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of the**

**SOUTH CAROLINA SEA GRANT CONSORTIUM'S
SEVENTH ANNUAL WINTER CONFERENCE**

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FOREWORD

They're called swamps, bogs, bottomlands and marshes. Throughout history man has treasured freshwater wetlands for their bountiful game while simultaneously altering them to plant crops, harvest timber or build buildings.

South Carolina is rich in freshwater wetlands — ranging from flooded sloughs on Hunting Island to the floodplains of the Edisto River; from Carolina bays near Myrtle Beach to isolated depressions in Marlboro County.

Wetlands in South Carolina vary widely, yet they constitute a vast, interconnected network of water exchange across the state. We're just beginning to understand all that they do. They can absorb flood waters, filter out pollutants and maintain groundwater levels. They can harbor unusual plants and valuable hardwoods and provide highly productive wildlife habitat.

As the population of South Carolina expands, industry, government and residents are moving into freshwater wetlands — some by accident and others intent on taking advantage of their natural functions.

The purpose of this conference, "Wealth or Wastelands? South Carolina's Freshwater Wetlands," was to present the facts about wetlands and to offer a forum for discussion of the conflicting perspectives surrounding them. Recorded herein, national and state scientists characterize wetlands, while policymakers debate management strategies. Through this forum, the South Carolina Sea Grant Consortium hopes to expand public awareness of these valuable natural resources, enabling the state to better articulate future wetlands policy.

ACKNOWLEDGEMENTS

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WEALTH OR WASTELANDS? SOUTH CAROLINA'S FRESHWATER WETLANDS

OPENING REMARKS Dr. James Timmerman

Good morning. Welcome to the South Carolina Sea Grant Consortium's conference entitled, "Wealth or Wastelands? South Carolina's Freshwater Wetlands." As many of you know, the wetlands of our nation are in danger, and have been in danger for many years. Draining, filling, timbering and other alterations of these resources have resulted in a loss of more than one-half of our nation's wetlands. And despite several recent decades of efforts to protect wetlands, these resources are presently being destroyed at the rate of more than 300,000 acres per year. The loss of wetlands in the early days was not surprising. Wetlands were viewed generally as sources of disease and pests. In fact, the government used to give away wetlands to anyone who would drain them or take them off their hands.

We now understand more about these areas. We know wetlands as places of recreation, of exposure to the wonders of the world. We need wetlands for their many public benefits. Wetlands buffer the effects of floods and storms. They reduce erosion and filter sediments. They filter our water and can recharge underground water supplies. And by now, most people know that the biological productivity of wetlands can exceed that of agricultural lands. At the South Carolina Wildlife and Marine Resources Department, we are keenly aware that a broad array of wildlife and fisheries are dependent upon wetlands, providing critical habitat for some species.

Now, here in South Carolina we have been fortunate. Because of our rate of and type of development, in most cases we have found it easier to develop around wetlands than to alter them. Yet, those areas where wetlands are found are valuable for other purposes as well. On the coast we have been addressing the issues of accommodating development while preserving the saltwater marsh-

es. However, inland freshwater wetlands present another problem. We estimate that nearly 25 percent of South Carolina is wet at some point or another during the year. The government regulatory process in inland freshwater wetland areas is not always clear. For instance, not all agencies use the same types of criteria to identify whether wetlands are present or not.

It is not surprising that wetland landowners become frustrated with these situations. It is important that all of us — landowners, developers, conservationists, scientists, and government regulators — work together to strive for a clear sense of public policy. We need to increase the protection of our remaining wetlands; at the same time, we need to reduce the frustrations and misunderstandings that exist with regulatory processes. Therefore, the Consortium's conference this year is dedicated to a better understanding of the issues that affect South Carolina freshwater wetlands. We hope that we will stimulate a broader discussion of the future directions of state policies, particularly as they relate to our freshwater wetlands.

Ms. Margaret Davidson

Thank you. I'd like to briefly introduce to you each of the speakers this morning. The person that we've asked to talk to us about the status of our nation's freshwater wetlands is Scott Feierabend, who is the director of the Fisheries and Wildlife Division of the National Wildlife Federation located in Washington, D.C. Scott's been working with a whole range of concerns about wetlands, including migratory birds, endangered species and federal wildlife legislation. He also authored a book, *The Status of Our Nation's Wetlands*, which was published by the Federation last year.

STATUS OF OUR NATION'S WETLANDS

Mr. Scott Feierabend

Margaret asked that I speak today on the status of our nation's freshwater wetlands. When thinking about how to best approach my topic, I decided to structure my remarks around three general themes: first, how wetlands are defined; second, the functions and values that wetlands provide; and third, the status and trends of our wetlands. Let me open with a discussion of defining wetlands.

Before we can discuss the legal, political, scientific, and policy questions underlying the freshwater wetlands debate we need a fundamental understanding of, and if possible, a consensus on what constitutes a wetland. Governor Campbell has already initiated the discussion of the definition of "wetland." On November 15, 1988 during the press conference to release the National Wetlands Policy Forum report, Governor Campbell stated, "We have known from the beginning that our no-net-loss goal is attainable only with the formulation of a true definition for wetlands. We must begin to identify true wetlands and implement a coordinated regulatory framework."

Not only is the Governor's statement meritorious, but it also is one with which anyone interested in wetlands should have no room for disagreement. The problem framed by his remark, however, is that what I perceive to be a "true wetland" may differ considerably from what he perceives to be a "true wetland." **In other words, how we define wetlands is not as simple as it might appear. Moreover, if we can agree even on a single definition, how we interpret that definition and put it into practice may also differ.**

Thus, there are two basic elements at issue here: first, defining wetlands, and second, delineating the boundaries of wetlands consistently with how these areas are defined.

First, what is a wetland? In 1869 John Muir observed, "When we try to pick out something by itself, we find it hitched to everything else in the universe." This is certainly the case for wetland ecosystems, which are inextricably linked to everything else in the biotic and the abiotic world. If you've ever walked across a wet meadow in springtime and found yourself ankle deep in water and

mud, you certainly know firsthand what a wetland is like. If you've hiked a dry and dusty springtime pond or a parched prairie pothole during late summer, you have seen another form that wetlands can take. While we generally think of wetlands as the wet places of our world — the swamps, the bogs, the marshes — wetlands also can be dry during much of the year. Each wetland type is a unique amalgam of soil, hydrology, vegetation, and other characteristics.

To describe what a wetland is, however, we first have to understand why a wetland is. Water binds all the components needed to produce wetlands. It's the lifeblood of wetlands, and it's the dominant influence on soil structure and the kinds of plants and animals characterizing a wetland. One attribute shared by all wetlands is periodic or constant inundation or soil saturation. Stability is not common, nor is it desirable, in wetland systems. Unlike upland habitats, wetlands are dynamic, transitional, and characterized by constant, natural perturbations. The most visible and significant of these perturbations is periodic inundation and drying. Changing water depths, be they daily, seasonal, or annual, have an overbearing influence on plant species compositions, structure, and distribution. Additional influences, such as complex zones of water regimes, salt and temperature gradients, and tide and wave actions, produce wetland vegetation that is generally stratified, much like that of forests. These factors combine to yield a diversity and wealth of niches that make wetlands such important habitats.

With this brief and admittedly general introduction, one might conclude that defining wetlands is a simple and relatively straightforward exercise. Unfortunately, defining wetlands has not proven to be simple or straightforward. For example, during its deliberations, the National Wetlands Policy Forum found there were more than 50 different definitions of wetlands in use in the United States.

One of the major reasons for such broad variations in the definitions of wetlands is that these systems are by their very nature transitional features of the landscape whose composition, functions, and boundaries are in a state of constant flux. But there are other reasons why many definitions of wetlands exist. One reason is that

people in various regions of the country have different needs for wetland functions and thus have different perceptions of wetland value. As a result, definitions may vary by locale based on local concerns, scientific studies, and other factors. A second reason for the variance is that the tools available to define wetlands locally, such as plant and animal lists and soil maps, are not uniform across the nation. Moreover, these tools used to define wetlands may also be limited by the varied perceptions that soil scientists, attorneys, hydrologists, politicians, and even wildlife biologists hold of wetlands.

Finally, the development of a definition for wetlands may necessarily reflect the needs of its definers. For example, agencies whose primary mission is resource conservation may be predisposed to define wetlands as comprehensively as possible in order to maximize their protection. By contrast, agencies motivated by development and expeditious permit review may be inclined to adopt much narrower, less protective definitions.

However, it may come as a surprise to many of you that the two federal agencies charged with regulating activities in wetlands, the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency, use a common definition for wetlands. Specifically, they define wetlands to be those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. But this definition does not address the issue of wetlands delineation or what constitutes a "true" wetland.

Even with a single definition of wetlands under which to operate, problems remain if we cannot agree how to describe the boundary of a wetland, locate its edges, and determine its size. Therefore, employing different delineation methodologies to interpret a single definition fosters confusion, inconsistency, frustration, and confrontation between bureaucracies at the federal level. Specifically, the EPA and the Corps have never been able to agree to a common delineation methodology. The result has been, predictably, that everyone with an interest in wetlands, be it for development or for protec-

tion, is dissatisfied. There is a silver lining to this cloud, at least at the federal level. Because of the controversy and the problems that the differing delineation methodologies used by the EPA and the Corps have created, the two agencies are presently attempting to converge on a single methodology. If correctly done, the convergence of methodologies should enhance federal wetland protection programs and, most importantly, should also serve as a lesson to other bodies formulating and implementing programs to protect wetlands.

The second major theme that I'd like to cover this morning is the value and functions of wetlands. Before beginning, however, it is important to distinguish between wetland value and wetland function. **Wetland value is not synonymous with wetland function.** Wetland function is what a wetland does, regardless of interpretation of its worth. For example, a wetland may function by storing 50,000 acre-feet of flood water, producing 100 mallards per acre, or retaining 20 tons per acre per year of sediment. Wetland value, on the other hand, is an interpretation of the relative worth of a wetland function and can be positive or negative. For example, the flood storage capacity of a wetland upstream from a town has a high positive value to the residents of that town. Yet the same wetland downstream might have a low positive value to the residents of the same town because it provides no flood protection.

Wetlands account for only 5% of the land surface area in the 48 contiguous states, but they are among the most productive habitats on earth. Only now are we beginning to understand that wetlands provide numerous benefits — both ecological and economic — to society. Some of the functions most commonly associated with wetlands include the following: flood conveyance and flood storage, sediment control, wildlife habitat, recreation and aesthetics, food and fiber production, water quality, water supply, and education and research.

Let me expand on a few of these areas briefly to demonstrate the numerous and important ways in which we benefit from wetlands.

The economic value of wetlands is enormous. In the

Emergency Wetland Resource Protection Act of 1986, Congress found that wetlands contribute to a commercial marine harvest valued at over \$10 billion. They support a fur and hide harvest worth \$300-400 million annually and are the basis for over \$10 billion in annual expenditures on nature study, fishing, hunting, and other outdoor recreation. The U.S. Fish and Wildlife Service estimates that in 1980, almost two million waterfowl hunters spent in excess of \$3 million. While the economic benefits of wetlands from fisheries, pelts, and waterfowl are substantial, they pale in comparison to the economic benefits from wetland ecosystem functions such as groundwater recharge, flood flow modification, nutrient and waste retention, and storm surge modification.

The second value we gain from wetlands is groundwater recharge and discharge. In some instances, wetlands play an important part in replenishing or recharging groundwater supplies. Surface water bodies connected to groundwater systems can recharge these systems as their waters migrate and percolate into the surrounding aquifer. These wetland recharge sites may serve an important role in maintaining groundwater quality levels at the local and the regional level. With supplies of clean water becoming an increasingly precious commodity in the nation, we cannot afford to overlook the important role wetlands play in the cycle of water. Although research is needed to understand the dynamics of water movement into, through, and out of wetlands more fully, we do know that wetlands and groundwater are inextricably linked.

The third value we gain from wetlands is flood flow alteration. Many wetlands can slow and retain large amounts of water. In some instances wetlands also can absorb flood waters and then release these waters slowly. This ability gives some wetlands extraordinary value as temporary water storage areas and makes them important in altering flood flows. At times of peak runoff, rivers and streams often overflow their banks into adjacent flood plains. Wetlands and flood plains can retain this overflow and reduce its rate of flow. Peak flows of flood water are reduced and flooding made less damaging. Isolated freshwater wetlands in other nonpartisan wetlands also hold rain and runoff and contribute to flood control. Wetlands

are especially valuable as flood moderators because the water they retain almost never reaches water courses when they are at flood stage.

The fourth value is water quality. While we are only beginning to understand and appreciate the value wetlands provide for the maintenance of water quality, it is clear that nutrient and waste retention and transformation are important functions many wetlands serve. Research now has documented that many naturally occurring wetlands can remove and retain nutrients and sediments. While a number of wetlands can treat waste and contaminants effectively, others may have only a limited ability to do so. Additionally, while some wetlands can serve as nutrient sinks for years, their capacity to assimilate nutrients can be overloaded and overwhelmed eventually by excessive nutrient enrichment. All wetlands are different with different capacities, and all can be overloaded. The idea that wetlands may benefit society most when used as dumping grounds for raw sewage and contaminated waters is an error and should be resisted. Research now underway will help determine which wetlands are best suited for nutrient and waste retention and the implications of using various kinds of wetlands for water quality enhancement.

The fifth value is habitat. Despite the small land mass wetlands represent, they harbor an unusually large percentage of our nation's wildlife. One authority estimates that approximately 900 species of wildlife in the United States require wetland habitats at some stage in their life cycle, with an even greater number using wetlands periodically. Another source has concluded that representatives from almost all avian groups use wetlands to some extent, and about one-third of our North American bird species rely directly on wetlands for some resource.

A large number of federally listed threatened and endangered species also rely on wetlands for their survival. In 1986, 209 animals and 109 plants were listed as threatened and endangered here in the U.S., and 45% of these animals and 26% of the plants listed depend directly or indirectly on wetlands to complete their life cycles successfully. In addition, of more than 2,500 plants in need of federal protection, approximately 700 are wetland-dependent or wetland-related.

Research has demonstrated that wetlands less than one acre in size support an abundance of life forms. Thus, the loss of wetlands, both large and small, impacts a broad array of plants and animals.

Finally, the worth of a specific wetland can vary depending on whether it is judged by society as a whole or by an individual. To the developer of a potential industrial complex, say, on San Francisco Bay, the value of the marsh as habitat for fish and wildlife cannot compare with the economic value of the site for development. Nor is the mere size of a wetland a reliable measure of its value. The relationship of one wetland to others must be considered, as well as how they interact, and how the wetland contributes to the functioning of the watershed and ecoregion of which it is a part. **Because many wetlands are interconnected, impacts on a single wetland may not be isolated.** Modifying or destroying an isolated wetland may modify the flow of water in an area to the point that this change may affect wetlands perhaps miles away in the same watershed.

The assessment of values of wetlands is a complex undertaking, and no system presently in use provides a full range of information about wetland values, and most are of little use in measuring the relative values of one wetland compared to another.

In conclusion, wetlands are an important part of our nation's heritage. Like soil, air, and water, they are to be treasured. Wetlands benefit all citizens of the United States, and so we must find an alternative to the continuing sacrifice of these critical resources.

The final topic I will very briefly touch on this morning is the status and trends of our nation's wetlands. Simply said, and as was heard a moment ago, losses of wetlands in this nation have been dramatic, with less than one-half of its original 250 million acres now remaining. To the best of our knowledge, wetland losses occurring through man's activities began in earnest in the late 1700s, and by 1954 almost 40% of the country's wetlands had been developed or destroyed. The status of the nation's wetlands continued to deteriorate after the late 1940s, with the rate of wetland loss increasing dramatically from the

mid-1950s to the mid-1970s. An overall loss of one million acres occurred during this period, and 95% of that loss is attributable directly to human activity. **Based on extrapolation of data at the Fish and Wildlife Service, current trends of wetlands loss are equally dramatic and are now estimated to be between 300,000 and 450,000 acres per year.**

With regard to inland freshwater wetland systems, these areas sustained nearly 97% of the wetland losses between the mid-1950s and the mid-1970s, representing a net loss of 11 million acres of vegetative freshwater wetlands. According to the Fish and Wildlife Service, 87% of these losses were the result of conversion to agricultural land, with most of the remainder due to the conversion of wetlands to urban uses. Many of the losses of freshwater wetlands have occurred in the bottomland hardwoods of the lower Mississippi River flood plain, the prairie pot-holes of the Midwest, and the pocosin wetlands of the Atlantic coast. Over 70% of the nation's pocosin wetlands, originally covering over two and a half million acres, are found in the Carolinas. Although these shrubby, evergreen-dominated bogs are freshwater wetlands, they are particularly important in stabilizing water quality in coastal marshes, and their disturbance may threaten major commercial fisheries. Through conversion to agricultural or pine plantations and, increasingly, peat mining, the pocosins have been reduced to an estimated one and a half million acres, only approximately 700,000 acres of which remain undisturbed.

Current estimates of the amount of wetland acreage remaining in the nation vary. The Fish and Wildlife Service estimates that only 99 million acres of wetlands remained in the mid-1970's. Conservative estimates conclude this has been reduced to approximately 95 million acres as of 1987. Some authorities believe as few as 80 million wetland acres now remain in the 48 contiguous states and 30 million acres, or about 37%, of these areas are so badly contaminated and degraded by toxic substances as to be useless.

A final but very key point to bear in mind in discussing status and trends of wetlands is that these estimates only consider wetland acreage. In other words, statistics on

losses describe only physical and vegetative changes that can be observed from aerial photographs and so provide no estimate on the rate of beneficial functions provided by wetlands that are being lost. In some cases, the loss of wetland functions may be less significant than the statistics suggest; conversely, in other cases the functional losses may be much more significant than the statistics suggest.

So what does the future hold for us here? To answer this question, let me look back several centuries to an era of widening geographical and cultural horizons, the age of the Renaissance. During this formative period of man's history, the Renaissance citizen's view of the entire world, including its scientific element, underwent total transformation. Intellectual barriers were broken, and knowledge and enlightenment flowed into ever-widening circles. The winds of scientific change blowing during the sixteenth century ultimately would influence modern environmental thought and policy. The concept of a widening circle has merit today, as it did when first described in the 1500s, and it applies especially well to wetlands.

For centuries the wet areas of our world were regarded as nothing more than wastelands, foul smelling tracts that harbored disease and pestilence and that were impediments to growth and progress. As a result, they became repositories for our refuse and hazardous wastes, sites for commercial and residential development, and ready targets for agricultural drainage. In recent times, however, we have come to understand that wetlands provide man a number of important ecological and economic services. As this circle of enlightenment regarding wetlands widens, our role toward these special areas will increasingly tilt away from that of destroyer to that of conservator.

Today's conference and your active involvement in the months ahead will establish such a watershed for the state of South Carolina. Thank you very much.

Ms. Margaret Davidson

Thank you. We've asked two folks to address the issues of uses and impacts in freshwater wetlands. I'm going to

introduce both of them, and then I'll let them each take their turn. The first speaker will be Jon Kusler, who is currently the executive director of the Association of Wetland Managers. Jon comes from a varied background. Not only does he have a law degree, but he also has a Master's and a Ph.D. in science subjects. Jon has been involved in interdisciplinary activities associated with wetlands for about 20 years. He has worked with four states that have developed wetlands legislation and policies. He has also worked closely with a number of the federal agencies and he has recently been an advisor and a contributor of materials to the National Wetlands Forum. Let me also tell you about Russ Lea, who will be speaking after Jon. Russ is the director of the North Carolina State Hardwood Research Cooperative and he is associate professor of forestry at N.C. State. He also acts as a consultant for Triangle Wetlands Consultants, who work very closely with the forestry industry on wetlands and forestry waste disposal issues.

USES & IMPACTS IN FRESHWATER WETLANDS PART 1

Dr. Jon Kusler

I'm very pleased to be here. I understand that South Carolina is beginning some serious debate as to what kind of legislative initiatives, what kind of protection management might be appropriate for this state with regard particularly to your freshwater wetlands. I suspect that trying to adopt legislative solutions or coming up with implementing plans and programs regarding freshwater wetlands is not going to be easy because I don't think you can apply some of what has been applied in other states or at the federal level to South Carolina. I've been asked by Margaret to address or share some thoughts with you on the impacts of various activities on wetlands and how these impacts might be reduced.

I'd like to stress that as you begin initiatives in South Carolina, you need a re-evaluation of the wetland approaches that have been applied to date. Some past approaches to the problem are applicable, but I think you need to think very specifically about how to address the problem in South Carolina.

But first let's examine the wide range of activities that are having impacts on wetlands around the country. The five major types of activities right now that are having impacts on wetlands include filling, impoundment, drainage, pollution and removal of vegetation.

The first activity, filling, may take all kinds of forms, whether it's pushing dirt into a wetland as in road-building or actually dumping solid waste into a wetland, or putting fill into a wetland for residential-industrial construction.

The second activity is impoundment. During the impoundment of waters a lot of wetlands get drowned out. If you put a dam in a forest or wetland, the waters come up, the forest disappears and you get open water. But we impound wetlands in all kinds of ways and it's not just through dams. We put dikes along rivers, dikes that don't have any kind of drainage. Waters back up behind them. By changing the water regime you may destroy the wetland.

Drainage is the third type of activity. Drainage takes a variety of forms, not just in agriculture but in channelization

for flood control. Also in the category of drainage are certain activities — pulling water out of a wetlands such as pumping, for instance, to increase the water supply.

Pollution is a fourth major impact. Pollution includes not only the point sources of pollution, which everybody's been so concerned about over a period of years, but the nonpoint sources such as sediment, pesticides, herbicides, nutrients, stormwater runoff, and so forth.

And finally, the fifth activity is removal of vegetation. Now, all of these activities I mentioned earlier may cause the death of vegetation, but I am talking here about agriculture and forestry operations where you're manually removing some of the vegetation. This also includes mowing.

These are some of the major categories of activities that are causing destruction of wetlands.

Now, before we go on, remember some of these wetland functions that Scott explained — waterfowl, wildlife habitat, fisheries, food chain support, flood conveyance, groundwater recharge, erosion control, pollution abatement and recreation.

Now this chart is a key to my discussion, and it says four things. First, different types of activities — draining, pollution, filling — impact different numbers of functions. Particular activities will sometimes impact one function and not another. Some of these activities will impact, for example the erosion control and pollution abatement, but not others. Second, some of these activities have different types and severity of impact. The impact may be very minor, or it may be very great. Third, the impact may be short-term or long-term and not all activities have the same long-term impacts, obviously. And finally, the impacts may or may not be reversed naturally. You need to ask, are the impacts amenable to some sort of restoration by the activities of man? How amenable are they?

Now, this may seem awfully complicated, but realistically, if you are ever going to get a wetland protection program in South Carolina, you're going to need to think about these things specifically. I went to a wetland conference in Arizona a few years ago, and a fellow came

up to me and said, "We're making some progress in protecting our wetlands. How are you doing on yours?" Obviously, your situation is different from Arizona's with 25% of South Carolina being wetland, which may not be as much as Louisiana or Alaska — I did some work up in Alaska, and their whole north slope is wetland — but you have wetlands that occupy a mosaic of much of the land area of the state. Your wetlands are not like wetlands in Arizona which are contained in a very small portion of the state with highly defined boundaries; and you also have a lot of uses that are going on in wetlands such as forestry, agriculture, and uses proposed for wetlands. **Therefore, you're going to need to think of crafting a protection management program in terms of specific activities and specific impacts.** You're going to have to make your peace with the people who are going to be using some of those wetlands, whether its forestry operations or agriculture, because if you don't make peace with those who use the wetlands you're not going to be protecting the wetlands — you're going to be protecting some very selective wetlands within the state.

Now, let's examine how the major types of activities impact wetlands and their functions.

The first activity, filling, is one that has been most regulated by both the federal and the state wetland programs. You can see why it has been most regulated because if you fill a wetland, you wipe out all of the functions. So in terms of number of functions impacted, type and severity of effect, short-term or long-term effect, whether the effects can be reversed naturally — in all the impacts, filling is the most destructive to wetlands. Also, filling is not amenable to restoration. Think about how much it would cost to start pulling fill out of a wetland.

However, once you examine some of the other activities, they are not quite as damaging on the same scale as filling. Drainage can also be very destructive. You can destroy a wetland by draining all the water out of it; after draining, it's no longer a wetland. Draining can destroy most of the functions of the wetland. It may still have some pollution abatement if there is still vegetation and there may still be some groundwater recharge and so forth, but it's not functioning then as a wetland but just

merely as another dry land area that has some of these same functions. However, draining is not as destructive as filling in certain other respects. The impact of drainage may be relatively short-term in comparison to that of fills, and I cite specifically places like Indiana where a lot of agriculture took place in wetlands in the early years. The ditches and drains are not being maintained, and a lot of these are reverting to wetland. I know that in some areas of the country — like in the North where we have a lot of beavers — it's amazing what a couple of beavers can do for a drainage ditch running a couple of miles through an agricultural field. The beaver can put the water back into that agricultural field pretty quickly. Also, if you're determined, it doesn't often cost an awful lot to block the drainage. Now, with drainage, you may have hurt the soils and so forth, but you can recreate the wetland relatively easily in comparison to filling.

The next activity, impoundment, is not in the same magnitude in terms of destruction as filling or drainage. Impoundment of waters in many instances will enhance some of the functions as well as destroy some of the others. For example, if you impound a forested wetland, you may end up, if it's deep enough, with open water, but if you do not, you may change the species composition and end up with a marsh. If you don't impound a wetland too deeply, as we're doing with a lot of duck ponds, you may enhance the wetlands for waterfowl. You may enhance it for fisheries by impoundment. You may enhance it for aquaculture by certain kinds of impoundment. You may in some instances even enhance its pollution control functions. You can enhance the flood control. One of the experiences that's most cited for flood control in wetlands is the Charles River, where the Corps of Engineers acquired about 8,000 acres of wetlands because they decided it was cheaper than building a dam.

Pollution may or may not have huge impacts on wetlands. Now, if the pollution is, for instance, sediment, and you've got lots of sediment coming into a wetland, anybody who's worked with stormwater facilities knows that in some instances stormwater facilities will fill up, literally fill up in three or four years if sediment loadings are high enough and they're not very deep. By the way, a lot of stormwater facilities quickly become wetlands

even though they're not designed for that. So, certain kinds of pollution can destroy the entire wetland. Other kinds of pollution may wipe out all the vegetation or create a Superfund site as you have at the Kesterson National Wildlife Refuge in California (where toxic selenium from agricultural drainage has contaminated the refuge), but the wetland may still have flood control and flood conveyance functions. Still, there may be pollution which may not be so serious, such as high nutrient loadings that may shift the populations in the wetland, the kinds of trees, the kinds of creatures.

Now, the removal of vegetation is something that everybody gets excited about, particularly if you approach wetlands visually, and I'm afraid that an awful lot of wetland management has been approached visually. We tend to equate what we see happen in a wetland in terms of an air photo with the way the wetland is, and it's just pure nonsense. With due respect to my friends at the Corps of Engineers, you can re-vegetate a spoil bank and it looks vegetated, but it may not serve any of the functions of a naturally occurring wetland. On the other hand, you can denude an area for forestry, and it may be serving a lot of the functions that it did before, although there may be temporary deterioration in habitat and pollution control. You can knock down trees and grind up the soil and everything else, as long as you keep the hydrology intact and you keep the soil intact, you got a good chance in a relatively short period of time to at least get an understory and marsh vegetation. It takes a long time, obviously, to regrow trees. Many of these effects are reversed naturally and some of them require some help by man.

Obviously, one could get into more depth about the various impacts, but the point that I'm trying to bring to you is that the impacts vary depending on functions and if you are going to try to approach wetland protection in the state of South Carolina, you're going to need to think about these variations very specifically and not with our stereotypical generalities.

Now, how good have we been at reducing impacts nationally, or tailoring management tools to different kinds of impacts? We've been pretty bad. We've been lousy. That's why you can't just look to another state or your

federal government or 404 [Section 404 of the Clean Water Act, 1972, as amended]. As the Office of Technology Assessment concluded in 1984, despite the 404 program at the federal level, about 90% of the wetland losses were continuing. And why was this true? The reason why is that the 404 program primarily applies to fills. Theoretically, the regulations also apply to hydrologic modifications, but it is primarily designed to deal with, or should I say, it inadvertently deals with fills. It does not address some of these other types of impacts.

Why does the 404 program primarily address fills? And why do many state programs similarly only address fills? There are a couple of reasons. The first thing is obviously the lobbyists, the various interests. For instance, agriculture is considered verboten in terms of you don't regulate it, it's exempted. And forestry has been, in general, exempted. So hydrologic modifications in terms of drainage and impoundment have not, in general, been regulated. Second, the biggest offender is not agriculture. The biggest offender is government, and the reason why, if you go anywhere from the Mississippi west until you get out to the far West, we have impounded, we have pulled the water out of the rivers to an incredible extent.

I was working on a wetland restoration study this last year, and we had some people from Arizona, and they were talking about the fact they were going to have to continually replant cottonwoods all along the rivers out West. Why? Because we've put in dams and we have cut off the flood flows to the flood plain. It turns out that cottonwoods will only propagate when they have flood flows. So we're talking about terrific numbers of cottonwoods along a lot of streams in the West that ain't gonna be there in 50 years unless we go replant them, or unless we go ahead and we somehow let flood flows get out onto the flood plain again. The very aim of a lot of our control structures is the opposite, however — to stabilize the water levels and not let the flood flows get out there.

The fault is not always with the private sector. The truth is that a good percentage of impoundment has been done by government, and usually governments are not subject to regulations — at least, not the same kinds of regulations (including local, federal, state, and so forth).

Pollution — well, we obviously have the National Pollutant Discharge Elimination System (NPDES). We have point source pollution controls. We are just now getting into trying to deal more with nonpoint sources, and there's always been the belief that somehow those pollution guys over there were taking care of things, they were tending the store. The truth of the matter is it's only recently that any states have been really looking at the impact of pollution on wetlands, and finally, a few states like Connecticut are beginning to establish standards for protection of wetlands. So having somebody tending the store does not mean that they are tending it in terms of protecting the wetlands.

One of the reasons that 404 and other programs have not regulated removal of vegetation is because there are political limits to how far you can go, and it's often felt that you have to allow some removal and it's just a question of how much. But I think that our problem has been perhaps more fundamental than simply not having political opposition. I have worked over the last 20 years with a lot of wetland managers, and they're my friends, but I think they're the cause to a great extent of their own problems. Most wetland managers and the people who have worked up wetland statutes have been botanists and biologists, and with all due respect to their expertise, and they are experts, they tend to look at wetlands as isolated chunks of hydric soils and hydrophytic vegetation. They define the wetlands based on air photos. They think of the wetlands in terms of a snapshot, in terms of a relatively short period of time, something that you could actually define as a true wetland on an air photo.

Now, for some purposes air photos work OK, but for many purposes they just don't work at all, and that's why we're in, I believe, the mess that we're in. If you go ahead and simply have a snapshot approach to, and almost a visual approach to, the impacts of activities on wetlands, you start doing dumb things, really dumb things. I don't mean to be critical of our Office of Technology Assessment and our Fish and Wildlife Service, but equating fill and destruction of wetlands with certain kinds of agriculture and forestry because the vegetation has been removed is dumb. It's just dumb. I mean, fill is forever. Fill is virtually irreversible and it is very hard to

restore. On the other hand, removal of vegetation, often has a very short-term impact. It is not irreversible. It only affects a few of the functions.

Now, I would like to give some examples of what I would call traps in our thinking. **Because we've been looking at things in a kind of a snapshot, visual way, not in a hydrologic way, we end up with absurd conclusions.** As I said, over the last couple of years I've studied restoration projects. Unfortunately, most of the restoration projects that are being done around the country are being done by botanists and biologists. They should be involved, they should have a principal role, but they are not getting the hydrologists involved and frankly, a lot of the money that's being spent is just wasted. People are sticking twigs into areas that have no hydrology and thinking they might grow. In project after project there's absolutely no basic consideration of the hydrology. You have to get the long and short-term hydrology right, and then you can think about re-vegetation, and if you don't do the hydrology right, the vegetation is going to die over time or it's going to be a very short-lived wetland. If you get the hydrology right, if you put your money on that, a lot of the reseeded will occur naturally. We may be spending a lot of money on the wrong things.

Now, another real problem with approaching a wetland as a snapshot is that we end up with trying to protect wetlands in ways we can't protect them. Take, for example, flood storage. How many think that wetlands store flood waters? If you talk to some hydrologists about what happens when water falls on land that is already wet, they will almost universally agree the water runs off more quickly than if it falls on land that is dry. So for a very, very small rain or a flood event, water flowing on a wetland will flow out of the wetland more quickly than it will flow off of equal upland. However, if you have a big rain and you dump a lot of water into a wetland, you have a different situation. If you pour water slowly into a funnel, it runs out as quickly as it comes in. If you pour a lot of a water into the funnel, the water builds up in the funnel. **However, it's not the surface area of the wetland that stores water but it's the lip around the wetland that has the potential to store water.** You need both the lip and the wetland. Now if you don't have

the lip, you don't store flood waters. If there's no lip on the wetland, no way of building up a head in the wetland, the water just runs out if you have too big an aperture. Now, what do our wetland laws do? These laws have been drafted by lawyers who work with the botanists. The wetland laws say we're going to regulate the wetlands, the immediately flooded portions, the areas that are subject to inundation all the time. However, if you regulate a wetland but you allow the rim to be destroyed, you aren't going to have flood storage. **Now, you wonder about why people say we need buffers for certain purposes. If you don't have the buffers, you're not going to get the wetland function. It's that simple.** There's very strong evidence, particularly for larger flood events that wetlands do store flood waters. However, wetlands may not store water for very small flood events. In this case, runoff may be more rapid.

What does this all mean in terms of South Carolina and how you proceed? I'm not suggesting that you go back and throw out all the thinking that's been done elsewhere. I'd build on, at least, the good, and question some of what has gone on, and ask, "Is this applicable to the situation here in South Carolina?" If you are going to adopt a statute, I think it should be function-oriented, so that you begin to look at impacts in terms of particular functions and particular factors that relate to those impacts and functions. There should be a strong hydrologic base. The idea of a permitting system is fine, and you need it, but you need to evaluate permits in a different way than they have been evaluated in the past. You need to work on the buffer concept.

I would like to suggest that states, as an administrative matter, if not in the statutes, need to think of wetlands in two major categories.

The first category is what has sometimes been called wilderness wetlands, wetlands that are already sites of rare and endangered species. They are wetlands that have very special values. They are wetlands that may be in an almost unaltered state, and they may not be all your wetlands. These are the wetlands needing very tight controls — acquisition, perhaps tax incentives. The second category you might call managed wetlands. These

are wetlands such as those along rivers that have already been dammed. They are wetlands that are subject to forestry practices, agriculture, aquaculture, including a lot of the urban wetlands. And for the managed wetlands you need to think about managing the long-term hydrologic regime to maximize the values and minimize the impacts. And, in many instances, you need active management of the water in one way or the other.

Next, you need to think about not only having a permitting system but tying your wetland protection into your dam permitting, your in-stream flow, your public water statutes, your stormwater, your flood control and so forth, because you have to manage wetlands in terms of the water sources and what's happening to them. I think that adopting a no-net-loss standard, is a very sound idea. But you need to allow all kinds of possible activities within some of the wetlands, emphasizing again minimization of impacts and compensation in some instances. **You can restore wetlands, or at least approximate many natural functions, particularly of open marshes. But you have to approach restoration and creation very cautiously, particularly where the hydrology is difficult.**

I thank you very much. It's nice to come down here.

A Spectator

Do you have any thoughts regarding the staffing levels in both the state and federal wetland programs?

Dr. Jon Kusler

Obviously, one of the big problems for EPA, Corps, Fish and Wildlife, and so forth, has been that they don't have enough staff to do permit analysis and to do the kind of calculations that are needed. But the Wetlands Forum report makes recommendations for common definitions, better boundary definition procedures, and a no-net-loss standard for wetlands, and I think these recommendations are relevant to staffing levels. I'm convinced that we've been using the staff in wetland permitting programs extremely inefficiently. The federal 404 permit procedure says that every single permit has to be evaluat-

ed essentially on its own merits. The wetland botanist has to balance economic considerations with biological considerations with flood loss reduction; what often happens is that every single permit must grind through a terrific, analytical process. Much of the time is eaten up by the wetland manager trying to play judge. Now, if you get some of the technical problems worked out, such as boundary definition — and you say our standard is no net loss of acreage and function, then you focus the technical people on technical questions and the technical people will not spend all their time trying to make political decisions.

A Spectator

Could you comment on the status of a federal wetland law as opposed to a section 404 law which is mainly aimed at filling?

Dr. Jon Kusler

I think there are going to be some proposals for a federal wetland law. I have a feeling these laws are not going to have a lot of bucks attached to them, given the status of our economy, but I think they should be looked at very seriously. If you look at the thinking in the states, maybe even amongst some of the people participating in the National Wetlands Policy Forum, the feeling is that the 404 law needs to be very substantially revised. A lot of the wetland acts that were adopted in the states are now out of date. For instance, Massachusetts' wetland act dates back to 1963. People were doing the best they could at that point in time. **My appeal is that because we get so stereotyped in the way we approach things in our thinking, let's apply what we've learned in terms of new legislation. That's where you people have an opportunity to build upon what's been learned.**

USES & IMPACTS IN FRESHWATER WETLANDS
PART 2
Dr. Russell Lea

I think Jon has given you the overall picture of wetlands use. He narrowed it down to certain impacts affecting certain functions. I'm going to use my perspective as a forestry researcher and talk about what impacts forestry might have on the functions of wetlands.

You've seen this map before. These are some of the drainage areas within the Southeast in which I work with the Hardwood Research Co-op. I deal with the public agencies and the forest industries that manage this land base. We have considerable potential acreage of bottomland hardwoods in this area so research is no easy challenge when we start talking about assessing functions and attributes of these bottomland hardwood systems.

Let's first examine the wetland forest types. These are just some of the types that we have in the Southeast, and I would dare say you have all of these forest types right here in South Carolina. First, the muck swamp type, dominated by cypress tupelo. Water is on it for a greater portion of the year.

Second, the pocosin type, with the ericaceous shrubs and the pond pine, fire climax species. This is a little bit different than certainly a muck swamp type, but it's still a forested wetland system. Third is a typical red river bottom system, such as the Santee or the Cooper or systems like those in the Southeast. It still gets water on it, but it also dries out during a given period of time, and you can see the water lines on those trees and you can tell where the water gets to.

Fourth, the lazy rivers, or the coastal plain rivers, like the Waccamaw, the Black River — rivers that don't come out of the Piedmont carrying a lot of energy or a lot of sediment. They're lazy rivers that also have a different function than these other types.

Fifth, the piedmont wetlands. Bottomland hardwoods are associated with the creeks in the Piedmont. Again, they have a different function. There's a little bit higher energy involved with these systems, but they could be equally important to the entire system.

My standpoint is that I assess the impacts of forest prac-

tices on bottomland hardwood ecosystems. We set up a study to look at exactly what's happening to selected functions when we go into forests with logging equipment, remove vegetation, etc. We chose the state of Alabama as a likely target for several reasons. It's got a hell of a diverse river system, and if you look at just the drainage area of the Tombigbee and the Alabama River, you might say that that forms the Gulf of Mexico just like the Ashley and Cooper Rivers down here form the Atlantic Ocean. It's an incredible system. We focused our attention on Mobile Bay, so you may say we're at the highest end of the trophic level.

We justified this research based on several things. One is that forested wetlands are important. Furthermore, we wanted to get very specific in developing better forest management practices. **Don't forget that a lot of forestry actions in bottomland hardwood systems are exempted under federal law and under other wetland laws**, and we want to be sure that if we're exempted under our best management practices, that they are dialed in properly for given sites and given conditions, so we can justify them on the value of this research alone. And then you must consider lack of quantitative data on the impacts or any impact on a forested wetland system. You see so many of these studies that have been conducted in watersheds in the uplands, and the reason they conducted those watershed studies and ecosystem studies in the upland is because they can put a weir up and they can measure everything coming out the bottom of the weir as far as water quality and nutrient runoff and this kind of thing. It's harder to discover what a swamp does when it's flooding several times a year and the water is in and out and you're trying to assess an impact or response of the ecosystem to an impact. So there hasn't been a lot of effort in swamps.

The objectives of our study were several-fold. One was to quantify the impacts of four levels of harvesting and disturbance on the hydrology, water quality, and soil properties, and then use these properties as indices of functional changes. Again, I think Jon set me up for this because there are certain things that these perturbations do relative to functions, and I'll give you some examples a little bit later. You can see why we targeted our study

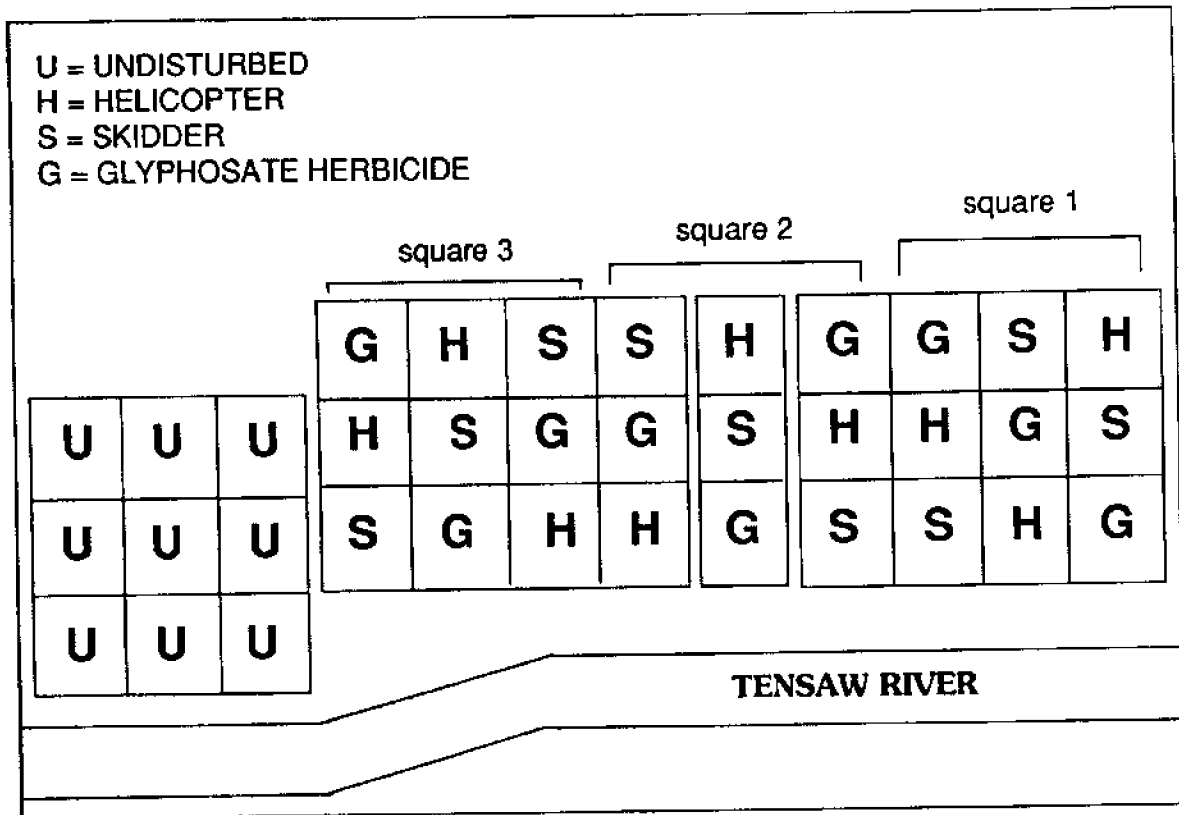


FIGURE 1. Tensaw River Experimental Design

for the Mobile River Delta. It's a vast resource of cypress and tupelo, extremely productive land at 60 cord per acre. The average bottomland hardwood forest around the Charleston area would yield 30 cords, so there's about twice as much wood out there per acre in this ecosystem than you would get on the average bottomland system in South Carolina.

So we chose the Mobile Tensaw Delta — it's an effluvial deltaic plain. The total watershed is 11.2 million hectares of a fairly uniform type. There are three major channels: the Tensaw River, the Mobile River, and the Middle River. The delta has a diurnal tide. It has salinity problems. There's a considerable hydroperiod, and it has soil gradients. There's also a lot of history in the delta. When you look across that area, it's anything but pris-

tine. The pictures show some of the old pole boat runs that existed from when they used to log around the turn of the century. Essentially it was cable logging on boats, using PBs and old misery whips. They cut this timber down, and you can still see the old skid trails, or the old pole boat runs, very clearly.

Here is a slide of the equipment that has lived and died at the hand of loggers out there. This is what they call a groundhog, which is just a glorified pole boat, only it skids along the ground and has a pretty considerable impact in the process of doing that. It's sitting up here on the side of the river, because no one's going to use it or make money using it anymore.

We decided to select standardized treatments which

might be possible today, options like a helicopter and a rubber tire skidder, similar to an operational timber harvest. Then we studied what happens when you do a helicopter logging job but remove all vegetation. In this way we didn't have to model the contribution of vegetation to the functioning of hydrology and soil parameters. We essentially took a certain amount of our plots and kept the vegetation off of them, so we didn't have to model vegetation's contribution. Therefore, we had an uncut control.

We put the study in and went out there in a helicopter and logged the entire study site just to get a baseline control across it.

And that slide shows what it looks like from the air. You see that big cookie cut out of there; that was helicopter-logged, and that's our study on the Tensaw River channel. It's about 60 acres clear-cut.

Now regarding impacts, whether you're helicopter logging or you're trafficking with a piece of equipment, when the tree hits soil, it goes splat — there's an impact no matter what you do. If a tree hits the ground, there's going to be an impact on the site.

Now, we started to control some of the treatments. First, we used a skidder treatment in a controlled way so that we could assess the impact of a rubber tire skidder on a site that was extremely wet and extremely fragile, subject to major impact. We were looking for maximum and minimum impacts. We weren't trying to learn the best management practice out there. We wanted to get a handle on what was the range of influences of a very intensive practice, a rubber tire skidder, vs. a less extensive practice, such as helicopter logging.

And this slide shows the result of our skidder treatment, and anybody would say, what a mess, but to me, that's a success. That's exactly what we wanted. We wanted a very controlled impact, and you can see that we got a pretty good controlled job of impact in using that rubber tire skidder on the site.

And then this slide shows putting the herbicide treatment

in. Here we tried to eliminate again all the vegetation once it started getting established and we kept it out over a period of a couple years.

From an aerial view, you can see the herbicide plots punched out. We have replicated three by three factorials of the herbicided plot, the skidder treatment plot, and the helicopter log plot, so we have nine replications of every treatment on the 60 acres, and each plot is about an acre large. Treatments were randomly assigned to account for variability along environmental gradients parallel and perpendicular to the Tensaw River (Figure 1).

Furthermore, we wanted to be able to say, when we're assessing impacts in the future, that we have a good set of indices. We wanted to make sure that these indices applied to the functions. We wanted to be sure that there was efficiency in collecting this information, and certainly we wanted interpretive simplicity. In other words, after you get the data, can the average person understand what you're trying to tell him? Then does the data relate to ecosystem integrity and recovery? We wanted to find those things that you would do first to assess function.

These are the indices that apply to the functions of the bottomland hardwood, from soil acidity to total soil organic matter percent to hydroperiod, mechanical resistance of soil, etc. Some of the indices go across several functions and describe the attributes of those functions, and some of them don't. Some of them are very specific to a given function (Table 1).

Let's look at the results. Several patterns of response were observed among indices of ecosystem functions. Net production of woody plants and a number of soil physical and chemical indices showed a pattern of lowered rates of values for all clearcut treatments, with greatest decrease for the skidder treatment (Figure 2).

A second pattern held for soil temperature and the decomposition rate of organic matter, such that values or rates increased for clearcut treatments versus the undisturbed stand. Revegetating skidder and helicopter plots had soil temperatures and decomposition rates lower than the herbicide plots, but greater than the undisturbed

TABLE 1. Selected Indices of wetland abiotic functions.

Index	Hydrology	Water quality	Nutrient cycling
bulk density (whether soil is loose or tightly compacted)			x
mechanical resistance (resistance of soil to compaction)	x	x	x
saturated hydraulic conductivity (amt. of water which will move through soil under saturated conditions)	x	x	x
soil redox potential (measure of soil saturation)	x	x	x
soil oxygen %	x	x	x
soil acidity	x	x	x
soil temperature		x	x
soil organic matter %		x	x
total N & P of soil water (nitrogen & phosphorus)	x	x	x
soil nutrient levels			x
hydroperiod (length of time a site is saturated or flooded)	x	x	x
sedimentation	x	x	x

areas (Figure 3). Sunlight and temperature differences among treatments controlled this response pattern. As vegetative cover developed, soil temperatures cooled and the decomposition rate slowed.

A third pattern describes soil mechanical resistance and total phosphorus in soil water, indicating the amount of soil structure lost or destroyed due to the different treatments (Figure 4). The fourth pattern of sediment accumulation was unique (Figure 5). Roughness of plot surfaces creates frictional drag on the sheet flow of flood waters and catches sediments. Herbicide-sprayed plots had the least vegetation and, therefore, lowest roughness and low sedimentation. Tall slash piles of logging debris combined with remaining herbaceous ground cover may explain the higher sedimentation rate after helicopter treatment. Sedimentation rate differences between treatments may have been greater had flooding been for a longer duration or associated with higher flow rates.

Well, these slides show some of the regeneration that occurred. You don't have to worry about regeneration. There are bodacious quantities of regeneration.

Another thing we wanted to do in this study was assess

the function of neotropical migratory songbirds in response to the clear cut, in response to the edge and in response to the regrowing timber. The edge refers to an ecotone, which is where different ecological zones meet, often containing abundant and varied wildlife.

These are just some of the number of species differences we're getting in the uncut forest vs. the edge vs. the clear cut. Again, you can't make generalizations about species number. There're different species in the clear cut than the uncut forest, but the numbers are about the same. And then there is the edge effect, which is already dramatic — all the species pile into the edge (see below).

	Species Richness
Edge	41
Clearcut	27
Uncut	26

And as you start looking for birds on these sites, certainly the woodpeckers come right back into that opening, the big gap out there in the forest where you have snags and other things. The birds make their homes there and feed there, and then as it starts regrowing, you start getting the songbirds back in the regrowing timber. The prothonatory warbler returns in a very short time frame.

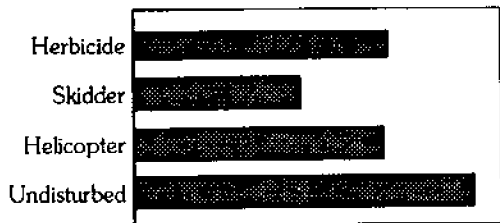


FIGURE 2. Generalized response pattern of soil hydraulic conductivity, redox potential, and acidity, total nitrogen in soil solution, woody plant productivity, and the inverse of herbaceous plant productivity.

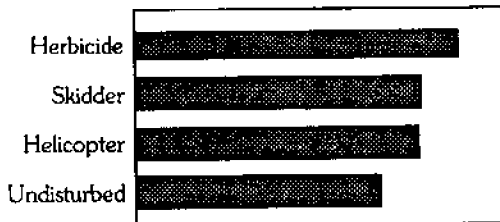


FIGURE 3. Generalized response pattern of soil temperature and organic matter decomposition rate.

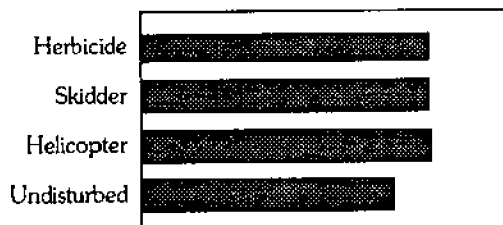


FIGURE 4. Generalized response pattern of soil mechanical resistance and total phosphorus in soil water.

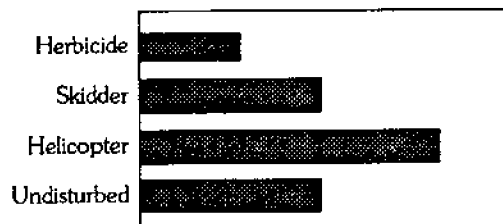


FIGURE 5. Response pattern of sediment accumulation.

Then you start looking at more of the interior species as this site ages out. There are not-so-permanent impacts so they can still use this area as it starts regrowing. You start getting some of the long-legged birds back in, and then as they mature you get species like swallow-tailed kites.

The indicators of wetland functional values chosen for this study yield a detailed picture of important ecosystem responses induced by timber harvesting practices, but are not comprehensive. **The sufficient set of parameters chosen for future assessments of impacts on wetland functions must be custom-fit to the wetland values of concern.**

In closing, I wanted to show you what happens after a long day of activity in the swamp — you try to cool down. Unfortunately, these graduate students didn't realize the chemistry of that water; it tends to shrivel you up. [Audience laughter.] Thank you.

Ms. Margaret Davidson

We've tried to give you an overview about wetlands issues and now we're going to talk about some of the things that are happening from a national perspective. Later this afternoon, a panel will examine a hypothetical case study focused on a situation here in South Carolina.

The next person to speak is Dr. Edwin Clark. Dr. Clark is Vice-President of the Conservation Foundation, which is located in Washington, D.C. He's the director of their Water Resources and Environmental Conditions and Trends programs and is currently the project director for the National Wetlands Policy Forum and the National Groundwater Policy Forum. Before joining the Conservation Foundation, he was with the U.S. Environmental Protection Agency. Dr. Clark is very knowledgeable about a variety of subjects. The Conservation Foundation has been involved in wetlands issues for quite some time. He will talk about the National Wetlands Forum, which has just recently made its formal recommendations.

A NATIONAL POLICY FOR FRESHWATER WETLANDS

Dr. Edwin Clark, II

The Conservation Foundation has had a long-standing interest in wetlands, which is why Lee Thomas, Administrator of EPA, came to us for assistance with a National Wetlands Policy Forum.

In fact, there was no coherent program for dealing with wetlands. He came to the Conservation Foundation — we're a non-profit policy research consensus building organization in Washington — because he had seen the results of our effort a couple of years earlier on groundwater. We had brought people together under the leadership of Governor Bruce Babbitt of Arizona to try to figure out a national policy on groundwater, and Lee Thomas thought maybe that same sort of approach might help with wetland issues.

Over the past two decades, the nation has almost inadvertently developed a whole series of activities related to wetlands. Of course, historically, most of the government activities have been related to converting wetlands, destroying them, altering them in some way. Our national policy in the last century was to sponsor their drainage and their fill, get rid of them. They were, as Scott said, places where there were mosquitos, pestilence, and wild creatures from the deep.

Historically, there has been no coherent program for dealing with wetlands. We had Section 404 of the Clean Water Act, which few people involved thought was going to be a wetlands protection program when it was started. We had the Fish and Wildlife Service and the Park Service protecting areas. We had some effort in the National Environmental Policy Act (NEPA) to try to control what the federal agencies could do in terms of directly converting wetlands. These were some of the things that started in the early 1970s.

We also had some state programs being developed and a lot of private efforts — the Nature Conservancy, the National Wildlife Federation, Audubon, and Ducks Unlimited all have put substantial resources into protecting wetlands, along with some local efforts. These activities have been going on at different levels of intensity for the past two decades, but substantially uncoordinated and in an incoherent manner that has created a lot of frustration

on both sides. They've created frustration on the part of those who are concerned about preserving wetlands, because they really haven't been all that effective at stemming the loss. And they've created frustrations on the other side — for the people who want to use wetlands; the landowner, the farmer, the developer. These people see all these "different definitions" — Scott mentioned the 50 that we found. They don't know what the laws are. They know that some people get away scot-free with doing things, and others can get hauled into court. And whatever it is, the decision can be delayed for a long time.

So there are substantial frustrations on both sides, frustrations that have resulted in a deadlock, at least at the federal level, for more than a decade.

We thought that maybe if we could set up a process which would back away from the bitter battles that were taking place in the courts, in Congress, among the agencies; if we get a group of people who had some prestige, some knowledge, some insight, but weren't going to get caught up in these day-to-day issues and could look at the forest as opposed to the individual trees, then maybe we could come up with something. And that's why Lee Thomas came to us, because we had done this with groundwater, and he asked us to do the same thing with the wetlands issue.

Governor Tom Kean from New Jersey had been on our groundwater forum and had been a very useful contributor to that, so we asked him if he would chair this effort for us and he agreed. They had been working on wetland issues up in New Jersey. Actually, halfway through the forum's activities, New Jersey enacted a very good, it appears, inland wetlands law in the state, and he was very interested in this issue as well as a whole range of environmental issues.

So he agreed to become chair, and your governor, Carroll Campbell, along with Governor Booth Gardner from Washington agreed to serve as vice-chairs of the forum. We had a wide diversity of interests represented. Participating from the private sector side were the forest industry, the oil industry, the large developers and the home

THE NATIONAL WETLANDS POLICY FORUM

Members

- The Honorable Thomas H. Kean, Chairman;
Governor State of New Jersey
- The Honorable Carroll Campbell, Vice Chair;
Governor, State of South Carolina
- The Honorable Booth Gardner, Vice Chair;
Governor, State of Washington
- Peter A.A. Berle, President, National Audubon Society
- William D. Blair, Jr., Past President, The Nature Conservancy
- Willard T. Chamberlain, Senior Vice-President
for Corporate Affairs, ARCO
- John DeGrove, Florida Atlantic University
- Nancy R. Elliott, Supervisor,
Town of Yorktown Heights, New York
- James G. Gosselink, Louisiana State University
- Peter Grenell, Executive Director,
California State Coastal Conservancy
- Jay D. Hair, President, National Wildlife Federation
- Dick Holler, Hollier Farms, Inc.
- Dennis Kelso, Commissioner,
Alaska Department of Environmental Conservation
- Frederic D. Krupp, Executive Director,
Environmental Defense Fund
- Jack Larsen, Vice-President, Weyerhaeuser Company
- Melvin Simon, Chairman, Melvin Simon and Associates, Inc.
- F. John Taylor, Taylor Grain and Livestock
- John Turner, President, Wyoming Senate
- Robert Wetherbee, Vice-President,
National Association of Conservation Districts
- Shirley McVay Wiseman, Shirley Wiseman & Associates

Ex-Officio Participants

- William P. Horn (succeeded by Susan Recce), Assistant
Secretary, U.S. Department of the Interior
- J. Curtis Mack II (succeeded by B. Kent Burton), Assis-
tant Secretary, U.S. Department of Commerce
- Peter C. Myers, Deputy Secretary, U.S. Department of
Agriculture
- Robert Page (preceded by John Doyle), Assistant Secretary,
Department of the Army
- Lee M. Thomas, Administrator, U.S. Environmental
Protection Agency

Representatives

- Brenda S. Davis, Robin O'Malley,
George G. McCann, and Richard Schwabacher, representing
Governor Kean
- John N. McMillan, Sr., and William D. Marshall, representing
Governor Campbell

- Andrea Riniker and William Alkire, representing
Governor Gardner
- Hope Babcock, representing Mr. Berle
- Nathaniel Williams, representing Mr. Blair
- Robert J. Jirsa, representing Mr. Chamberlain
- Barbara Brumback, representing Mr. DeGrove
- Bonnie O'Brien, representing Ms. Elliott
- Elizabeth Riddle, representing Mr. Grenell
- J. Scott Feierabend, representing Mr. Hair
- Fran Hunt, representing Mr. Hollier
- Douglas R. Redburn, representing Mr. Kelso
- James T.B. Tripp, representing Mr. Krupp
- David Mumper, Patricia Hill, and Scott Berg, representing
Mr. Larsen
- Fred Worstell, representing Mr. Simon
- Mark Maslyn, representing Mr. Taylor
- Rich Olson, representing Mr. Turner
- Steven N. Meyer, representing Mr. Wetherbee
- J. Michael Luzler, representing Ms. Wiseman
- Susan E. Recce and Martin L. Smith, representing
Mr. Horn
- J. Roy Spradley, Jr. representing Mr. Mack
- Mack Gray, representing Mr. Myers
- David Barrows, representing Mr. Page
- John Meagher and Dianne Fish, representing Mr.
Thomas

Conservation Foundation Staff

- William K. Reilly, President
- Edwin H. Clark II, Vice-President
- Gail Bingham, Vice-President
- Michael Mantell, General Counsel and Senior Associate
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- Malcolm Baldwin, Baldwin Associates
- Jon Kusler, Association of State Wetland Managers
- Joseph S. Larson, University of Massachusetts
- Daniel E. Willard, Indiana University

builders. On the environmental side were the National Wildlife Federation, along with the heads of the Audubon Society, the Environmental Defense Fund and the Nature Conservancy. We also had many agricultural representatives, a Cajun farmer/forester from Louisiana, the vice-president of the National Association of Conservation Districts, and a farmer from the Farm Bureau who lives in Illinois. There was also a rancher from Wyoming. So we had the agricultural interests represented, state and local agencies, the California Coastal Conservancy, the head of the Alaska Department of Natural Resources, the representatives from South Carolina, New Jersey, and Washington, and a local person, to bring in a local perspective on these issues, along with some academic, independent experts to help keep us honest. We had the advantage of also having the heads of the five federal agencies primarily involved in wetlands participating. Lee Thomas attended every meeting.

The forum itself, met four times between July of 1987 and July of 1988 and had its last meeting this last July to approve the final report. The staff met more times than that independently of the forum. The staff contributed option papers, issue papers, background papers and draft reports. And we released a report on November 15th, 1988. The final report contains over a hundred recommendations, quite specific in many cases, and puts forth an eight-point program which I'd like to summarize for you, on what the nation should be doing about wetlands.

But first I would like to mention a couple of insights that I personally gained during this process, insights that I wasn't expecting when we started.

My first realization was that we know distressingly little about our wetlands resource. Scott gave you the statistics, but basically any data on the rate of wetlands loss, the type of wetlands loss, are already 20 years out of date; they are based on an average from the mid-1950s to the mid-1970s. There have been some regional studies since then but nothing that has a rigorous national statistical basis. The information gathered has not been as useful as it should have been for policy making. We don't even have statistical data, showing the

rate of loss of wetlands in each of the 50 states. Also, we may know a lot about the biological characteristics of wetlands but not a lot about what is causing them to be altered. In addition, we know almost nothing about the functions and how to measure them. When we start talking about functions and regulating on the basis of functions I get nervous. I agree, conceptually, that regulating on the basis of functions is the way we should go, but we need much more study before we can measure functions accurately, and particularly predict them.

The second point — a point that Jon hit very well — is that there are multiple causes of alteration. Most of our statistics, as Scott said, are based on aerial photographs. In a photograph you may see the wetland change, because somebody cut down the vegetation, or for other causes, but a lot of changes take place that you're not going to see from aerial photographs. For instance, one change not seen in an aerial photograph is chemical contamination. I've been working on Kesterson National Wildlife Refuge out in California, a wildlife refuge that has been severely contaminated by agricultural runoff, so much so that the reproductive process in birds has stopped after a very bad period of mutagenic effects and teratogenic effects. That alteration would never be picked up in these surveys because it doesn't appear in aerial photographs. You've got the same sort of problem, for instance, down in the Everglades. Because of the inflow of nutrients into the Everglades, the biology there is changing. The type of vegetation is shifting from the natural grasses into cattails and things like that which are different; this shift in vegetation may affect that whole ecosystem and its ability to support its natural species. Such an alteration is never picked up in the types of surveys we do.

So we ought to be concerned about some of these other types of alterations, which are largely ignored, at least by the regulatory programs that exist so far.

My third insight is one that Jon again referred to: the importance of water to wetlands. Now, this may sound silly, but it was a little bit into the project before I said, "Wetlands. Well, that means land and water." People focus on the land side of it all the time, but it's really the

water side that's more important. **I would hypothesize, that we've lost more wetlands because of changes in hydrology in the water regime than we have because of changes in the land use directly.** Jon gave you some examples of this problem, but one of the most dramatic is the Louisiana coast where the flood control system along the Mississippi River has cut off the natural sediment that was required to nurture, to maintain those wetlands; and because of this change in the hydrologic system, Louisiana is losing an estimated 30 to 60 square miles of wetlands a year. The loss has nothing to do with land use changes. Those wetlands are just sinking below the Gulf of Mexico because of changes in the hydrology from the flood control projects. Therefore, we need to look more closely at the water. Section 404, the primary federal regulatory program, at least as implemented, only deals with a very small part of the problem, maybe 10 or 15 percent. If we are really going to get a national wetlands program, we have got to look well beyond Section 404.

One final observation: even if we were today to stop all activities that filled wetlands or that in other ways affected wetlands, even if we were to stop doing anything that led to conversion, there would still be conversions going on, because of the results of past activities. The flood control system along the Mississippi River is an example. We don't have to do anything more, and we're still going to continue to lose 30 to 60 square miles a year. As a matter of fact, if we don't do something, we'll be in real trouble.

So there's a base rate of loss which is going to occur unless we take positive actions to reverse it. We can't say that we'll protect wetlands by regulating new activities. That's not going to preserve our wetlands base.

Those were some of our insights during this process that influenced our recommendations. Basically we said we need three components of a strategy. First, we need to set a national goal for wetlands. Now there is no goal stated in national legislation to guide the programs. The Clean Water Act, Section 404, as you probably know, hardly mentions wetlands at all. I think the first mention of wetlands was in the 1977 amendments in an obscure

way. There are goals for the Clean Water Act which can be applied to wetlands, but no goal set forth clearly for wetlands. So the first thing we need is a national goal. Next, we need to protect the resource. To protect the resource, we have to reduce losses, but we also have to increase restoration. And third, we have to improve the protection management process, get rid of some of these inefficiencies and frustrations. So those are the three parts of our strategy. Unlike many efforts of this kind, we not only have to make our recommendations, but we have to figure out how we're going to get them implemented.

Now, I would like to review our eight-point plan.

The first point was to set a national goal. That was one of the most controversial issues for the forum. It was the issue that was brought up at the first meeting, and it was an issue that was debated through to the last meeting. But we agreed on a goal. **In the short term our goal would be no net loss of wetlands measured both by function and acreage. But more significantly, in the long term would be an increase in the quality and quantity of the nation's wetlands base.** This was a dramatic goal considering the group we had together and where we were starting. By the way, your governor, Governor Campbell, was an important person in getting that goal agreed to. Now, that goal, as it's stated, does not mean that we're not going to have any conversions, that we're not going to have any wetlands altered in any way. There are reasons why we will still have conversions, some of them natural, some of them because that may be the best thing to do. But the goal does imply that the losses have to be checked and we have to establish policies that will compensate for the losses that do occur.

The second point of the program was planning. In the wetlands area, I have become a believer in planning. One of the problems with our wetlands programs is that they are primarily reactive. You wait until somebody wants to do something to a wetland, and then you hope you find out about it, and then you decide what to do. But we need to get ahead of the efforts of development. We need to figure out what we want done with this re-

source, how we want to protect it. We need to find out where the wetland is. In a lot of cases we don't know that. We need a planning process that recognizes the multiple values of society: economic values, social values, as well as biological/ecological values. This planning process tries to reconcile those different values, how you're going to use, save, and protect this resource. And that's planning. We recommended advanced planning in many areas, and finally, we recommended that every state initiate a state wetlands conservation plan. **To me, the state wetlands conservation plan is the keystone to the whole framework because that's the plan you use if you're going to achieve the goal of no net loss.** We recommended those plans be developed with the goal in mind of no net loss, state by state.

The third point was incentives for private protection. Most of the wetlands, of course, are in private ownership. Ask anybody from the Corps, EPA, or Fish and Wildlife trying to regulate those lands and the uses that are made of them. If the incentives exist to convert wetlands, it is going to be very difficult to stop conversion. **We must provide positive incentives for private owners to protect the values, and the functions that those wetlands provide, and not only the wetlands themselves but the upland areas that contribute to them.** We have to give more attention to compatible uses in wetlands. Let's see if we can help the landowner make a profit or at least some income out of keeping this wetland in a form that will provide the functions that we value. We also recommended some more traditional approaches, a new wetlands conservation trust which would provide tax benefits for people preserving wetlands. Certainly the most expensive recommendation was an agricultural wetlands reserve program which would operate something like the Conservation Reserve Program that was enacted in the 1985 Farm Bill. This recommendation would permanently protect up to five million acres of existing wetlands through conservation easements, taking them out of crop production. We also recommended expanding other incentives of that nature, for instance, the Water Bank. One of the problems with the Water Bank, of course, is that it does not offer permanent protection. We ought to be looking at permanent protection because, in many cases, if these

wetlands are filled, as Jon said, that's irreversible. So I think these positive incentives are an important issue.

The fourth point was improving regulatory programs. Included in this point are several issues. One is the definition and delineation issue. We have to have consistent definitions and consistent delineation methodologies. Another issue is the need for more resources to the agencies implementing these laws, and more resources for enforcement. We have also recommended that regulatory programs including 404 clearly deal with drainage, harvesting vegetation and other types of activities that alter wetlands. Finally, we recommended that the regulatory program try to make it easier and less burdensome to the landowner and to the developer, with better information, quicker processing, better planning and more consistent policies. **Perhaps the most unusual proposal considers a regional general permit which would allow people to convert small acreage of wetland, if they provided prior compensation predominantly through a public mitigation bank.**

The fifth area is government activities, reducing the amount of alterations caused directly by roads, dams and things like that; and a proposal for a coastal barrier resources act for the most valuable wetlands. We gave some consideration to how these facilities are operated because they could be operated in ways to promote wetlands protection. We talked about reduced inducements, in which the main area is the flood control program, the flood insurance program. And we discussed acquisition, that we ought to accelerate the efforts to acquire in public trust the most valuable wetlands.

The sixth area was better information. I've already said that we were disturbed by how bad and untimely the available information is. A lot of research must be done, and this information must be made available quickly and in a way that's useful for decision makers.

The seventh area dealt with restoration and creation. Many recommendations in this area are focused on research and monitoring because we have a lot to learn about that process. The agricultural wetlands reserve program does include another two and a half million acres of

restored wetlands. In this proposal we were thinking about the Midwest, the prairie pothole region, where we have some confidence in the restoration process that will take place if the drainage is cut off. We also recommended that there be a wetlands restoration initiative, a public-private activity similar to the North American Waterfowl Management Plan that Bill Horn, Assistant Secretary, for Parks and Recreation proposed. But our proposal would focus on restoring wetlands on public lands and in areas where creation of public facilities has resulted in the conversion of wetlands or the drying up of wetlands. One recommendation I'd like to mention may not be so important in South Carolina, but out West is potentially very important. We proposed that the government land-owning agencies, the Forest Service, the Bureau of Land Management, agencies like that, inventory their wetlands and start taking action to protect them.

And finally, we had some recommendations about financing this wetlands program, which could be expensive. I mentioned the agricultural wetlands reserve program as the most expensive part, but of course that program will pay for itself in reduced crop support prices. There will be savings in efficiency, certainly savings to the landowner and to the public at large, but there will also be costs. We recognize that now is a time of tight budgets, but we also think that there are substantial costs if we don't stop conversion. Governments should get wetland programs underway as soon as possible, and the states must take the lead. Our recommendation is that the federal regulatory programs be delegated to the states with some technical and financial assistance. Delegate the program to the states if the states can demonstrate that they have the authority and capability to achieve a no-net-loss goal and if — and this is the important part — if they have undertaken a state wetlands conservation plan which shows how they will achieve this no-net-loss goal. If states can develop such a plan, then we can get the program down at the state level, near the resource, and it will be more efficient that way.

Well, that is just briefly an overview of the report's recommendations.

We have already started on the implementation phase,

where there is a lot of interest. As you saw, President-Elect Bush endorsed the forum's report at the Governors Association meeting. We've been meeting on the Hill. Senators Mitchell and Chaffee are interested in it. EPA has already started figuring out how it's going to implement the recommendations. I think this has a chance of going somewhere, and the forum is going to be working on trying to make it get there. Thank you very much.

Ms. Margaret Davidson

Next on our program, Frank Redmond will speak to you about the federal processes that apply to wetlands. Frank is currently the chief of Wetlands and Coastal Programs with Region 4 of the EPA located in Atlanta. He has been working with EPA since it was founded and has been very involved with the implementation of the National Environmental Policy Act (NEPA) in Region 4.

REGULATORY PERSPECTIVE ON FRESHWATER WETLANDS

Mr. Frank Redmond

EPA plays an important role in wetlands protection, and the cornerstone of our effort is the Section 404 permit program. We've been involved in wetlands protection since the 1972 amendments to the Federal Water Pollution Control Act, now called the Clean Water Act, were passed. EPA jointly administers this program with the Army Corps of Engineers. Many activities which adversely affect wetlands, however, are not regulated under Section 404, as you have already heard here today.

We conducted a strategic planning study in 1985 to assess the problems associated with wetlands and to determine the directions that EPA should take to enhance our wetlands protection efforts. We created a new Office of Wetlands Protection in Washington as the office to carry forward these things that we discovered in our planning efforts. **The region itself, Region 4, is investigating some organizational change to give wetlands even more visibility in the formal structure.** We want to elevate that office within the structure in the region. As Dr. Clark has said, on November 15th the Wetlands Forum issued its report, "Protecting America's Wetlands: An Action Agenda." The report, of course, recommends over a hundred specific actions for all levels of government and the private sector as well. EPA is developing its own action plan as the first step to take action, responding as fully as we can within our existing resource constraint. The plan shows some major steps that EPA has underway or plans to initiate which implement specific forum recommendations under EPA's scope of influence. Of course, the Office of Water Programs in Washington will spearhead these actions, but the regions will play the major role in implementing these actions. We are going to continue, of course, to explore further actions in which we can more thoroughly implement the forum's template that they've given us in this report.

The action plan is in the development stage right now. I'd like to share with you some of the ideas that we are considering, that are being discussed with headquarters and with the regions.

First, the EPA has adopted the goal of the National Wetlands Policy Forum, which is to achieve no overall net loss of the nation's remaining wetlands base, to restore

and create wetlands where feasible, and to increase the quality and quantity of the nation's wetlands resource base. In order to achieve this goal, we have established seven objectives. I'll go through these objectives one by one, and give you some of our ideas. Also I will tell you about some of the activities that the region has undertaken to try to bring these objectives about.

The first objective has to do with the planning initiative that was talked about earlier by Dr. Clark. EPA will provide technical support and participate in the application of planning approaches to protect wetland resources, including the preparation of state wetlands conservation plans. Region 4 is presently working on the wetland planning efforts in the western Kentucky coal fields, the east Everglades, the Pearl River basin in Mississippi, and the Florida Keys. We've been involved in a special area management plan in the Mobile Bay and mining permits for Occidental Chemical in north central Florida. In the latter two cases, a long-term plan for protection of wetlands and mitigation of unavoidable losses was developed. We will continue to work with the states and the Army Corps of Engineers to initiate new planning efforts within the staffing resources that we have.

The second objective deals with mechanisms to increase state and local roles in wetlands protection. Again, EPA will provide guidance, technical assistance and support to enhance the role of state and local governments in both regulatory and non-regulatory wetlands protection efforts. **We've recommended that the agency incorporate into its action plan a schedule for delegation of the 404 program to the states.** We're going to investigate means to provide increased funding grants to the states, and we're going to figure out how the states, through their existing resources, can provide funding. Region 4 has worked for a long time to transfer information between states on the effective use of Section 401 certification to protect wetlands. 401 is part of the Clean Water Act which requires the state, before any permit is issued by the Corps of Engineers, to certify to the Corps that everything's all right with the water quality. We have provided the states with a draft of a handbook on this Section 401 certification. We want the states, in carrying out this 401 certification, not to in-

clude just water quality considerations but also to consider wetlands, preservation, and the protection of those wetlands in that certification. We have provided guidance to the state of Kentucky and soon to all the states of the region to discuss the use of this certification. The region is also reviewing its circular national priority list, or its Superfund priority list, to determine if some sites that involve wetlands give us an opportunity for the restoration or enhancement or creation of wetlands. Furthermore, we are discussing the actual assumption of the 404 program with the state of Florida. The state of North Carolina, under a Corps general permit has significant application review responsibilities, and this has been a very effective method for the state to assume a major role in wetland protection.

EPA will work with the Corps to establish and implement a single delineation methodology for regulated wetlands. We're recommending a joint manual on jurisdictional responsibilities between EPA and the Corps. This manual has been in the works for some time now, but we need to finalize it. We need to establish a training course that is applicable to members of both agencies so we'll better ensure consistent application of the methodology in the manual. Region 4 has worked with the Corps of Engineers on wetlands jurisdictional issues associated primarily with the pocosin wetlands, which exist in 19 counties in North Carolina and bottomland hardwoods in the lower Mississippi Valley. The special case not only identified pocosin and bottomland hardwood wetlands as a resource of special concern, but also allowed EPA to provide guidance to the Corps on wetland delineation techniques that are applicable to these systems.

Our objectives are regulatory fixes and enforcement. EPA will increase its enforcement efforts through the application of administrative and judicial penalty authorities. EPA will work with the Corps to increase enforcement against unpermitted discharges into wetlands. Region 4 has been working with the state of Tennessee to invoke the 401 certification program in enforcement actions as a pilot program. We've also been working with the forest industry to prevent use of the 404-F silviculture exemption to circumvent regulatory jurisdiction, and we will re-

view the potential for involving field investigators from other programs outside the wetlands area in reporting what might be potential violations. Again, I mentioned to you we were looking at some organizational changes. We're also looking at increased staffing for the regional office to carry out not only the enforcement efforts there but also the planning actions and the planning assistance that we'll give to the states.

You've heard mitigation spoken of today. All EPA actions will reflect a policy that overall wetland conversions should be fully offset by wetland restoration or creation. EPA will work with other key federal agencies involved in the Section 404 permit program on a joint mitigation policy which reflects the forum's mitigation recommendations.

Let me talk a little bit about mitigation because I think it's an extremely important concept for us all to understand and to grasp. We want to apply compensatory mitigation only to projects which conform to the existing Section 404(b)(1) guidelines. We want to adopt a strong mitigation policy for wetlands, but we want to be sure that mitigation is defined to include avoiding, minimizing, rectifying, reducing, or compensating for adverse environmental impacts. **Any discussion of mitigation should always be prefaced with the concepts of avoidance and practical alternative analysis.**

The region supports the reconvening of a mitigation task force, and we're requesting, of course, that our people be represented on that task force, which is normally done at a national level. We have counseled headquarters while developing this action plan regarding mitigation that we move cautiously in developing policy on mitigation banking. Mitigation banking, entails considerable legal, scientific, and administrative complexities, and it has the potential for being seriously misused. We want to develop standardized criteria for determining the success of mitigation activities. We propose the development of a mitigation scorecard or rating system to be used to evaluate the success of enhanced or created wetlands. We want to consider mitigation banking efforts after compliance with guidelines, and we want to apply this only on small projects — general permits for isolated wetlands that are covered by nationwide permits.

We will work to increase public awareness of wetland functions and values. To increase public awareness beyond the normal developing of brochures and pamphlets and things like that, we're going to target special organizations such as real estate associations, farmers, local zoning authorities and so forth. We also want to see in the state conservation plans encouragement for public awareness; we want the plans to target the elementary education school programs in each state.

Wetlands restoration is another one of the objectives. We have already talked about Superfund restoration or investigating the national priority list for opportunities for such restoration. We also will identify opportunities and initiate some demonstration projects to restore or create wetlands to serve Clean Water Act goals such as nonpoint source pollution and control of stormwater runoff. EPA will also identify areas appropriate for wetland restoration based upon advanced planning processes and consideration of cumulative impacts of wetland losses within watershed areas. We have been involved with TVA (Tennessee Valley Authority) in three demonstration projects in Kentucky using wetlands for waste water treatment. We have proposed another demonstration project at the Chattanooga, Tennessee Nature Center for creation of wetlands for waste water treatment, and we're going to use that as an educational program. We are funding research projects in the western Kentucky coal fields on wetland restoration of coal mine sites. We've also been working with the phosphate mining industry in north central Florida to require the restoration and monitoring of bottomland hardwood wetlands on 3,000 acres.

EPA will continue to develop and test methods for assessing the cumulative effects of wetlands loss and degradation. EPA will work to incorporate these assessment approaches into comprehensive planning and permit decisions for wetlands. On a regional basis, we will review the historic losses which have occurred in the pocosin wetlands. We hope to develop cumulative impact assessment procedures for pocosin wetlands in North and South Carolina and utilize this information in future advanced identification efforts.

Generally, that sums up what we're thinking about in our

action plan. The agency, or at least the wetlands part of the agency, is very grateful for the forum's work. We have needed some goals like this for many years. Now we'll have a tool to work with, an extremely valuable tool in terms of protecting those wetland resources that we value so highly. Thank you very much.

Ms. Margaret Davidson

Thank you, Frank. This afternoon, we will begin with a slide show on South Carolina's wetlands. The person presenting the slide show is Dr. John Mark Dean from the University of South Carolina, a professor of biology and marine science, and active in coastal resource management.

OVERVIEW OF SOUTH CAROLINA'S FRESHWATER WETLANDS

Dr. John Mark Dean

South Carolina is a state of diverse and beautiful landscapes. From the mountains to the sea we have many undisturbed areas; some of the most beautiful and the most critical for man's well-being are our wetlands. Wetlands are transitional areas between land and water systems where the water table is usually at or near the surface and the land is covered by shallow water. They are found in all parts of South Carolina, although most are in the eastern half. They vary in character dependent upon location. Wetlands are not necessarily continuously wet; therefore, investigation of plant type and zonation, soil composition, and water regime is necessary to determine whether an area is in fact a wetland. **About one-quarter of our state, or four and a half million acres, are wetlands.** Although we are the smallest state in the Southeast, we rank fifth in wetland acreage. While nationally, about 54% of the original wetland acreage has been lost, South Carolina has been more fortunate mainly because we have been a relatively unpopulated state. We do know we have lost significant amounts of bottomland hardwood forest; however, precise figures are difficult to find.

A type of inland isolated wetland, called a Carolina bay, has been heavily impacted and now only one to two percent of the original Carolina bays are undisturbed. Our population boom is expected to continue. **A 23 percent increase in population is expected between 1985 and the year 2000.** Since many will want to live near water, and wetlands lie between open water and the land, we will see increasing pressure on these systems.

South Carolina's wetlands can be roughly classified according to where they are found, on or near the coast, or inland. Within these areas there are many different types of wetlands. Coastal wetlands are tidal and can be salt or freshwater or anywhere in between. Saltwater marshes are dominated by grasses, particularly the cordgrass *Spartina alterniflora*. The Southeast contains about 80 percent of the national total of salt marsh. Salt marsh wetlands help dissipate wave energy and decrease land erosion. They are sources of food and nursery areas for fish and shellfish which are commercially and recreationally important. Both salt and freshwater coastal marshes are highly productive areas and are used by a wide range

of migratory and non-migratory birds, reptiles, and mammals, and they offer unique recreational opportunities. Coastal wetlands make up about 11% of South Carolina's wetlands.

Inland wetlands are of two types: those associated with rivers, lakes, and streams, and those isolated from other water bodies. Eighty-nine percent of South Carolina's wetlands are inland. Wetlands associated with other water bodies may be forested or dominated by shrubs, grasses, or sedges. These are flood plain wetlands. As rivers rise during storms, water spreads out into these adjacent flood plains and is released later more slowly. The effect is a reduction in flood peaks in urban areas downstream. Flood plains also act as buffers against erosional forces to the adjacent land. As water slows down and spreads out over the wetland, sediments settle out and various physical, chemical, and biological processes bind the sediment, and in some cases pollutants, in the soils and the plants. The result is clearer, cleaner water in the adjacent waterways. This can mean significant cost savings for purifying water and improved habitat for fish and wildlife. Flood plain wetlands are especially favored by animals because food, shelter, and migratory pathways are readily available.

Inland isolated wetlands have no connection to other surface water bodies. They are upland depressions with standing water at least part of the year. Many are forested, and good examples of these are Carolina bays and cypress-tupelo swamps. Isolated wetlands may be very significant groundwater recharge areas. **As many as one-fourth of the people of South Carolina depend on groundwater for domestic or livestock supplies and irrigation.** Because isolated wetlands generally are very productive systems and have diverse plant communities, they function as significant wildlife habitats. In South Carolina they contain several endangered or rare plant and animal species.

Inland wetlands of both types are used for timber production. Timber is the largest cash crop in South Carolina, the fourth largest source of revenue for the state, and provides greater than 40,000 jobs. All types of wetlands potentially have historical or archaeological value, educa-

tion and research value, and open space and aesthetic value. They also help regulate area climate by influencing air temperature and sometimes air pollution. **All forests, including wetland forests, have a role in global climate regulation.**

How have wetlands been impacted by man? In short, in just about any way you can think of. We have filled them and cleared them, drained them and dredged them, built in them, impounded them, polluted them, and withdrawn water from them.

Nationally, between the mid-1950s and the mid-1970s, 97 percent of conversions from wetland to non-wetland were in inland freshwater areas. Eighty percent of those conversions were related to agricultural activities. Filling wetlands alters the water regime, subjects adjacent and downstream land to increased flood heights, and increases erosion on adjacent lands. There can be extensive changes in the plant and animal communities with the change in water regime. Building on a wetland usually means filling it; sometimes expensive flood control projects are then needed to protect property. Clearing wetlands increases flooding, increases sediment load in adjacent water bodies, and decreases wildlife habitats. Draining alters the entire plant and animal community, usually forever, and alters the way water is exchanged between the surface and underground. Dredging alters water flow, increases sedimentation, and changes plant and animal communities. Impoundment or damming of streams means sediments and nutrients are trapped upstream and are deficient below the dam. Oxygen concentrations in the water can decrease, causing problems for plants and animals. Flooding regime is altered. Adjacent lands may erode, and groundwater flow is altered. Water withdrawals and diversions can lower the underground water table and make less water available for downstream users. When freshwater flow decreases into coastal areas, saltwater wedges from the ocean intrude farther inland and cause problems for municipal water suppliers, private well users, and inland plants and animals. Impacts to streams and rivers inland can directly affect coastal wetland integrity.

South Carolina's coastal wetlands are managed by the

South Carolina Coastal Council, but wetlands outside of the eight coastal counties have no state management and only some minimal amount of protection from the Army Corps of Engineers 404 program. Under this program a permit is required to fill in a wetland, but other impacts are not regulated.

Many of man's uses of wetlands are compatible with retaining the functions of the wetland area, but management is needed to protect the resource. There is a great deal of interest in wetlands protection on the national level. The National Wetlands Policy Forum, convened in 1987 under the auspices of the Conservation Foundation with Governor Campbell as a Vice-Chair, has called for a national wetlands policy. This group of governors, conservation groups, regulators, foresters, oil producers, agriculture interests and home builders have developed broadly supported recommendations which balance wetland protection and economic development. They have recommended that wetland acreage be stabilized in the short term and increased in the long term. They recommend Congress enact legislation requiring each state to prepare a wetlands management plan. They also recommend increasing tax benefits and direct subsidies for conservation easements. Governor Campbell is considering means to implement these recommendations in South Carolina. South Carolina has an invaluable resource in its wetlands. Wetlands are now known to be of great economic and aesthetic value to society, and they require vigorous management to maintain those values for future generations. Thank you.

Ms. Margaret Davidson

Thank you, John. We've asked Dr. John Winberry, a professor of geography at the University of South Carolina, to talk with us about the changes in the cultural context and use of wetlands in South Carolina. How we have evolved as a society has an impact on how we view land and wetlands. John Winberry has been working on cultural geography and coastal geography for a number of years.

CHANGING ATTITUDES AND LAND USE PATTERNS IN SOUTH CAROLINA'S FRESHWATER WETLANDS

Dr. John Winberry

Over the last few decades the competing land uses along this country's seaboard and the resultant destruction of sand dunes and coastal salt marshes have created concern among ecologists and other scientists. They have identified long-term environmental damage to the coast and measured the economic loss due to the disappearance of salt marshes. Their concerns have elicited considerable attention and resulted in the Federal Coastal Zone Management Act in 1972 and the recently passed South Carolina Beachfront Management Act. For the most part, however, freshwater wetlands have not received such attention, although the human impact on and modification of them have been extensive, as we have heard today. At the time of European settlement, wetlands in this country covered some 215 million acres, but the Fish and Wildlife Service estimated only about 45 percent of these, approximately 99 million acres, were existent in the middle 1970s.

The Fish and Wildlife Service in 1982 estimated that South Carolina had almost 2,000 square miles of freshwater wetlands, representing about 6 percent of the state's area. This is a rather conservative estimate because it considers only those wetlands in the coastal plain and of course does not include saltwater wetlands either. Almost 90 percent of these freshwater wetland areas comprise bottomland hardwood forests on riverine flood plains and bays and pocosins. I do not have any data on the amount of wetlands in South Carolina that have been lost or modified over the years, but the one statistic that might provide some insight comes from a 1984 government report. It stated that over half the tidal freshwater wetlands, or marsh areas, in the state were in coastal impoundments, in other words, had undergone some kind of modification. These tidal areas constitute only about 10% of the freshwater wetlands in the state, but many wetland areas have been drained and modified by agriculturalists, foresters and developers through the years.

Wetlands represent the transition between terrestrial and aquatic systems, and they have a widespread geographic distribution across South Carolina. We can divide the freshwater wetlands found in the coastal plain into three types: tidal freshwater wetlands, bottomland hardwood forests, and bays and pocosins. Each is characterized by

a specific geographic location, a particular ecology and a different origin.

Tidal freshwater wetlands, represented in the foreground of this slide, form along the lower part of riverine flood plains. They experience daily tidal changes and flooding and a limited amount of saline intrusion. The Atlantic coast from Georgia to southern New England has the most extensive development of freshwater marsh in the country.

Bottomland hardwood forests are found in the broad flood plains of rivers throughout the Coastal Plain. Underlaid by easily erodible sedimentary rocks, the Coastal Plain area has been worn down to base level, and rivers expend their energy in broad meanders. They undercut adjacent bluff areas and expand the flood plain of the river. Cutoffs result in abandoned channels and oxbow lakes, as illustrated in this slide of the Wateree flood plain near Stateburg in Sumter County. These bottomland forests have become refuges of many ancient species, including the cypress, the alligator, turtle, gar and many amphibians.

The bays, or pocosins, as they were called by the Indians, technically are any areas typified by mucky, peat-like soils, hydrophytic plants and trees, and a generally waterlogged character. In 1700, John Lawson, traveling across the coastal plain of South Carolina, referred to his experience in crossing a bay, and I quote: "It was a prodigious, wide, and deep swamp, being forced to strip naked and much ado to save ourselves from drowning in this fatigue, but with much ado we got through." Lawson perhaps is not very poetic, but he did give a clear sense of what a bay or pocosin was like.

A special kind of bay illustrated here is the Carolina bay, typified by its circular to oval shape, oriented along a northwest-southeast axis and typified by a rim of sand, at least on the southeastern side. Carolina bays are boggy and characterized by swamp trees such as gums and cypress. They occur along the coastal plain in the thousands, varying in size from a few acres to thousands of acres. Much debate has swirled around the question of their origin. Some have argued that a catastrophic event

such as a fragmenting meteor caused the bays, while others have identified normal processes of lake formation resulting from prevailing and dominant winds. All these ideas are reviewed in a very fine book by Dr. Henry Savage entitled *The Mysterious Carolina Bays*.

My purpose this afternoon is to probe attitudes toward the swamp, but also to focus more on the history of land use as it has affected the freshwater wetlands of South Carolina. About eleven or twelve thousand years ago, the first human inhabitants, the native North Americans, arrived in South Carolina. Carrying a simple but effective hunting technology, they settled along the bluffs overlooking the riverine flood plains. Thousands of years later the settlement of Charleston in 1670 began the century-long colonial period, during which time freshwater wetlands played a vital role in South Carolina's economy. The early 19th century saw an increased expansion of agriculture into wetland areas and their clearing for other purposes. But the end of the century and the introduction of extensive logging had a major impact on bottomland forests. **Human modification of the wetlands, therefore, has had a long history and changing land use is evident still today.**

Before turning to the history of land use, however, I would like to spend a little time considering our perception of and attitude toward wetland areas, swamps in particular, because I feel they play an important role in how we use them. John Lawson's description of a Carolina bay represents an attitude held toward bays and swamps throughout the history of European settlement, and Dr. John Brickell in 1737 wrote of pocosins as, "generally the habitation of wild beasts;... being very low wetland and so full of cane and underwood that there is no passing through them." **The swamps have always been dark and foreboding, filled with creatures and plants from the reptilian age, and seemingly resistant to the invasion of man and his civilization.** It is no wonder that Lee County's famous chrome-eating Lizard Man has his home in the Scape Ore Swamp, and even the individual who made the footprints that started that story relied on a basic fear of the swamp for its effectiveness.

This fearful attitude was reinforced by other factors. During the colonial period malaria was a rampant fever that took many lives each summer. Introduced by black slaves from Africa who carried the plasmodium that causes the disease, it was spread by mosquitoes throughout the Coastal Plain. Not until the end of the 19th century, however, was the plasmodium identified as the cause of the disease and the mosquito as its carrier. Throughout the 18th and 19th centuries the disease was thought to come from the bad airs, or "mal aria" — the basis of the name "malaria" — or, as one colonial South Carolinian said, "the corrosive vapors of the stagnant waters [that] evaporate and mix with the air [to] become prejudicial to health and ... cause agues and fevers." As a result, Carolina planters fled their plantation homes during the summer months to escape the hot, close swamps and their miasmas. Fear of the swamp was thus compounded by its perceived role as a source of dread diseases. One interesting point here is that although planters did not realize the disease's association with mosquitoes, their impoundments of water and control of daily flooding apparently increased the mosquito population and ironically, thus, the frequency of the disease.

Some colonial naturalists, however, took a different view of these wetland areas. Eighteenth century artist and naturalist Mark Catesby wrote, "The swamps, so filled with a profusion of fragrant and beautiful plants, gives a most pleasing entertainment to the senses, therein excelling other parts of the country." Others also knew and appreciated the swamp for its aura and protection, and Francis Marion, the famous Swamp Fox, for instance, used the bottomland forests of the Santee and Peedee Rivers as hiding places during the American Revolution.

The turn of the 20th century, however, saw some important changes in attitude toward the natural environment, especially during the presidency of Theodore Roosevelt. First, attempts at national forest designation and expansion of national parks were part of this new mood. But this concern focused less on ecological issues than on the need to preserve natural resources, and conservation programs were limited more to upland forests than scenic areas. The negative and fearful attitudes toward the swamps changed slowly.

The major factor associated with the history of freshwater wetlands has been the change in land use. Our story begins thousands of years ago with the arrival of South Carolina's first occupants. The Cal Smoak site, an archaeological site overlooking the Briar Creek Branch Swamp and the flood plain of the Edisto River in Orangeburg County, provides an archaeological record of human occupation over ten millennia. The hunting and gathering tradition known as the Archaic then dominated the indigenous way of life, and people had to go when and where resources were available. To maximize access to such an array of resources, food supply and such, settlement sites were selected near ecotones, the boundaries between different ecological zones. Not only were ecotones typified by a greater variety of resources but adjacent ecosystems offered the diversity needed by the Archaic peoples. Cal Smoak, for instance, was situated such that six different environmental zones were within three miles of its site. The flood plain, offered a variety of plants and associated fauna including waterfowl, deer, squirrels and turkey, while the adjoining uplands offered rabbits, opossums, squirrel, and a variety of different birds. **The native North Americans seemingly fit into the natural ecosystem, sensitive to its available and seasonally changing resource base.**

But these peoples also actively modified the wetlands environment. John Lawson, again in 1700, reported, and I quote, "We found ... some Seewee Indians firing the cane swamps, which drives out the game, then taking their particular stands, kill great quantities of bear, deer, turkeys, and what wild creatures that the parts offered."

Even after agriculture became a part of the indigenous economy about 3,000 years ago, locations along the bluffs overlooking bottomland forests remained characteristic. Ecotone locations facilitated hunting and gathering but also provided access to rich bottomlands for the planting of corn and beans and other basic crops. Villages frequently were established on bluffs, and the agricultural fields would be laid out in the bottomland areas. Burning of the swamps perhaps allowed the preparation of farming areas as well as successful hunting.

The end of the 17th century saw the beginning of Eng-

lish settlement near present day Charleston. The proprietors of Carolina intended their new colony to make a profit and encouraged experimentation with various subtropical crops, none of which achieved any commercial success until almost a half century later. In 1699 the Earl of Bellemont recommended the development of the forest industry in South Carolina, but this focused largely on interfluvial pine lands rather than the swamps. During the 18th century, however, a water-powered sawmill was located in a bay or swamp area thirty miles north of Charleston. Canals were dug into the swamp to remove cypress logs which were used to make roofing shingles for export. In 1759, references to cypress lumber and sawmills appeared in the South Carolina Gazette, but still, the major timber exploited was pine throughout the colonial period.

One of the major economic activities that developed early in colonial South Carolina was the raising of livestock, and by the 1680s, barely 10 or 15 years after the establishment of Charleston, visitors reported large herds in the colony. Livestock raising was very much a frontier occupation, spreading into the forests of coastal and then interior South Carolina. The cattle grazed primarily in the upland forest but also used the swamps for food. Here the frequent burning which the Indians and also the Europeans followed had expanded the cane breaks along the edges of the swamps, and again, John Brickell in 1737 referred to, "the swamps where hollow canes, myrtle trees, and several sorts of vines grow and produce good pasturage for cattle." In 1712, James Freeman, a South Carolinian, commented on the importance of swamps, "there is a sort of short cane growing plentifully in the lower moist land which bears a long green leaf in winter on which the cattle delight much to feed."

But the real exploitation of the freshwater wetlands involved the planting of rice. Rice had been introduced into Carolina in the late 17th century, but only in the early 1700s had it become an important commercial crop. Initially, freshwater swamps were cleared for rice fields, and embankments created reservoirs in the riverine flood plains. This began the exploitation of the bottomland forests on a larger scale and brought some cypress lumber to market, but the cypress logs for the

most part were piled into windrows and burned. By the 1760s a new technology was developed which shifted the bulk of rice production to the freshwater tidal marshes near the coast, those areas that experienced a daily flooding because of tidal change. Canals were cut to drain the marshes, earthen dikes were raised to impound them, and rice production took on a specific geographic distribution along the coast of South Carolina.

The key to the tidal system was the rise and fall of water level in the rivers flowing to the coast. High tide causes the rivers to rise by backing up the waters and flooding the marshes. Along the immediate coast the tidal bore introduced saltwater, but farther upriver the waters flooding the bottomlands were fresh, and here rice planters laid out their fields. A wooden culvert with an outswinging door on both sides of both ends allowed water to enter and leave the fields with the tide. At high tide with the river gate raised and the field gate lowered, water from the river rushed through the trunk to flood the fields. But that water could not escape during low tide. To drain the fields just the obverse would occur: the river gate would be lowered and the field gate raised. Thus the fields were flooded and drained by using the energy of the tides.

For almost a century rice planters made use of this unique technology as the basis of their great success. In the early 1850s, 98 percent of South Carolina's rice was produced on the coast in these tidal areas, and of the 559 rice growers in the nation producing more than 20,000 pounds per annum, 446, or 80 percent, were in South Carolina. Tens of thousands of acres of marsh and swamp in the state were impounded and transformed into rice fields, and the basic geographic patterns are still evident on topographic maps, as here illustrated, and in the landscape.

South Carolina's rice planters, however, were not the only agriculturalists aware of the productive soils of the wetlands. The state geologist, Michael Tuomey, wrote in 1848, "The alluvial soils of the state are exceedingly valuable.... they are often of great depth, amounting in many cases to from ten to twenty feet in some of the rivers. The whole is composed of black mud — being de-

composed vegetable matter mixed with sedimentary matter." These alluvial lands had long been cultivated, even back to the indigenous period, but in the 1840s there were concentrated attempts to drain and impound more of these wetlands for agriculture. James Hammond cleared and drained extensive areas of swampland along the Savannah River and urged other planters to follow suit. Although some land was not good for cotton, it could be turned to corn. In 1880 Harry Hammond in a study of cotton production in the South, reported considerable swampland in South Carolina being cleared between 1845 and 1860, although primarily for corn. The rich soils enticed planters, but to be successful, drainage projects had to be on a large scale.

In 1856 the South Carolina Assembly passed an act to promote draining and improving the inland swamps. This provided that two-thirds of the owners of two-thirds of the land of a particular swamp area could form an association or corporation with a limited power of eminent domain and self-assessment to pay for draining an entire area. This arrangement, however, was not that widely used. Still, a considerable amount of wetland apparently was cleared during the first half of the 19th century.

The disruptions of the War Between the States and Reconstruction lasted for many decades after 1860, plunging South Carolina and other Southern states into a deep poverty. Still, the region had important resources in its vast forests, extensive river systems, and cheap labor. As the 19th century neared its end, two themes dominated the region's economy. The first was the elusive idea of Henry Grady's "New South" and its promise of economic success. Second and related to that idea was the introduction of Northern capital to the region to exploit its resources. Henry Savage has written of these themes and argued that the Northern industrialists took advantage of cheap labor to build a textile industry and of underpriced lands to control vast forests for profit that benefited the state and region only slightly.

By the turn of the 20th century, the rice industry in South Carolina was on its last legs. In 1860 the industry had produced 120 million pounds of rice, but this plun-

meted to only one-half million pounds in 1910. Land was readily sold to pay taxes and satisfy debts, and northern industrialists came to control many of the old rice and cotton plantations along the coast. In 1930 out-of-state owners controlled about 60 percent of the former rice plantations in Georgetown County. Many of these were managed for wildlife and hunting and kept in a quasi-natural state, preserving many of the old impoundments and trunk systems.

The bottomland forests of the interior, however, had a different story. By the early 1880s the vast woodlands of the Great Lakes states had been cut over and exhausted, and lumbermen looked south. Logging, as already noted, had a long history in South Carolina, but the scale had been limited. By the 1890s, however, timber companies had purchased hundreds of thousands of acres and opened large, steam-powered sawmills. Before 1890 South Carolina's lumbermen had not exceeded 200 million board feet each year in annual production, but this had more than quadrupled to 900 million board feet by 1909. Swamp trees, probably, constituted no more than 25% of this, but logging railways, as here illustrated from the area of Beaufort, were built into swamps to remove the cypress, the gum, the tupelo and cottonwood trees that had been cut.

Cypress was the most important tree of the swamp because of its durability, and represented by value about 8 percent of all logs cut in 1905. The Atlantic White Cedar was found useful for telephone and telegraph poles and was also lumbered extensively. Swamp hardwoods were cut especially for veneer, about one-half of which was used for furniture-making. High grade hardwoods were used also for plywood production, while lower grade hardwoods were used for crates, for baskets, and other boxing material. Timber holdings had been acquired at very low prices and were rapidly cleared.

Logging was at its high point during the four decades surrounding 1900, and by World War I many large mills found their lands exhausted or severely depleted. By 1930 South Carolina's total timber production fell to less than 400 million board feet. A new ethic began to affect South Carolina forestry: the need to conserve and en-

hance production. For the most part, this attitude was related to the expansion of pines, and even cut-over bottomlands were planted with valuable and multiple use southern yellow pine. The slow growing cypress and swamp hardwoods gradually reclaimed many bottomland areas, but the pattern of forest clearing and modification of the swamp had been well established.

In the 1930s plans were made to exploit another South Carolina resource, flowing water, for power production. The rivers had been used for transportation since the colonial period, and as early as the 1790s improvements were made with the construction of canals. The first of these canals was built to connect the docks of Charleston along the Cooper River with the Santee River system that drained much of the state's interior. The 22-mile long Santee Canal was dug through the riverine flood plain and was one of the first modifications of bottomland areas related to river use. The earliest production of hydroelectricity in South Carolina came from dams built on streams in the Piedmont in the latter part of the 19th century, but plans to develop a reservoir and power generation plant along the Santee and Cooper Rivers, where a 35-foot drop in relief could be used, took form in the late 1930s. By 1943 dams on the Santee and Cooper Rivers created two reservoirs that flooded more than 150,000 acres of forested bottomlands -- Lake Moultrie and Lake Marion.

The dam building craze took off with a vengeance after the Santee-Cooper complex began producing electricity, and plans were made to dam virtually every potential river in South Carolina. A six mile long dam was proposed at Buckingham Landing, just below the confluence of the Congaree and Wateree Rivers which would create a 186,000 acre reservoir that would flood the bottomland forest to Camden and Columbia. This project, of course, never materialized, but other problems began to develop in relation to the Santee-Cooper complex.

Charleston Harbor began to experience an increased silting that affected harbor navigation. Geologists concluded the basic cause of this was the redirection of flow of much of the Santee River into the Cooper River into

Charleston Harbor. To resolve this problem, the Corps of Engineers built a redirection canal around the city of St. Stephen in Berkeley County to carry water out of Lake Moultrie and put it back into the Santee system. This new canal was cut through the flood plain and will return the ecosystem in the lower Santee to freshwater habitat and make many changes in the flooding regime and biotic complex.

This paper has reviewed the changing patterns of land use that have affected South Carolina's freshwater wetlands, focusing on the indigenous period, rice planters, and the clearance of swamps for agriculture, lumbering, and hydroelectric development. But the resources of the bottomlands are still recognized, and continued trends of exploitation are well in place. In South Carolina, Carolina bays have been drained extensively for agricultural purposes. This practice has been going on at least since the 1890s, but the 1985 Food Security Act, passed by the federal government, and its restriction on wetland clearance may limit this. In fact, the Soil Conservation Service people said that there have been no wetlands cleared in South Carolina since 1985, so we'll have to see what the impact of this will be in the long term. South Carolina's freshwater wetlands, therefore, have had a long history of land use and modification and face even greater threats today. Knowing what has happened to them in the past provides us an important perspective, but at the same time it does not free us from the need to evaluate and plan carefully for their future. Thank you.

Ms. Margaret Davidson

Thank you, John. In the following panel discussion, we will present to you a hypothetical case study of a possible development activity here in South Carolina, and we're going to ask the folks on the panel to work with that case.

First, I want to introduce you to Trish Jerman, who will be the moderator of the panel. Trish is the area representative for the Carolinas for EBASCO Envirosphere, which is an environmental consulting company. Under Governor Riley's administration, she was the head of the Governor's Office of Natural Resources, and while there she established and chaired a state task force to coordinate data ac-

quisition and policy development on wetlands. She is also a member of the board of the South Carolina Wildlife Federation.

The panelists include Jimmy Chandler, who is director of the South Carolina Environmental Law Project. A native of the Georgetown area and a lawyer, he's recently moved back to Pawley's Island and has been involved in recent litigation at Willbrook and at Debordieu developments on the coast. For a long time, Jimmy has made a lively but perhaps lean living as an environmental attorney.

The next panelist is Vivian Newman, who is in her third year as chairperson of the National Coastal Committee of the National Sierra Club. Although she currently lives in Maryland, she has roots in South Carolina. Her father was from Allendale and is a Citadel graduate. She's also the chairman of the Maryland Wetlands Committee and has served on a task force for non-tidal wetlands.

Duncan Newkirk founded Newkirk Environmental Consultants in Charleston in 1984. He's from Jacksonville, Florida and is a graduate of the University of Georgia. Before Duncan entered the private sector he was the deputy director and permit administrator of the South Carolina Coastal Council.

Le noir Sturkie is a member of the South Carolina House of Representatives from District 88, and he was the chairperson for the Environmental Affairs Subcommittee of the House Agriculture and Natural Resources Committee. He's an attorney from Lexington County, which is West Columbia, and has been a Republican member of the House since 1984.

Last but by no means least, is Kurt Wassen, president of Westvaco Development Corporation. Kurt, who lives in Summerville, serves on the Executive Committee of the Charleston Trident Development Board and is a member of the Industrial Development Research Council. He's a former chairman of the Dorchester Planning Board and is active in many civic and professional associations. And with that, I will turn it over to Trish Jerman.

A SOUTH CAROLINA CASE STUDY OF FRESHWATER WETLANDS

Ms. Trish Jerman, Moderator

We've been talking in generalities this morning, and we thought it would be good to wrap up by focusing more on a specific hypothetical case study. The parcel contains 220 acres of high land, 100 acres of wetland. Within that 100 acres of wetland there are approximately 40 acres of freshwater marsh adjacent to the creek, 30 acres of scattered, isolated red maple and sweetgum wetlands, and 30 acres of flood plain, bottomland hardwood. The hypothetical project consists of a hundred acres of half-acre lot, single family houses, another hundred acres of quarter-acre lot patio homes, 20 acres of condominiums, 20 acres of an equestrian complex, and 5 acres of a tennis complex. Now we're going to ask for reactions from various members of our panel to this proposal, pro and con. We will begin with Vivian Newman, who's going to talk in fairly general terms about the Sierra Club's position on wetlands from the national focus.

Ms. Vivian Newman

We at the Sierra Club would like to think that we're precursors to the National Wetlands Policy Forum because we started this agonizing process of developing a national policy on wetlands several years ago. Developing a policy was not as easy as you might think, even though Sierra Club members agree with one another on many things. Throughout the process, we discovered that people in different parts of the country wanted more and more stern wording. I want to read a little bit from the text just to give you an idea of where we're coming from.

We are advocating a consistent public policy to preserve and restore the hydrologic, biologic, and aesthetic values of wetlands as public assets. We place the highest priority on the protection of existing natural wetlands. Because our goal is to reverse, not merely slow, the trend of wetlands destruction and degradation, we also support restoration of degraded wetlands. Wetlands protection should be promoted further through increased public understanding and enjoyment of wetland values through compatible uses. In order to increase the quantity, diversity, and quality of the nation's wetlands, we believe that public incentives to wetlands degradation should be removed, and we list all the possibilities such as tax benefits for development, of conversion, and so forth. We also believe that public incentives for wetland protection should be

extended to include tax benefits, transfer of development rights, and all the possible variations of those things. Public and private agencies or trusts should acquire wetlands for preservation management, research, and education. We support the establishment and strengthening of federal, state, and local programs for planning management and regulation of human activities that affect wetlands. These programs must be adequately funded and staffed to provide ongoing inventory research, surveyance, enforcement, and education. All proposals for development activities in wetlands should be considered to be environmentally significant and therefore must be subject to an environmental assessment or environmental impact statement and public review. Public and private use of wetlands must not involve obliteration or significant alteration that would degrade their natural functions. Filling, excavating, grading, and other direct and indirect disruptions should be prohibited. Advanced identification of critical wetlands should be utilized to avert damage to these areas. We have a pretty absolutist idea about what should be done about wetlands. Those are our premises.

Ms. Trish Jerman

Let's turn now to Kurt Wassen, who has a somewhat different approach to how to handle wetlands. Kurt, please illustrate, on this diagram what you would do with this particular parcel of property if someone handed it to you.

Mr. Kurt Wassen

In approaching a tract like this from a development standpoint, **first we would try in our design to avoid as much of the higher productivity wetlands, characterized by areas of marsh and creek-bed with adjacent bottomland hardwoods around it.** So avoidance of higher quality wetland is the first thing we try to do. Next, as you design the layout of this subdivision, which would involve two hundred acres of single family lots with some auxiliary facilities like condominiums and an equestrian complex and a tennis complex, you'll find that in order to utilize this tract economically, because of the scattered nature of the isolated wetlands, you'll have to invade many of these wetlands. Now, you have two alternatives. You can work around the wetlands completely. These wetlands vary in size from a

HYPOTHETICAL REAL ESTATE DEVELOPMENT PROJECT

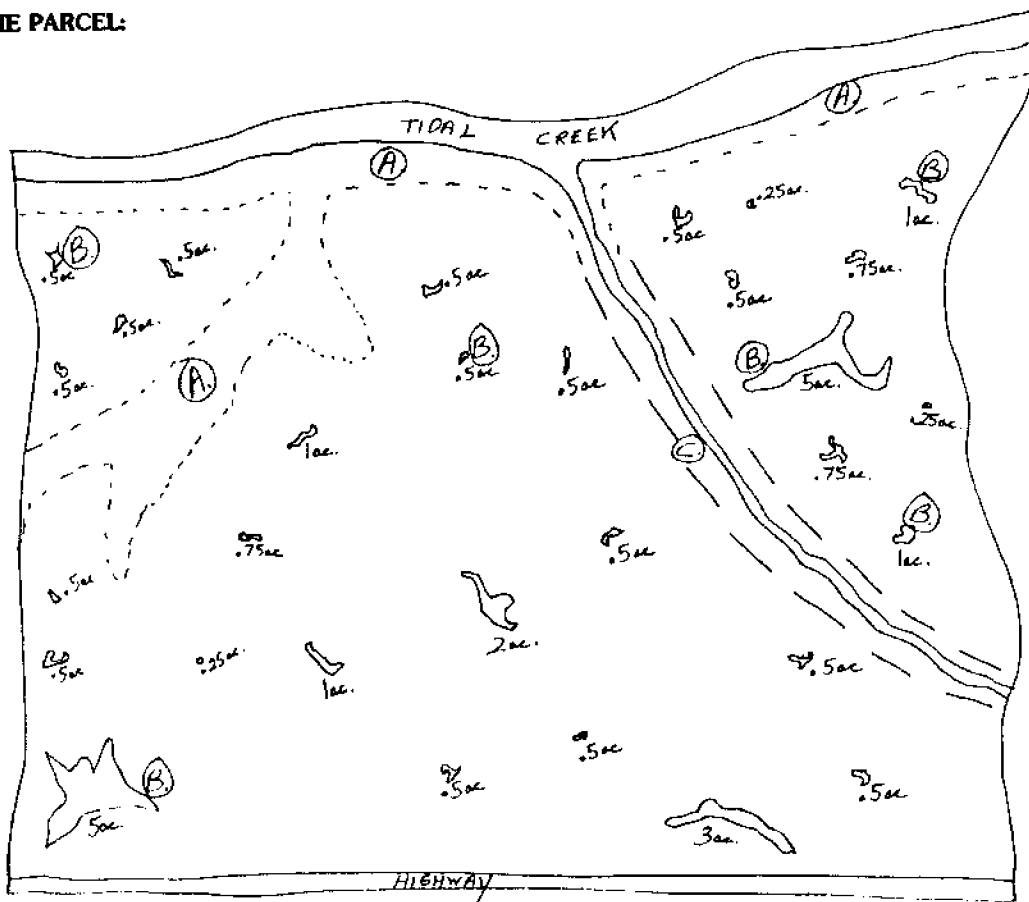
THE ACREAGE: 220 acres high land
 100 acres wet land:

- A. 40 acres of fresh marsh adjacent to creek, wet year-round
- B. 30 acres of isolated red maple & sweet gum, wet < 60 days/year
- C. 30 acres of floodplain, bottomland hardwood, wet < 30 days/year

THE PROJECT:

- 100 acres - 1/2 acre lots, single family
- 100 acres - 1/4 acre lots, patio homes
- 20 acres - condominium complex
- 5 acres - tennis complex
- 245 acres

THE PARCEL:



half acre up to five acres. Actually, there are 26 isolated wetland parcels that make up only 15 acres, so they average less than an acre in size. Because of their scattered nature, you'll probably find it very difficult to locate houses around there without invading some of these wetlands.

Now, if you invade more than 10 acres of these wetlands — as I say, there are 15 acres of these isolated wetlands that are one acre or less in size — it's immediately going to put you under the Corps of Engineers 404 regulations. But remember that these very small isolated wetlands provide very little wildlife habitat. They're too small to be very significant for erosion control; and they provide virtually no recharge to the aquifers, because if they did, they wouldn't be isolated wetlands in this area. Most of your isolated wetlands result because the substrata are impervious clays and keep the water on the surface.

To utilize this property, you will need several road crossings. Probably you will have to bridge this wetland in one place, probably in this area. Over here, in order to get to this tract on the right, you're going to have to cross the stream once or possibly twice depending on how you design your layout. You could cross these various areas in two or three places with no more than probably two acres of fill. You could either put a box culvert across it or pipe, with earth fill around it, and that fill could be done under the exemption, National Permit No.14, which provides for minor road crossings.

In carrying out this development, one of the things that is called for in the development is 20 acres of an equestrian complex. Bottomland hardwoods and a creekbed can very easily be incorporated into the design of that. Horses need places to graze. They also need places to get their feet wet. So at least part of that flood plain could very easily be used for the equestrian complex.

Now, there are three isolated wetlands that are from three to five acres. Several things could be done with those. As I mentioned, a number of these isolated wetlands are probably going to have to be filled in order to lay out a subdivision economically. To mitigate and make up for those fills, you could enlarge one of these five acre wetlands by excavating outside the wetlands and even excavate some of the

wetlands, although the agencies are becoming more and more reluctant to let you excavate even within a wetland. You could create literal shelves around those which would be areas for emergent wetlands species to grow. And then you can also buffer these areas. **Unless you place some buffer around these wetlands, your development is going to have an adverse effect on the wetland areas sooner or later.** If you develop right up to each one of these isolated wetlands, in time, because of the character of development where you put in drainage ditches, your water table is going to drop. You have to put in drainage systems in order to develop a subdivision, and you have to put in roads which create drainage. Some of those areas are going to be adversely impacted and will probably lose their wetland character in time. So that's one reason why we would not be hesitant to fill some of those and mitigate in other areas. Let's say you fill 10 or 15 acres of wetlands. Combine that and group them together and come up with larger wetland systems adjacent to it to mitigate the loss of the 10 or 15 acres that you filled.

I think now might be a good time, Trish, to show my slides. Previous slides showed some beautiful examples of freshwater wetlands, and I don't know of any self-respecting developer who would advocate invading virtually anything that you saw in those slides. But I want to show you some slides of freshwater wetlands that were not shown in any of those earlier presentations.

These are jurisdictional freshwater wetlands. Nine, ten months out of the year, you will not get your feet muddy or wet in these wetlands. All freshwater wetlands are not like the ones that John Dean showed in the slides. These wetlands, the kind that I just showed you, are the ones that are giving developers the hardest time. Unless we have some accommodation for these wetlands, because they are so scattered, economic development in the coastal plain is going to be severely impacted.

Ms. Trish Jerman

Thank you. Duncan, how might you do things differently if this were your parcel to play with?

Mr. Duncan Newkirk

My one-man company specializes in helping people start

developments very similar to this hypothetical one. First, in the ideal situation, we would demand that the property not be purchased under any kind of conditions until all the wetland boundaries have been established, until the boundaries have been either signed off by letter or until the plats have been surveyed and platted with points and signed by the Corps and the Coastal Council. That's one of our strongest stipulations. We would do our best to get the potential purchaser-developer to layout a land plan on the property before he purchased the property to see if it was economically feasible to develop the property without any major alterations in wetlands. We've learned from hard experience that if you want to do a development on the coast these days, you'd better do it this way or you're going to get bogged down. In fact, you'll probably lose your shirt.

We would propose pretty much what Kurt said. We'd avoid all the wetlands. You'd probably need a crossing over each one of these linear wetland systems. We would stay out of any wetland an acre or more. We would like to be able to fill some of the three-quarters to a half acre isolated wetlands, and we would propose a permit. We would certainly be in Nationwide 26, less than 10 acres. We are presuming we're in the Coastal Zone, so we need Coastal Council certification. We'd propose a mitigation for that by either creating or putting buffers along the bottomland or the tidal wetland systems. It is common to dig out these wetlands because you can do that under the 404 program as long as you don't fill, but we no longer recommend that. We don't recommend that the developer try to put lake systems in the wetlands. If you leave the wetlands exactly like they are, you use them as open space in the development as parks. I've been through a couple of developments where we've sold lots and we've had no problems selling wetlands as part of a lot as long as you clearly deed-restrict the wetland as part of that lot. The buyers understand that they can't alter the wetland.

Wetlands have become a tremendous consideration in development. My business has boomed because most banks on the coast of South Carolina will not let a developer close on a piece of property until he has a complete wetlands survey signed and approved by the Corps of Engineers. **The bank will not give you a construction loan for a commercial or development project until**

it knows that the project can go forward without a wetland problem. We've had two or three cases where the lawyers called us at the last minute. We've stopped or held up a closing for as much as two years because there was suspicion of a wetland problem. The bank may refuse to close on a project until the wetland issue is resolved, or until a decision is made to develop around it or to get a permit to fill it.

Now let me tell you what happens when you have to bridge one of these linear wetland systems. You're probably looking at the difference in development costs between a couple of hundred thousand dollars for a causeway, and about a million or a million and a half dollars for a bridge. That's a tremendous development consideration. If the developer doesn't want to build a bridge, he's almost forced into a permitting process. That permitting process takes his time and money, takes the agency's time and money, may take Jimmy Chandler's time and money if he has to get involved in some kind of litigation or appeal for his clients. And that's the kind of thing that should not happen. **A tax incentive is a good idea for non-use of wetlands.** That gives the developer some incentive to stay out of these permitting situations, to bridge some of these areas, to try to fill or dig up less of these wetlands.

My pet peeve in this wetland business, is that we need some kind of Land Bank situation for mitigation on wetlands. When we develop around this half-acre wetland right here, we probably lose much of its value as a wildlife habitat because I feel not only that the wetland is important but the ecotone system and high ground around it is important as habitat. Even if we put a 75-foot buffer around it, you've still got a housing project around it. It can't possibly be that important as it was as a raw piece of land for a wildlife habitat. I think we might use some of these small wetland areas in developments.

Ms. Trish Jerman

Thank you, Duncan. We're going to give Jimmy the opportunity now to tell us how he would respond if this were real instead of hypothetical.

Mr. Jimmy Chandler

The proposal as originally presented to us, as you see up

here, was that there would be 220 acres of high ground and 245 acres of development. I was prepared to hear a proposal today to fill 25 acres. I haven't heard such a proposal from either Kurt or Duncan. Their idea of using some of the flood plain for an equestrian center I think we would support. Uses can be made of these wetland areas when they're only wet for thirty, sixty days out of the year. The wetlands can be used the rest of the year without filling them, without altering them and losing the wetland function.

My approach to wetland permitting is from a public policy management perspective. What is the loss to the public of the alteration of these wetlands? What functions are we going to lose? Are we going to lose flood capacity? Are we going to lose wildlife habitat? Are we going to lose aquifer recharge? Are we going to lose filtration? What will we lose if we allow these wetlands to be altered? Then we need to look at what we will gain. What does the public stand to gain from this? **The Supreme Court said in the recent Willbrook decision that if you're looking at only economic gain for the developer and others who are working with the developer, then that's not a good enough reason to constitute overriding public interest, and therefore to allow alteration of these areas.** Frankly we were surprised and pleased at how strongly the Supreme Court ruled. Now we need to ask regarding a project if the evidence is clear and convincing that an alteration of the wetland is going to result in net public benefits, and how clear is it that we are going to get these public benefits? Are we actually going to replace all of the wetland functions by mitigation?

One of the biggest problems with mitigation is that it is handled on a case by case basis without strong guidelines as to our overall goal. If mitigation is going to be factored in, we need guidelines so that we know where we're going. If you read the Coastal Management program, if you look at the Coastal Zone Act in South Carolina, you will not find the word "mitigation" in there. It's not part of the regulations. It's not part of the Coastal Management program policies, yet mitigation is discussed on an awful lot of permits. We need some guidelines to begin developing clear policies.

Ms. Trish Jerman

When Kurt and Duncan talked about what they were going to do, they cited law that would presumably enable them to do what they wanted. But Jimmy, you talked in terms of not allowing developers to make alterations in wetlands unless there was a clear public benefit rather than an economic benefit to a private interest. What am I missing here that makes Kurt and Duncan think they can make alterations and you, Jimmy, think they can't make alterations?

Mr. Jimmy Chandler

You can always find something in the law to support a position one way or another. Until August 8th, we didn't know that private economic benefit could never constitute an overriding public interest in South Carolina, at least in the coastal zone. Now we have some evolving laws and until we get clearer laws, people will pick out the parts of the law that they like the best.

Ms. Trish Jerman

All right, let's play with the law a little bit. Let's say that tidal creek up there at the top of the picture is not tidal but rather is a freshwater creek and this is an inland tract. How does that change what the developers want to do with it?

Mr. Kurt Wassen

If it were a freshwater creek, not tidal, the Coastal Council is out of the permitting process, out of the certification. I'm assuming when you say that it's not tidal that it is out of the eight coastal counties. We have a double standard in this state because the Coastal Council does not recognize the National Permit 26 of the 404 process that the Corps of Engineers does. Any fill at all needs certification by the Coastal Council. Under Permit 26 of the 404, you can fill up to one acre without any permit, and you can fill up to ten acres with notification to the Corps. If the Corps does not object, you could presumably fill up to ten acres. So, if you design this project without exceeding ten acres of fill, you would not have to apply for a permit under 404, and you wouldn't have to deal with the Coastal Council. Therefore, your permitting process would be significantly shortened. Today in the

coastal counties, you have to deal with the Coastal Council, and then you have to apply to the Corps of Engineers for your permit, and of course that brings in other agencies, too, like the U.S. Fish and Wildlife Service, the archaeologists and the S.C. Department of Health and Environmental Control (SCDHEC).

Ms. Trish Jerman

Are you telling us that you would fill up to ten acres if you had this as an inland tract?

Mr. Kurt Wassen

You wouldn't necessarily fill it, but all I'm saying is that the process for an inland tract is much less complicated.

Ms. Trish Jerman

Duncan, would you do anything different?

Mr. Duncan Newkirk

In this hypothetical land plan, there is an unusual amount of isolated wetland that would be awfully hard to plan around. That hypothetical piece of property would be awfully hard for anybody to develop without filling some wetlands, because they're just scattered all over the piece of property.

Ms. Trish Jerman

What would be the environmental reaction if this project were done outside of the coastal zone and you didn't have the Coastal Zone Management Act to fall back on as legal recourse? Jimmy?

Mr. Jimmy Chandler

Well, it would be a lot more difficult, obviously. The Coastal Zone Management program is the source of all the policies that require an overriding public interest — lack of feasible alternatives — before wetland alterations can be approved. **Outside the coastal zone, in the 404 program, if you're dealing with less than one acre, you don't even have to notify anybody; you can just go in and fill.**

Ms. Trish Jerman

Let's talk about, very quickly, changes that you guys think would be important to make wetlands management

as you would like it to be — the ideal — rather than as it is now.

Mr. Kurt Wassen

There are several things we would like to see done. One is the removal of the Coastal Council from jurisdiction over isolated freshwater wetlands outside the critical zone. This would eliminate duplication and the need for certification so that the developer would be working only with the Corps of Engineers. Now, there's no lead agency that you deal with. You have to deal with all of them. The permitting process is ungodly long, believe me. We've spent over two years trying to get a project approved, and that is a long time to have your money tied up.

Second, we need a classification system for freshwater wetlands. If you can come up with a classification system that would classify wetlands as low, medium, and high value, then you can develop a positive mitigation policy, and develop guidelines that would allow you to work with the low quality wetlands.

Mr. Duncan Newkirk

We desperately need to simplify our permitting process. We need a more uniform system so that we get an answer, "yes" or "no," more quickly from the environmental review agencies. And we need a well-defined appeal system that works on both sides.

Mr. Jimmy Chandler

One of the things that the Sierra Club and a lot of other groups are going to be working on over the next couple of years is the enactment of a comprehensive freshwater wetlands protection act. **Thirty eight of the 46 counties in South Carolina don't have any kind of state wetlands protection system.**

A hundred years ago we thought that wetlands were wastelands, places that ought to be filled and drained. Perhaps 40 or 50 years from now, after we fill many of these "low quality" wetlands, isolated areas that are only wet for a little time of the year, we will discover that we've created another serious problem. We've got to move very carefully and not assume that some areas are low quality. Now, while saying that, I also understand the

realities, the limitations of environmental groups keeping in touch with development proposals. The priority must be to preserve the wetlands that everybody agrees are "high quality" wetlands; and we need to direct the major efforts towards clearly identifying and strongly protecting the areas that everyone acknowledges are valuable. **The burden should be on the developer or on the industry to establish that an area it wants to alter is of low value. There shouldn't be any assumption that it's of low value.** We know that the permitting process often takes a long time. But if you analyze what happens during a one or two-year permit decision process, you often find that a developer will submit a plan that an agency has to say "no" to. My experience is that the regulating community will work very hard with developers to try to get the developers to modify their plans to come up with something that the regulators can say "yes" to. And these modifications take time. If a plan is turned down, it has to go back to the engineers, to the planners and the designers, and then there are constant negotiations and trade-offs. Often plans are submitted that simply can't be approved. But once developers understand better what can be approved they will do better planning so we can reach decisions on a more timely basis.

Ms. Trish Jerman

These have all been interesting suggestions, some of which can't be enacted without conflicting with others. These conflicts put the burden of action on the General Assembly or on Congress. I'm going to turn now to Representative Sturkie and get his feel for how the General Assembly is going to react to these proposals. There have been several proposals for wetlands legislation introduced, and obviously various groups of actors have very different ideas about how this legislation should look. Representative Sturkie, can you give us a feel for what's likely to happen in the next year or two?

The Honorable Lenoir Sturkie

That's a very interesting question. It is rumored to be true that we will have at least four or five different wetlands bills being introduced in the General Assembly this year. Now I know of one bill that has been drafted, and I'm still trying to see where the others may be coming

from. There is growing interest in the General Assembly to do something about the question of protection of wetlands and how far that protection should go. I spoke with John McMillan, who is working with the Governor's Office in developing a wetlands policy. And of course the Governor is advocating the development of a statewide wetlands policy. In my conversations with the Governor, he has indicated to me that basically he wants to define what our wetlands are, and then to protect those wetlands that we think should be protected. But the problem is to balance the interests.

The General Assembly does have an extreme interest in establishing a statewide policy for wetlands protection. However, trying to get a medium ground between two different interests, to balance the developers' perspective and the environmental perspective, you have to hit the medium ground, to reach compromise to get a bill through the legislature. I hope we move quickly on dealing with this issue.

One of the problems that we may have with this particular bill, is the group that protects the farmers' interest. In South Carolina, the farmers have one of the biggest groups. They have a fear of someone telling them what to do with their land, with their wetlands or with streams going through their property.

I'm sure that we will be having public hearings on the wetlands issue. I'm sure many of you will be attending those public hearings, because I, along with many others, are novices at many of the issues that are involved in wetlands. It will be a learning process for us to determine what is the best policy for the state to follow, who should have jurisdiction, and what should be the permitting policies.

We've got some people on the committees and in the House who agree that the saving of our wetlands is a very important issue. They want to do something about this particular great natural resource that we have in South Carolina. We want to try to protect it and at the same time, if we can, balance the economic growth and the development that South Carolina is currently experiencing .

Ms. Trish Jerman

Thanks. Now we want to open the floor to the audience to ask questions. In addition to the folks sitting up here to answer questions, most of the people who have been on prior panels today are still here. In addition, sitting in front are some state agency and federal agency people. We have Sally Knowles from DHEC, Danny Johnson from Water Resources, Don Hill from the Corps, and Roger Banks from Fish and Wildlife. There are also some Wildlife and Marine Resources and Coastal Council representatives scattered around the room. So, if you have any questions that require a regulatory or a technical focus that those people sitting up here can't answer, we'll nab someone from the audience to answer. Yes, in the very back...?

A Spectator

I have a question for Mr. Wassen from Westvaco. I've got to applaud your courage for coming here today [laughter]. Even though Westvaco has an outstanding reputation as being an environmentally sensitive organization, you have committed the dual sins of being both a developer and a forester. But I'd like to ask you from a public relations standpoint, how well deserved, do you think, the reputation of developers is? There seems to be a very negative feeling here against developers.

Mr. Kurt Wassen

Like in any other activity or profession, there are always some who don't perform at a high level, who don't maintain the standards. I appreciate your comment. We do try to do a good job and be sensitive to the environment. **Most developers try to be sensitive today, but remember, basically they are responding to forces in the marketplace.** They build what people want. Now, obviously they miscalculate and a project goes down the tubes, but basically what we do is market-driven. We don't develop property for the sake of ourselves. We develop it because there's a demand for it, and we're in a fast-growing area, so there's still plenty of demand. If we don't develop it, somebody else will.

A Spectator

I have a question for Representative Sturkie. I was wondering how the Representatives feel about the monitor-

ing program. With the laws we have now, a developer can get a permit, and the agencies say, "Well, you can have a permit if you mitigate here and if you don't touch this area." But we see very little monitoring by the agencies, verifying that the developers have done what was promised. Do you have a feeling for that?

The Honorable Lenoir Sturkie

Probably most of the General Assembly is like me — they probably don't understand what you're talking about. I'm not meaning that as a slam against the General Assembly; it's just that the General Assembly has delegated the monitoring to someone else. It is very difficult for us to watchdog the monitoring unless a problem is brought to the attention of a particular committee or individual. Possibly the General Assembly should examine whether the monitoring is being done; then the Assembly could change the legislation that allows that monitoring, or revise it, or change the oversight procedures.

Ms. Trish Jerman

Any other questions?

Ms. Sally Knowles (S.C. Dept. of Health and Environmental Control)

One of the recommendations of the Committee of the Future that met at Hilton Head was to create an umbrella natural resources agency. Does the panel see an umbrella agency really happening in the future? And would such an agency decrease the permitting problems you've been talking about?

Mr. Jimmy Chandler

I doubt that you can get any one board or group of people in this state that has the time or inclination to become knowledgeable enough to make informed decisions on all of the variety of environmental issues that come up in the permitting process. If you're going to turn all environmental problems over to a group of five or seven people, these people are going to be swamped. They would not be able to pay enough attention to the individual projects to give them the attention that the projects need.

Ms. Trish Jerman

Any other comments from the panel?

The Honorable Lenoir Sturkie

The General Assembly's posture towards setting up big committees and commissions is very negative, so I don't know how possible or feasible the creation of one tremendous agency would be.

Ms. Trish Jerman

Yesterday at the Natural Resources Forum, Freddie Vang the director of the Water Resources Commission, said that if you reduce the number of agencies dealing with issues, you limit the democratic process. If you have five or six boards with six or seven board members on each, there are that many more points at which the public has a chance to have a say as well as that many more public hearings.

One of the reasons always cited for merging agencies is to get permits out faster, and many of you know that Georgia has a merged natural resources agency, unlike South Carolina. This theory was put to the test not long ago when Fort Howard Paper Company was trying to decide whether to locate a paper mill in Georgia or South Carolina and applied to both states for permits. South Carolina actually returned its permit decision in fewer days than did Georgia. So, I'm not sure if that argument holds water.

Mr. Gene Ott, Editor of Environmental Prospectus

Does anyone have any ideas for programs to control the loss of wetlands other than programs regarding permitting? And is concentrating on permitting the proper way to protect wetlands?

Mr. Duncan Newkirk

A tax incentive in this state for preservation of wetlands is an awfully good idea. If you want to give a developer or someone who owns the land an incentive to preserve wetlands, a tax incentive is a good way to do it.

Mr. Jimmy Chandler

Many of the permitting problems come from the fact that we've got unclear guidelines. There's not enough

predictability about whether a particular project will be approved. I've seen applications to alter wetlands about which agency staffs will say, "There's no chance that this application will be approved." Then about six months later the agency calls us up and says "Sierra Club, better get geared up because it looks like this one's going to be approved;" then we have to jump in. There are other applications that you would think would be approved very easily that get denied. If we had a clear set of guidelines so that a developer or an environmental group could look at a particular proposal, and understand whether or not it's going to be approved, then you'd cut down on conflict and arguing about what the rules are.

When Willbrook and Debordieu developments got permits for canals, I got a call from a developer who's a friend of mine. He called up and said, "You think I could get a permit to dredge a canal through a mud flat?" And I said, "Well, I don't know, you might have a big problem with it." About a month later the Willbrook decision comes out, and he finds out, no, he's not going to be able to get one. He calls me back and he says, "Thank you." He said, "At least now I know that I can't do it. I can go to sleep knowing that I haven't given up profits that I could have made on the waterfront lots." [Laughter.] If one person is going to make a ton of money because he is going to dredge and get waterfront lots, then anybody else is going to be a fool not to.

Ms. Vivian Newman

We would strongly support this kind of tax rebate, or tax deduction, or whatever you want to devise it for. Ontario has just passed a law that is giving a hundred percent property tax rebate to wetlands owners. All of these incentives should be explored. There has to be a carrot as well as a stick, and the carrot should be of some size.

A Spectator

Maybe the gentleman from the Army Corps of Engineers and some of the panelists can clarify something for me. I read about the channelization and ditching by the Army Corps of Engineers, the diking, the pumping of soil. A lot of marshes and wetlands have been lost this way. Yet the Corps is responsible for the permitting. It's like the fox in the henhouse.

Ms. Vivian Newman

I'd like to mention the sacred principle of consistency with regard to the coastal zone. We've certainly made a point in our policy that public development has to be subject to the same rules as private development.

Lieutenant Colonel Stewart Bornhoft, U.S Army Corps of Engineers, Charleston District

My public affairs officer doesn't like me to say this, but I think it's true: **the Corps of Engineers was dragged into the regulating business kicking and screaming.** We are not the Corps of Regulators, and quite frankly, we would not like to be in this business. But I learned a long time ago how to salute, and I was told to enforce the regulations. We have the fascinating challenge of taking rules made by the EPA and then enforcing those, and as a number of folks have pointed out, those rules are not always clear.

As far as the fox guarding the henhouse, the Corps of Engineers does not issue to itself a permit per se. I do not sign a permit as the Commander of the Charleston District to go do a certain activity. I need to get the comments of the various resource agencies such as the U.S. Fish and Wildlife, and EPA.

It is important that we look at avoidance. It's hard to capture the statistic of avoidance. When some people come into our office with their initial application, we are often the first agency folks that they have come in contact with about their project. In many cases there are wetlands on the property that they want to develop. We talk to them and we ask questions. And it dawns on them that it may be simpler in the long run for them to accomplish their end by rearranging the project, and eventually they never touch a wetland. **Nobody is ever capturing that statistic of avoidance, but I assure you that happens.** The planners in the Corps of Engineers go through the same process. Planners must first demonstrate that they have taken every possible step to avoid wetlands.

Ms. Margaret Davidson

Thank you Colonel Bornhoft. We have heard today that there is a variety of wetlands and a variety of folks con-

cerned with activities in, on, or around these wetland areas. It's a complex subject.

We're going to have and we need to have development. We need forestry. We need agriculture. We also need to protect our wetlands and protect, more importantly, their functions and their integrity, though not necessarily their acreage.

I'm not going to say anything about what kind of process we should have, but it is evident that we do need some clarity in whatever process it is that we do have.

The matter of a policy is dependent on two very different sorts of folks, dependent on, as represented by this audience, all the diverse interests in wetlands: the developers, the environmentalists, the consultants, the regulators, the managers and the scientists; and second, dependent on the public, the regular folks. All these people need to be involved in the development and the articulation of a policy because legislators like Mr. Sturkie cannot do their job until everyone is knowledgeable and aware. Unless there is a public process that precedes the political process, nobody's going to be happy. Thank you.

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