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An Outside Perspective on the Pocosins Conference and Suggestions for Future Work

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ABSTRACT

Pocosin development, primarily for conversion to agricultural and forestry uses, is progressing at a rapid rate. There is little known about the structure and function of pocosins, yet it is clear that they are important components of regional environmental stability. Major potential impacts seem to be possible degradation of downstream estuarine areas by increased freshwater runoff and use of agricultural chemicals, loss of critical habitat, conversion of the area from an atmospheric carbon sink to a carbon source, and a smaller than expected per capita increase in the regional economy. The overall social and political implications are, however, not well established and there is a definite lack of public awareness about the ecological importance of pocosin wetlands.

Key Words: economics, pocosin, drainage, estuarine degradation, social impacts, public education, habitat loss, wildlife, ecology

INTRODUCTION

This conference was viewed as a first step toward formulation of management guidelines for pocosin development. The stated purposes were to assess the current state of knowledge about the ecology of pocosin wildlands, synthesize information on current and projected uses of pocosins, attempt to characterize pocosin development and potential environmental impacts, and discuss the economic, legal, and political implications related to pocosin development and/or preservation. Because so many different topics were presented at the conference and because the audience that will examine the proceedings is equally diverse, I was asked to provide an overview of the papers. My analysis of the proceedings is from the perspective of a scientist who has been conducting research on wetland ecosystems in an area of the

country that has already placed great development pressure on wetland systems: the Chesapeake Bay region.

My objectives in this chapter are to discuss problems that might arise from unorganized development of wetlands on a large-scale regional basis, present an overview of each of the conference sessions, and discuss issues that I believe must be considered if an adequate pocosin management plan is ever to emerge. When discussing the sessions, I will emphasize the relationship between the conclusions that were made and the adequacy of the data bases that were used by the authors.

REGIONAL DEVELOPMENT OF WETLANDS: WHAT ARE THE MAJOR IMPLICATIONS?

Pocosins occupy approximately 20% of the North Carolina coastal plain and any attempt to manage them should automatically require a large-scale interdisciplinary effort. Private, industrial, and conservation groups as well as local, state, and federal governmental agencies must be involved if regional problems are to be avoided and if a suitable management plan is to be developed. The purpose of any management plan should be to provide for conservation of an adequate amount of pocosin habitat as well as to meet the needs of development interests. What major ecological problems might result from large-scale regional development of wetlands? An answer to this question requires an understanding of the consequences that result from alteration of natural wetland systems.

Although the conference participants failed to agree unanimously on a simple narrow definition, it is clear that all pocosins are characterized by the presence of standing water, either continuously or periodically, and can generally be classified as a southern bog ecosystem. Development, either for small-scale residential use or large-scale agribusiness and/or forestry, requires drainage of the land. On a small scale, drainage impacts may not be severe but it is clear from the proceedings of this conference that drainage of North Carolina's coastal plain has occurred, is occurring, and will continue to occur on a large scale and at an accelerated pace. What are the major impacts of pocosin conversion?

When wetlands are ditched for conversion to residential, timber, or agricultural uses, the hydrologic cycle is modified. Runoff is quickly diverted into the ditches and a larger percentage of the annual precipitation is exported to downstream areas at a faster rate than occurred under natural conditions. In coastal regions, the impacts that large-scale hydrologic modifications would have on estuarine processes must be considered. In addition to removal of water, conversion of pocosin land into agricultural and forestry uses requires extensive site preparation which may include the use of organic pesticides and fertilizers.

A third area of concern is the impact that drainage of extensive wetland areas will have on the global carbon dioxide cycle. Undoubtedly, a large percentage of the carbon that is stored in pocosin substrates will be oxidized on site or elsewhere if significant amounts of peat are mined and exported for energy production. The coastal plain region would be converted from a carbon sink to a carbon source. An important question is whether or not the oxidized carbon will have a significant influence on regional CO₂ levels which may affect the global changes in the carbon cycle that are currently causing so much concern (Armentano, 1980).

A fourth concern would be the impact that extensive regional drainage has on groundwater quality and quantity. North Carolina has a humid climate with adequate rainfall so that irrigation would be required only infrequently. The major industrial user of water from the underlying aquifer is Texasgulf, Inc., and the long-term impact of that operation is unknown. It seems unlikely, however, that groundwater depletion will result from pocosin alteration. A major potential problem is contamination of the aquifers through the use of chemicals. In drier climates (e.g., California), conversion of productive wetland soils into agricultural uses has created not only regional water supply problems but also groundwater contamination problems.

Finally, what are the economic implications of large-scale development of a regional resource? The loss of wetland resources will have a direct negative impact on certain segments of society (e.g., hunters). Positive impacts would be the creation of jobs as well as generation of economic growth that would be directly associated with development. However, the regional economic impacts of large-scale pocosin development may not be that large even though individual developers benefit. Pocosin development is diffuse; few people are employed and little urbanization results from the utilization of vast acreages of land. Furthermore, if pocosin development results in regional water quality problems, the overall development impacts would be undesirable because of estuarine eutrophication which would have negative impacts on one of the largest economic groups in that portion of the state. In short, all of these issues need to be considered if a wise course of action is to be followed in the management and development of North Carolina's pocosins.

SESSION OVERVIEWS

Introductory Session

The overview paper by Richardson et al. demonstrated that drainage of pocosin wildlands is proceeding at an alarming rate and that there is a real need to develop an integrated plan to ensure that development of the remaining pocosin wildlands will not result in severe regional environmental problems. Richardson calculated that over 16% of the coastal plain (2.2 million

acres; 914,000 ha) could be classified as pocosin and that over 50% has been totally converted or drained for development since 1962. An additional 600,000 to 800,000 acres will quite likely be totally developed during the next ten years.

Richardson and Thompson identified five groups that are, or should be, interested in pocosin development: (1) governmental agencies, (2) industry, (3) conservation groups, (4) social scientists, and (5) natural scientists. They suggested that these groups have the expertise needed to develop a management strategy that provides for the maintenance of both a healthy regional environment and economy while avoiding environmental disasters as well as confrontations that so often result when so many special interest groups are attempting to influence the decision making process.

Resource Ecology Session

The purpose of the papers in this session was to summarize information on natural features of pocosin wetlands and to provide a framework for understanding structural and functional attributes of pocosin ecosystems.

Conference participants were unable to arrive at a common definition for pocosins because of differences in interpretation of what categories of lands would be called pocosins. Most differences of opinion were due to varying interpretations of the types of plants, hydrologic characteristics, and substrate characteristics of pocosins. If there is any unifying definition, it should be found in the wetland classification system of the United States Fish and Wildlife Service (Cowardin et al., 1979). Pocosins would be classified as Palustrine *systems* and would fall into either the Scrub-Shrub (vegetation less than 6 meters) or Forested (vegetation more than 6 meters) *classes*. Other designations would be: (1) Broad-leaved evergreen, *subclass*; (2) *water regimes* that are saturated, semipermanently flooded, intermittently flooded, and seasonally flooded; (3) fresh-acid *water chemistry*; and (4) *organic soil*.

A universally acceptable definition for pocosins is not easy to resolve but, nonetheless, is central to planning because the resource must be delineated before it can be managed. Christensen et al. described four types of pocosin wetlands based on an earlier study by Woodwell (1956). Most pocosin wetlands are dominated by several species of evergreen shrubs and/or pond pine. Except for the most hydric situations, the development and maintenance of pocosin wetlands appear to be strongly influenced by fire and many areas would proceed through succession to hardwood dominated sites if fire were eliminated.

Pocosin biota includes a number of unique components although Wilbur indicated that the fauna is not as well known as the flora, either taxonomically or ecologically. Pocosins provide the last remaining habitat for a number of species including the black bear and, perhaps, panther.

Wilbur's paper is important because it introduced the issue of managing the resource on a regional basis rather than considering each wetland in a case by case approach. Central to his discussion is the proposition that reduction of pocosin habitat below some critical, yet unknown, level could result in species extinction even though some pocosin habitat would remain. He discussed components of island biogeographic theory which, in this case, is important because the coastal plain wetlands are being fragmented and the result will be the production of islands of wetland habitat that are isolated from one another in a sea of managed lands. Wilbur presented important guidelines that must be considered as management plans are being developed.

It does not appear that any animal species is currently doomed to extinction because of habitat elimination. The pine barren treefrog (*Hyla andersoni*) may, however, be endangered because of loss of habitat and change in the quality of the habitat that remains. This species has specific breeding requirements; especially important are water chemistry and water flow characteristics. Monschein indicated that although some wildlife species might increase in number as a result of pocosin development, others will surely decline; the most vulnerable species is the black bear. Wilbur suggested that although pocosins provide suitable food and cover, bear would do better in other habitats. Pocosins are used as the last refuge by bears because the more preferred habitats have been eliminated or are too small in extent to sustain a viable bear population.

At this time, very little can be said about internal functional processes such as primary production, nutrient cycling, and decomposition. Only generalities about input and output characteristics are currently available although Christensen's research in the Croatan National Forest will provide important information on many processes, especially as they are affected by fire.

Citing work by Barber et al. (1979) and Skaggs et al. (1980), Richardson showed that it seems unlikely that pocosins are able to retain phosphorus and that the use of fertilizers on drained peat substrates will likely result in increased phosphorus runoff to estuarine areas. This phenomenon has been shown for other types of peat based systems although research findings are not always clear (Tilton and Kadlec, 1979; Zoltek et al., 1979; Ewel and Odum, 1978), and much more research is needed on the movement and storage of phosphorus in peat dominated substrates. Richardson also considered the impacts of pocosin drainage on the global carbon dioxide cycle and suggested the large amounts of CO₂ have already been released from drained North Carolina pocosins.

Daniel provided important insight into the hydrologic implications of pocosin drainage. He showed that natural pocosins regulate the rate at which water is delivered to downstream estuarine areas. Much of the net annual precipitation is retained in the wetlands for a long enough period of time that

most is lost to the atmosphere via evapotranspiration rather than as stream runoff. Pocosin drainage increases the runoff intensity and shifts the primary pathway of water loss from evapotranspiration to stream runoff. On a regional basis, there is evidence that this may cause salinity fluctuations in downstream estuarine areas. Daniel also indicated that ditching is likely to result in degradation of estuarine water quality but additional mass balance studies are definitely needed.

Nonindustrial Values Session

The major conclusions of the papers in this session were that an insufficient number of pocosin wetlands are owned by the public or are controlled by private conservation interests. Second, the areas that are currently protected are not evenly distributed; the northeastern portion of the coastal plain is poorly represented, given the amount of pocosin land that occurs there. Existing means are available for obtaining additional pocosin areas but a key missing element is public awareness of the importance of pocosins.

Perhaps the only aspect of pocosin wildlands that is important in the public image is their use for hunting, trapping, etc. As noted, Monschein suggested that pocosin development would result in increased numbers of some game species but others, such as the black bear, would be eliminated unless a suitable management plan is developed. How many and what should be the configuration of sizes of pocosin habitat that must be retained in order to maintain viable black bear populations in the coastal plain region? Answers to this question are not possible because there still are not enough data on the ecological requirements of the species. The paper by Wilbur is also germane to this issue.

The other papers in this session centered on the issues of ownership patterns, the role of public education in increasing information about pocosins, and means that are available for obtaining pocosin lands. Taggart, for purposes of describing the ownership patterns, divided the coastal plain into four sections. The most striking feature of his analysis was that only a small percentage of total pocosin land is currently protected and that the distribution of protected areas is not well balanced. Protected areas are especially lacking in the section of the state from the Pamlico River northward. He also noted that very few areas that are protected are using fire as a management tool. As shown by Christensen et al., in the absence of fire, many pocosins would succeed to hardwood forest which might result in the elimination of many interesting pocosin species.

An important factor that seems to be missing is an understanding of the importance of pocosins by the general public. The short-term possibility of alleviating this situation seems bleak for, as Ashton showed, there are few ongoing public education programs and most of the existing programs are

poorly supported. He presented a framework for development of a plan for large-scale public education but the possibility of success seems remote because of the current economic climate. In addition, there does not seem to be any readily identifiable constituency that is willing to push for implementation of any public education program.

Industrial Values Session

This set of papers was very informative and produced, for me, the largest number of notes and potential questions about the impacts of pocosin development. Street and McClees provided information, and a warning, about one impact that may affect the economic future of the region. Coastal fisheries, both commercial and recreational, are enormous and crucial to the regional economy. Several factors threaten that resource but most important to the present discussion are those that cause deterioration of estuarine water quality. Street and McClees's analysis of the shrimp industry shows a definite decline in the resource and they suggested that one possible cause has been deterioration of water quality associated with pocosin development. They suggested that the primary pollutant, in this case, is the amount of fresh water that is delivered to the estuary because the absorptive capacity of intact pocosin wetlands has been eliminated by ditching and resultant drainage.

It is unclear if the problems may be due primarily to development of pocosin wetlands or due to increased development on the piedmont. Water quality of the coastal estuaries is certainly affected by development of upstream watersheds in the piedmont (Humenik et al., 1980) but decreased estuarine water quality, as described by Richardson, may also result from pocosin development. In Maryland, three counties that border the estuarine portion of the Patuxent River have filed suit against the state and EPA for negligence because they believe that estuarine water quality degradation has been due to the inability of the state and EPA to control development of the upstream watersheds. Most of the problems seem to be due to nonpoint runoff from agricultural lands and/or point source discharges from sewage plants. The same problems, if they aren't already present, will surely occur in North Carolina as development accelerates in the piedmont. Unlike Maryland, however, North Carolina will have the additional problem of uncontrolled development of the extensive pocosin wetlands that border the estuarine areas.

From the papers of Campbell and Hughes, and Barnes, it is clear that with proper management, pocosin lands can be used to produce high yield agricultural crops and wood products. A certain percentage of pocosin wetlands can also provide peat which can be used for several purposes including energy production. Economically, it appears that those uses can be or are currently economically profitable. Based on the number of ditches that I saw while flying over the coastal plain, it seems that development will

proceed at an accelerated pace. The question remains, however, regarding the implications that development will have on the environmental stability of the region. None of the authors addressed that issue and it seems unlikely that answers could be provided at this time.

In my opinion, the following issues should be of primary concern.

1. What is the impact of peat extraction and conversion of pocosins for timber production on water quality of downstream areas? Barber et al. (1979) and Skaggs et al. (1980) show that changes can result from agricultural runoff.
2. Are the same problems associated with existing management plans for peat farming and forestry production?
3. Are impacts that result from development in the coastal plain as large as those that are or will result from development in the piedmont region?

In addition to the studies by Humenik et al. (1980), Kuenzler and his colleagues have been studying the impacts that floodplain forests have on water quality. It may be that their work will provide answers to the questions posed but it seems likely that answers will require additional research. Evidence was provided in this session that would indicate that the development industries are actively pursuing the questions of the impacts that their development has on estuarine water quality. First Colony Farms, Inc., has cooperated with scientists and it seems likely that effective cooperation could be fostered if all parties become committed to the idea of pursuing development with sound conservation practices.

Based on Barber et al. (1979), it would appear that all runoff from drained pocosin lands should be routed through additional wetlands (intact marshes) before it is permitted to enter streams that drain into the estuary. The wetlands could remove nutrients as well as suspended particulate matter. It will be necessary to determine the size and composition of the most effective buffer zones that are needed in each instance but, given the present state of our technology, the problem is not insurmountable.

Resource Economics Session

The papers in this session dealt with the economics of pocosin development. Harwood analyzed the economic potential for using peat for energy production. As also shown by Campbell, it is feasible to harvest peat from certain types of pocosin wetlands and those resources are very large. The major hurdle to using peat for energy production is that there is no current market. As other fuel prices increase, peat may become economically more competitive and a market will develop.

Lindenmuth and Vasievich performed a sensitivity analysis to determine if large-scale timber management is economically sound. They concluded, as

do Campbell and Hughes, that pocosins can provide high yields of timber at a profit even though the initial investment is large. This is due to current and projected costs of timber products which have increased significantly in recent years. The data used in their analysis are, however, speculative because few silvicultural data can be found in studies of altered pocosin wetlands. Clearly, more data are needed, but it appears that conversion of pocosins into timber production is economically feasible.

Postel provided an excellent overview of the natural functions of pocosin wildlands. The preservation benefits are hunting and other related activities, maintenance of estuarine water quality, water recharge and storage capacity, flood control benefits, critical habitat maintenance, ecosystem preservation, and option demand. Because data are lacking to assess critically many of the benefits, she suggested that a conservation policy toward pocosin development is warranted until a regional development plan can be produced.

Law and Policy Session

The papers in this session identified the political realities associated with pocosin development, discussed the legal strategies that could be used to preserve pocosins, and suggested policies to bring about a proper management plan for the development and preservation of pocosins.

Heath painted a rather bleak picture for enactment of adequate pocosin protection measures because the primary development interest groups are politically very strong. He suggested that development of an effective management plan will require that the preservation support constituency demonstrate that an adequate mix of developed and nondeveloped lands is in the long-term public benefit.

Brower analyzed the methods that are currently available for preserving pocosins. He recommended that existing avenues be utilized and that these techniques be exhausted before additional legislation is sought.

Cooper presented some strategies for developing management plans. Basically, there is no current policy (local or state) for pocosin management even though pocosins clearly provide many benefits to man. Cooper suggested that any emerging policy should provide for preservation and development with a tilt toward preservation because much is unknown about the long-term consequences of pocosin development. This would provide for future options. A management policy should be drafted by all affected parties and should be based on existing legislation. He outlined the minimum planning that is needed.

THE FUTURE: WHAT IS NEEDED?

Cooper presented a succinct summary of research that is needed as well as an approach to developing a plan to assure a long-term regional stability.

The basis of his argument is that we do not know enough about the social benefits of pocosins and the management plan should be one of caution and conservation to provide for future options. My personal opinion is that the potential for avoiding problems is slight unless a large constituency is developed to champion the cause of pocosin preservation.

A number of questions need to be answered and I would suggest that several need to be addressed very soon. Although the idea is not new (Odum and Odum, 1976), there is a definite need to interface ecological and economic theory to assure a workable plan for the management of the remaining pocosin wetlands. Considerations of economic benefits are much easier than analysis of both positive and negative benefits of nondirect impacts (e.g., compare papers by Lindenmuth and Vasievich, and Postel). Postel lists nondirect benefits that are important but it will not be an easy task to complete the analysis as has been shown by the continuing arguments about the value of tidal wetlands (Gosselink et al., 1974; Shabman and Batie, 1978 and 1979; Odum, 1979).

Quantifying ecological characteristics will not be easy either. There are few data on structural and functional attributes of pocosins. An expanded research effort is definitely needed with particular emphasis being given to:

1. Performing a state inventory as a first step in planning for the maintenance of regional diversity patterns. As this conference has shown, there seems to be enough interest in this task although the position of development groups is unclear. Special attention must be focused on the establishment of additional conservation areas, especially in the northern section of the coastal plain.
2. Research on the correct mixes of natural and managed lands that are needed to minimize downstream development impacts as well as maintain suitable habitat diversity to ensure that species extinction does not occur. More specifically, research is needed to determine:
 - a. The contribution of nutrients, sediments, etc., that reach the estuaries from piedmont sources versus the magnitude of the same materials from natural and altered pocosins;
 - b. The role that buffer zones play in ameliorating potential runoff problems from ditched pocosin lands. Richardson cites evidence that agricultural lands will export excess nutrients but there are no data from sites altered for forestry production or peat mining. It would be helpful if water from ditched areas were routed through wetlands. I would suggest that development interests and researchers interact to determine the size and composition of buffer zones that would be most efficient.

Comments from the audience clearly showed that development of the coastal plain is entering an exponential phase and that the impacts, including

bringing seemingly unwanted cultural changes to the region, are not fully appreciated in political circles. Because the public seems to be almost unaware of the importance of pocosins, enlightenment must come from researchers, conservation groups and the media. The proceedings of the conference are the first step in a process that I hope will ultimately lead to a suitable solution so that society does not lose yet another portion of the biosphere because some people failed to interact for the good of all.

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