out. This question becomes: can the procedures set out by the Act sufficiently control an area of environmental concern to withstand a substantial challenge.

Even the most casual review of the literature will show that the sort of phenomena listed in the Act as examples of areas of environmental concern are terribly complex things and that to adequately protect them requires a very careful balance of a huge number of factors. Some leading scientists have concluded that the only way to do this is to "go back to nature" or to require that the various elements of the environment be kept or restored to their natural state. In most areas this is probably impossible, practically, politically and probably legally. This means that some sort of compromise is necessary. But if the compromise is too far from achieving the objective of preserving the AEC, then it is also not going to achieve much in terms of safe guarding the health and safety of the public and could well come out on the losing end of a balancing test referred to earlier. This concern applies not only substantively but geographically as well. The survival of many areas that might well be designated as AEC's will depend on what takes place over a very wide geographical area...probably including several local jurisdictions. For example, the vitality of an estuary depends on the salinity of the water which in turn depends in part on the quantity and quality of the fresh water flowing into the estuary. But the quantity and quality of fresh water flowing into the estuary depends on the activity that takes place in areas many, even hundreds, of miles from the estuary itself. Thus some means is going to have to be found to insure that the devices adopted to implement the Act are adequate to achieve the substantive as well as geographic objectives of the Act.

If this is not accomplished, a person denied a permit might successfully argue that he was denied equal protection because his land was singled out for no rational reason, and secondly that because the regulations were not going to achieve the objectives of the Act that no public purpose was being served and therefore even the slightest regulation was a taking.

Thus it seems that it is incumbent upon the CRC to use their most imaginative and creative skills to deal with the problems they are confronting; that the marine scientists must martial their knowledge to facilitate the formulation of sound public policy and that the lawyers and planners must be open to new ideas so that the public policy that is adopted is adequate to meet the needs of the coast and to withstand constitutional challenge.

REFERENCES

1. Articles by Thomas J. Schoenbaum and Milton S. Heath, Jr. in the December, 1974 issue of the North Carolina Law Review.

UNIVERSITY OF NORTH CAROLINA, SEA GRANT ADVISORY SERVICES

PROGRAM FOR THE FORUM

COASTAL DEVELOPMENT AND AREAS OF ENVIRONMENTAL CONCERN

Mendenhall Student Center
East Carolina University, March 5, 1975

9:00 AM — WELCOMING REMARKS

Dr. Simon Baker, Sea Grant Advisory Services
Dr. John M. Howell, Provost, East Carolina University

9:15 AM — DESIGNATION OF AREAS OF CRITICAL STATE CONCERN IN OREGON

Mr. Glen J. Akins, Chief Planner, Oregon Coastal Conservation and Development Commission

10:00 AM — THE LAND AND ITS EDGE, Chairman, Dr. Jay Langfelder, Director, Center for Marine and Coastal Studies, North Carolina State University

Extent and Distribution of Areas of Environmental Concern in North Carolina, Dr. Arthur Cooper, Assistant Secretary for Resource Management, North Carolina Department of Natural and Economic Resources

Coastal Sand Dunes, Dr. Ernest Seneca, Departments of Botany and Soil Science, North Carolina State University

Scenery for Sale, Dr. Conrad Neumann, Curriculum of Marine Sciences, University of North Carolina at Chapel Hill

Utilization of Soils Information in Coastal Area Management, Dr. Stephen Broome, Department of Soil Science, North Carolina State University

11:30 AM — Speakers Respond to Questions from the Audience

12:00-1:15 PM — LUNCHEON BREAK

1:15 PM — THE WETLANDS AND WATERS, Chairman, Dr. B. J. Copeland, Director, UNC Sea Grant Program, North Carolina State University

Dredging and Birds in the North Carolina Estuary, Dr. James Parnell, Department of Biology, University of North Carolina at Wilmington

Salt Marshes, Dr. Dirk Frankenberg, Director, Marine Sciences Program, University of North Carolina at Chapel Hill

The Estuary - An Area of Environmental Concern, Dr. Gordon Thayer, National Marine Fisheries Service, Beaufort, North Carolina

2:15 PM — Speakers Respond to Questions from the Audience

2:45 PM — THE HUMAN COMPONENT, Chairman, Mr. David Stick, Vice-Chairman, Coastal Resources Commission of North Carolina

Archaeological Sites as Interim Areas of Environmental Concern, Dr. David Sutton Phelps, Department of Sociology and Anthropology, East Carolina University

Historic Sites, Ms. Janet Seapker, North Carolina Department of Cultural Resources, Division of Archives and History

Implementation of the Coastal Area Management Act, Mr. David Brower, Center for Urban and Regional Studies, University of North Carolina at Chapel Hill

3:45 PM — Speakers Respond to Questions from the audience

4:15 PM — Adjournment

ILLUSTRATIONS

Page	Source
Front Cover	Clay Nolen
VI	Simon Baker
1	Oregon Coastal Conservation and Development Commission
16	National Aeronautics and Space Administration
23	Les Thornbury
28	Jim Page
30-40	A. Conrad Neumann
42	Soil Conservation Service
48	James F. Parnell
54	Division of Travel and Promotion, N. C. Department of Natural and Economic Resources
59	Clay Nolen
65	South Carolina Wildlife Magazine
73	N. C. State Department of Archives and History
80	N. C. State Department of Archives and History
84	Jim Page
Back cover	Jerry L. Machemehl

RECEIVED
NOV 5 1975
SEA GRANT
DEPOSITORY

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