WATER MANAGEMENT IMPLICATIONS OF THE SOUTH'S THIRD FOREST

by

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INTRODUCTION

The South's Third Forest, which will occupy the land during the years 1969 to 2000, will not be a biologically separate entity from the Second Forest (1945-1968) although it will have distinctive characteristics (28).* These characteristics, based primarily on projections of growth and drain of wood fiber, will have a profound influence upon the Third Forest's production of other commodities: recreation, wildlife, and water. Current projections of the per capita consumption of paper and paper board far exceed earlier estimates; the current projection for 1980 is 728 pounds compared with the 575 pounds per capita predicted in 1965 (28). The startling aspect is that of the anticipated national needs for the year 2000 the South will be expected to produce approximately 65% - 112 million cords of the 172 million cords. This increased demand would cause the South to increase the annual total cut 2.3 times with pulpwood showing a three-fold increase over the 1968 cut. Unfortunately, this increase must be achieved in the face of a steadily shrinking land base. A net decrease of 10 million acres or five percent of the present forest area is anticipated by the year 2000. Major causes of withdrawal will be for agriculture, urban expansion, rights-of-way, impoundments, and recreational areas. The area of greatest loss will undoubtedly be in our hardwood resource. For example, in the past 10 years in Mississippi, we have lost to agriculture approximately $\frac{1}{2}$ million acres of bottomland hardwoods in the Delta. Also withdrawn from the hardwood resource is the land in the Barnett Reservoir, and in the future there may be withdrawals amounting to many more thousands of acres in the Tennessee-Tombigbee and the Pat Harrison Waterways in addition to numerous other proposed projects (18). Resource management is further complicated by apparent inconsistencies in Federal programs. Some programs subsidize forest establishment while others are reducing forest acreage through payments for drainage, water control, and reservoir development.

How then can a forest resource manager faced with the problem of tripling fiber production, in spite of a 5% loss of land base, also satisfy the greatly increased demand for forest recreation opportunities, water, and wildlife production? One of the means by which these demands can be satisfied is integrated land use. However, when one considers multiple use the question of assigning priorities immediately arises. Although the Multiple Use Act, Public Law 86-517, states that, "All the various renewable surface resources of the public forests will be so managed that they are utilized in the combination that will best meet the needs of the people", how shall we economically value an hour of aesthetic enjoyment in a forest? What is the value of an extra 10 square feet of "living space" to a city dweller? In essence, is it possible to price social value? Thus, the conflicts arise between consumptive and nonconsumptive uses of land, and multiply the problems of the forest manager.

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* Reference to literature cited.

This paper cannot deal with all of the ramifications of intensified fiber production and alternative land uses; therefore, the presentation will be confined to the water management implications of the South's Third Forest.

PROBLEM AREAS

Water Production

Fiber production and water production are, in a sense, competing uses. It has been estimated that the complete removal of the forests east of the Mississippi River would produce annually an extra 100 million acre-feet of predominately clean water (5). If we were to assume the same value here as for a gallon of converted seawater, the increased production would represent a total annual value of approximately 30 billion dollars. This, of course, does not take into account the loss of recreational values or the environmental implications of a denuded landscape. Even a 10% reduction in the eastern forest would yield sufficient additional water for 50 million persons (5). This would be, of course, a drastic solution to the problem of increasing supplies of potable water, and the most rational use of land resources must fall somewhere between forest removal and total commitment to fiber production. There are several areas, such as stand conversion practices and measures to increase yield, in which conflicts between water and wood fiber might arise.

It is estimated that 20 million acres of land currently in low quality upland hardwoods must be converted to pine in the next 17 years if the objectives of the Third Forest are to be realized (28). However, here in the sandy uplands of the Southern Coastal Plain are found some of our most important aquifers. Therefore stand conversion practices will have a profound impact, not only on ground water recharge, but also on regulation of runoff. Present stand conversion methods include the use of prescribed fire, herbicides, mechanical means, or a combination of these methods. In many erodable soils or in rough, broken topography, fire and mechanical methods must be used with extreme caution, particularly in those areas where the primary resource management objective is water production. In a recent study of prescribed burning in Northwest Mississippi hardwoods, it was pointed out that, although sediment yield increases from burning with subsequent injector treatment were not alarming, a three-year persistence in yield suggested the need for caution (30). The study had particular reference to loessial soils; sedimentation from sandy areas did not persist beyond the first year. Mechanical methods must also be utilized with great caution. Since, however, there are a variety of conversion methods from which to select, there should be no great difficulty in matching a particular method or combination of methods to a given site situation.

Perhaps the most profound effect of stand conversion on water management will be through the change in species composition of the resulting stands. It has been found that by changing from a hardwood composition to a coniferous species both the dormant season interception and the amount of radiant energy available for evapotranspiration during the growing season will increase (13).

Another problem area in water management is related primarily to flood discharges. The prevalent belief is that floods are related primarily to overland flow. It then follows that, since a well-stocked forested watershed has virtually no overland flow, maintenance of the intact watershed cover will prevent floods. This concept is no longer accepted by an increasing number of forest hydrologists (20,24). High flood discharges from forest lands are forest-related only in that forests generally occupy the steep, rocky, thin soils that are not acceptable to agriculture; therefore, cultural measures designed to reduce overland flow and increase infiltration are largely superfluous (24) and management efforts should be directed to more critical areas.

Generally speaking, most methods of increasing wood fiber production such as stand conversion, planting, and improved stocking levels will have some impact on water production.

Water-Based Forest Recreation

In addition to the production of water for consumptive use, consideration must be given to the area of recreational demand: specifically, water-based recreational activities.

For the most part, we take for granted the easy availability of water, even though it is crucial to life itself and to so many material and environmental amenities. Thus far, we have been blessed with large natural supplies and have managed to do well. But the total supply of water is finite. Along with other resources, the pressures on this supply keep on increasing also, especially at regional levels. The use of 1,400 gallons of water per day by the average American does not include his recreational needs.

Water plays a major role in the South's recreation by providing either the primary purpose of the visit or by supplementing some other activity. Many people come to the forest solely to participate in water-based activities; any other recreation takes second place. Almost half of the national population prefers water-based activities more than any other type of outdoor recreation (22). Even land-based activities are enhanced by nearby water that provides a secondary activity or improves the setting. Participation in different activities on outdoor recreation areas is an index to the degree of use and describes the nature of the use made of these areas. Boating, fishing, and swimming are among the most popular activities in the South. The same activities are expected to increase up to 17-fold within the next 30 years(28). Exact demands for outdoor recreation of the Third Forest cannot be predicted. However, it is estimated that demands for the year 2000 will be 10 times as great as in 1959 (28).

Any alterations in the quality and quantity of water areas will have a direct bearing on the recreating public. More and larger water impoundments are called for in the future, thus further reducing the land base. A diminishing watershed area will be expected to produce more timber and more water, yet it will be required to retain its aesthetic appeal. This further emphasizes the need for better multiple use management.

The South's Third Forest presents an unprecedented challenge to the resource manager. Costs and benefits need to be evaluated in terms of multiple objectives and alternatives. The required demands of the boating, swimming, and fishing public must either be met, or new, non-water oriented recreational activities must be devised that will hopefully fulfill the needs of this segment of society.

TECHNOLOGICAL ADVANCES

Faced with a decreasing land base and increasing competition from other consumptive uses of forest lands, it is obvious that the resource manager must intensify the levels of management of the existing resources. Intensified management on public and industrial lands is, unfortunately, only a partial solution--private owners must be motivated to intensify resource management. It is estimated that in the year 2000 there will be approximately 70 million acres of forest land in the hands of private owners and that timber growth must be increased by 50% on these lands (28). Generally speaking, it is on these lands that no management or only the lowest intensity of management is currently practiced. An intensive effort must be made to stimulate these owners to adopt resource management practices.

A. Forest genetics and tree improvement. Historically the harvest of natural stands of trees has resulted in the removal of the genetically superior stock, particularly in hardwood stands. Too frequently only genetically inferior parents have been retained for regeneration with the subsequent lowering of both tree growth rates and wood quality. This problem was early recognized by southern foresters, and the first conference on forest genetics was held in 1951. The primary purpose of this meeting was to assess the status of genetic knowledge as it was related to forest trees. It was felt even then that the ultimate improvement of the quality and growth of trees would be achieved only with the aid of forest genetics and tree improvement applications. There have been great strides in this area in the past 20 years, and today reported improvements in volume growth of young pine plantations established from first-generation seed orchards range between 10 and 50% (32). There is increasing evidence to show that, in many cases, phenotype and genotype inheritance characteristics are highly correlated, particularly if there was careful selection of "plus" parents (25). Research scientists working with slash pine (Pinus elliottii var. elliottii) have reported oleoresin yields virtually doubling when superior parents of some slash pine families were used (29); other scientists have reported higher yields of dry wood (4). These advances, coupled with improved silvicultural practice, offered an optimistic view for increasing fiber yields.

B. Site amelioration. Site amelioration practices may take many forms --site preparation, fertilization, drainage, and irrigation. Only the first three practices are in general use today. Irrigation, particularly in the area of waste water renovation, appears to be quite promising, both from the aspect of recycling water (27) and from the aspect of growth improvement. Treated municipal waste water has been applied to forested areas in Pennsylvania, and it was found that approximately 90% of the water applied at the rate of two inches per week was recharged to groundwater at acceptable standards of potability (27). In the South, where a three-fold increase in municipal waste discharge is anticipated, work is beginning in this area (6).

Drainage, however, has received more research attention and consequently is more widely used, particularly in the Atlantic and Gulf Coastal Plains. In the organic soils of North Carolina treated only by ditching, volume increases of five to nine cords per acre were found at the end of a 27-year rotation of loblolly pine (Pinus taeda). The magnitude of the increase was, of course, related to the distance from the ditch (15). Other studies dealing with slash pine on poorly drained mineral soils indicate that drainage response is significant both on newly planted (11, 17) and pole-sized slash pine (11). In the bottomland hardwood forests of the Mississippi Delta shallow-water impoundments, whose major function is to attract migratory waterfowl for sportsmen, show a doubling of diameter growth for representative species (2).

Site preparation practices such as bedding increase the effectiveness of drainage ditches. The addition of bedding serves in two ways to increase the growth: first, by reducing the competing vegetation for the critical first year; second, by increasing the volume of aerated soil available for initial root establishment and growth. Results of a recent study of wet soils in central Louisiana indicate that five-year height and diameter growth of both slash and loblolly pines was significantly different from normal when planted on sites prepared by furrowing, flat-disking, or mound-disking (3).

No discussion of site amelioration would be complete without some attention being given to forest fertilization. Although fertilization studies were initiated in Florida as early as 1945 (23), present South-wide results are still somewhat sporadic in nature. However, slash and longleaf (Pinus palustris) pines on Lower Coastal Plain and Coastal Flatwoods soils respond well to fertilizers, particularly phosphorus, and doubling of growth rates has been reported (8, 23). It has also been demonstrated that cultivation (7) and genetic selection (26) in combination with fertilization will produce more significant growth increases.

C. Cultural Practices. In general, cultural practices are of two types --those designed to increase fiber yield per acre, and those designed to increase water yields while maintaining an economic yield of fiber. An example of the first category is the recent work with intensive cultivation of short-rotation sycamore (Platanus occidentalis) plantations (16). Sycamore seedlings are planted at close spacings in rows, with sufficient distance between rows to allow passage of harvesting equipment. Harvests have been made with a conventional silage cutter and yields in four to five-year-old plantations of 40 to 50 tons of green wood per acre have been recorded.

In the second area are those practices for improving water quality and yield with minimum reduction in fiber production. Research scientists have approached the problem of reducing water losses either by selecting for species which are more economical users of soil water (12), or by application of transpiration inhibitors (31). Also in this area of research are those efforts to find the point of optimization of fiber and water yields through a manipulation of stand density (9, 14).

D. Recreational Developments. The great tidal wave of outdoor recreation activity of the 1960's stimulated a considerable amount of research to provide solutions to conserve the resource. This research was geared primarily to

priority problems relating to facilities, capacities and general classifications of participants (21). More facilities with larger capacities were provided the using public. However, the threat to the remaining natural resources still exists due to unrestrained consumptive and other non-consumptive uses of the various resources. The point is that it is now time to seek information through different avenues.

Recreation is need-fulfilling behavior. Preliminary work (1, 19) has shown that some recreation activities group into meaningful clusters and these clusters are seemingly associated with different human needs. Recreation managers are now called upon to plan for large populations. They should attempt to satisfy as many needs of the using public as possible. Perhaps they could select from each of these clusters at least one activity to replace several activities and relieve pressure on a particular resource, yet satisfying similar needs of the using public. This method should provide for substitutability and combinations of various activities that could best be installed in view of the using public, their needs and the resources of the Third Forest.

Besides increasing the quantity, recreation managers are also involved in ameliorating the quality of recreation experiences. It is seen that water skiiers and fishermen do not necessarily have compatible recreational drives: fishermen do not particularly appreciate the presence of skiing enthusiasts in the same vicinity. The upstream introduction of non-toxic chemical flocculants reduces the turbidity and enhances the quality of down stream water use (10). If layout and pavement of paths leading to the campground sanitary facilities is delayed till the area has been used for a while, it will reduce unnecessary trampling of the landscape. The users have the remarkable ability of finding the best route--the shortest.

The development of recreation facilities in the Appalachian Mountains, the Atlantic, and the Gulf Coasts will increase visitation to these areas by both southern residents and outside visitors. But it will not necessarily relieve recreational impact on the major timber-producing belt. More development in compatible land use management is needed within the timber areas. More than seventy percent of an average individual's recreation takes place within very short distances of his homestead. In our case his homestead happens to be inside the timber belt.

SUMMARY

Faced with the projected demands set forth in the South's Third Forest, resource managers must find means to increase wood fiber yields, supply a rapidly expanding demand for recreational experiences, and provide an ample supply of clean water. This, however, must be accomplished in view of a projected 5% net loss of forest lands. Research and technological advances in recreation, genetics, and tree improvement, site amelioration, site preparation and cultural practices provide some basis for optimism, but a large amount of work remains to be done. Research and technology alone will not solve the problem. An intensive effort must be made to stimulate private owners of forest lands to manage their lands more intensively.

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