Atlantic White Cedar Wetlands

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Ecosystem Processes and Biogeographical Considerations

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There is still so much to be known about Atlantic white cedar wetlands that it would be easy to develop a very large list of research and management questions. Rather than present such a list, I have chosen to organize my comments into three broad topics. The first topic deals with large scale considerations and might be considered under the heading of landscape ecology. The second topic deals with ecosystem processes and the third with autecology.

Landscape Ecology

A good way to frame our thoughts is to return to the keynote address by Eville Gorham. He described a large interdisciplinary project that is focused on peat bogs that extended over a large longitudinal range. Atlantic white cedar wetlands are analogous in many ways. *Sphagnum* peat is, apparently with few exceptions, the dominant component of the substrate. The primary difference, however, is that Atlantic white cedar wetlands are distributed over a very large latitudinal rather than longitudinal range. Atlantic white cedar wetlands occur as far north as Maine and as far south as Florida. In Maine the bogs contain flora and fauna that is primarily boreal in affinity. In Florida the flora and fauna are mostly of tropical derivation. This gradient is thus not only latitudinally large, but it is also climatologically quite different. The fact that one tree species and one genus of moss are common over a wide latitudinal range offers some very interesting research opportunities. Let me give one example.

Harry Hemond discussed acid precipitation and suggested that peat bogs are very interesting ecosystems to study in that context. If one considers the latitudinal range of Atlantic white cedar wetlands, one probably would find that acid precipitation inputs are quite variable. In

some parts of the range, particularly the industrial northeast, inputs are probably quite high. In some parts of the southeast, the inputs are probably not as large. By careful selection of sites, it would be possible to design a research project that would address problems related to the geographic impacts of acid precipitation.

We have heard that Atlantic white cedar grows in a wide variety of habitats ranging from higher elevation bogs in New England to low elevation raised bogs in North Carolina. What has interested me is the large number of habitat types that Atlantic white cedar grows in. In Florida, it occurs in areas where the pH of the water that flows through the bog is quite high compared to most other bog environments. What are the ramifications of this situation? Are nutrients processed differently in the Florida Atlantic white cedar wetlands? What are the ecophysiological adaptations that enable Atlantic white cedar to become established and grow in such a wide variety of environmental conditions? Certainly much more research needs to be done on these topics.

Atlantic white cedar wetlands are often contiguous with other types of wetlands. What factors are responsible for the degree of environmental heterogeneity that is observed in nature? What roles do Atlantic white cedar wetlands play in the landscape compared to other contiguous types of wetlands? Are nutrients processed differently as they pass through an Atlantic white cedar wetland compared to another type of wetland? The only information available to address these questions comes from the work of Joan Ehrenfeld and her colleagues at Rutgers. Their work clearly demonstrates that Atlantic white cedar wetlands are important components of the Pine Barren landscape. Are Atlantic white cedar wetlands serving similar functions in other parts of the species range? This question is particularly important in areas such as coastal North Carolina where the species is being commercially harvested and impacted by large-scale drainage.

Finally, we have heard that Atlantic white cedar wetlands serve as refugia for plant and animal species. There is not enough data to determine how important this landscape unit is in maintaining biotic diversity. Clearly much more information is needed in this area, especially in those parts of the range where Atlantic white cedar is being exploited.

Ecosystem Processes

Many of my comments and questions are related to Atlantic white cedar wetlands as a landscape unit. How much information is available on the structure and function of those wetlands? Several papers and poster sessions have dealt with structural characteristics while few dealt with functional attributes. It would appear that primary production has

only been measured in the Dismal Swamp and Frank Day undoubtedly has the most extensive data on decomposition processes. The Rutgers group has been studying nutrient transport processes and we have compiled data for one stand of Atlantic white cedar in Maryland. Perhaps there are other data, but it is quite clear that, compared to many other types of wetlands, little is known about functional aspects of Atlantic white cedar wetlands. There are undoubtedly a large number of viable research questions that could focus on the relationship between ecosystem production, decomposition, and nutrient cycling. One would certainly have to focus on hydrology as it relates to those processes. Dr. Levandowsky noted another research area. He suggested that there are some interesting physiological questions related to how plants obtain nutrients from highly acidic substrates.

Autecology

Autecology is the final topic that I would like to consider. A few years ago, the National Wetlands Technical Council sponsored several workshops. The workshops covered many topics, but the theme that emerged from each meeting was that we do not know enough about individual wetland species. One good example has been discussed at this symposium. What conditions are necessary for Atlantic white cedar to become established in a wetland? Many opinions have been expressed and it would seem that high light conditions must be present and that a proper seed bed should be present. Technically, I really don't know what those statements mean and we have heard that in some cases, the species can reestablish itself, but it doesn't in other instances when the conditions seemed to be correct. We know even less about other plant and animal species that are associated with this type of wetland. One problem in dealing with autecological questions is that it is difficult to obtain funding for that type of project. Another problem is that the number of people actually studying plants and animals in that type of wetland is rather small. What is clear, however, is that we need to know a lot more about how species become established, how they perpetuate themselves, and how they interact with other species. A good place to start would be to identify species that are rare or endangered and focus research activities on their autecology. More autecology work also needs to be done on Atlantic white cedar.

Finally, I would like to focus on the problem of species interactions. We have heard that Atlantic white cedar is replaced by red maple over parts of its range. In other parts of its range, Atlantic white cedar is not replaced by other species. What factors are responsible for those differences over the latitudinal range of Atlantic white cedar?