

Drainage

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"Is drainage of wet hardwood lands a problem?" I believe it is. First of all, water directly controls establishment of future crops of hardwoods and, secondly, their subsequent growth rates. Because drainage is a problem, we have to learn what water levels must be maintained for each species or type under a variety of site conditions. With a knowledge of the water requirements for hardwoods in hand, we can then ask, "What modified or new engineering techniques may be needed to achieve establishment and growth objectives?" Answers to such questions are needed if forest water control is to proceed on a scientific basis and leave the nickname "hardwood drainage" behind. Moreover, with a general knowledge of the natural water relations of bottomlands, swamps, ponds, and wet flats we will be in a much better position to provide interim guidelines to all wildland managers and engineers for the design of hardwood water management systems.

Let's look first at the impact of drainage on hardwood growth. This concern is not trivial because it involves 13 million acres of wet hardwood land in the southeastern Coastal Plain. How many of these acres have been drained is unknown, but it is considerable. Drainage is widespread because forestry enterprise is motivated to reduce flooding and improve accessibility for logging and other management purposes. Drainage of valuable hardwood land involves either the removal or diversion of surface water from the site. Unfortunately, ditches designed to remove only surface water may carry away vital soil water. Furthermore, adjacent roads frequently act as dikes that prevent surface water inflow. Canals through streambeds, designed to remove quickly the flood waters which periodically plague farmers and other upland property owners in headwater areas, also drain prime hardwood bottoms.

Site changes resulting from drainage will finally effect profound changes on stand composition, growth, and regenerative potential. At this point, however, our knowledge of exact cause-and-effect relations is limited. For example, we know that water tupelo and swamp tupelo thrive under very wet conditions, whereas other species, such as yellow-poplar, do not tolerate these undrained site conditions. We can be sure that drainage of swamps will be detrimental to tupelo and create conditions favorable for other species. In other words, uncontrolled drainage may produce environmental change which precludes continued production of wet site hardwoods. Nevertheless, drainage, like prescribed burning, fertilization, or pesticide control, is only another tool available to the silviculturist--but only if it is wisely controlled.

Occasionally, lands too wet for timber production can be improved by controlled drainage. For example, surface drainage of ponded water has resulted in invasion of hardwood and cypress into open swampland. Furthermore, soil-water conditions at the wet extreme of tolerance for hardwoods have been improved by limited drainage. However, because of limited information on the effects of water levels modification on hardwoods, we cannot prescribe controlled drainage practices on sites capable of sustaining hardwoods.

Drainage resulting from construction of access roads ordinarily poses no environmental change, because the ditches seldom exceed a size needed to remove only roadside water. Where hardwood stands are converted to pines, an intensive system of access roads and large canals or ditches is installed, and large volumes of water are quickly removed. However, drainage to convert prime hardwood land to pine production is largely a thing of the past because of the rise in demand for hardwood timber and fiber. On the other hand, improvement of wet pinelands for pine production through water control is a widespread practice. The impact of such drainage on the water regime of adjacent or intersected hardwood sites should be carefully studied in the evaluation which precedes project implementation.

It should be clear, now, that natural flow patterns of water in hardwood bottoms can be altered significantly by forest drainage practices on uplands above them. Foresters and

forest engineers deliberately canalize streams and branches to remove excess water which stands on the land. For obvious reasons (less soil must be moved and costs are often lowered), water control ditches follow natural drains through the woods; as a consequence, drainage water is routed through hardwood branches and streams.

Some increase in channel capacity by log-snagging, brushing, clearing, ditching, or a combination of these techniques should accompany drainage of adjacent uplands. If outlets are not improved, flow will overtop stream banks for long periods because water that once evaporated from a large surface is concentrated into one stream channel. Conversely, excessively large canals through downstream outlets drain adjacent bottomlands. The result is a reduction in depth and frequency of flooding and less water is available to recharge bottomland soils.

Ideally, water management systems should be designed to maintain only that water which is needed to recharge the soil and supply tree needs. Other water is then surplus and can be routed through control structures. But this water is not surplus in downstream channels; it recharges productive bottomland soils, it maintains aquatic and estuaries habitats, and it provides a buffer against salt water intrusion. In some cases, it may provide head and contribute to recharge of surface aquifers. But to accomplish these objectives effectively, discharge must be controlled.

In our eagerness to remove surplus water from uplands, we can easily overlook the detrimental effects of rerouting water from several watersheds into one large, improved stream channel which results in drainage of lands. Branches from which water has been diverted carry reduced low flow and may dry up as their contributing watersheds are diminished in size. The net effect on adjacent bottomlands is just as great as when streams are canalized by overly large channels.

Stream canalization is also a common tool of the flood control engineer in his efforts to reduce damage in headwater areas of the coastal plain. Upstream flood control has been justified by damage figures which demonstrate the total yearly losses caused by floods in headwater areas exceed those caused by major rivers overflowing their banks further downstream.^{1/} Where flood control is needed, new water engineering techniques must be developed to meet the objectives of flood control and to conserve the productivity of bottomland hardwood sites.

Hundreds of miles of canals have already been dug to handle flow from the estimated 2 million acres of wet forest land which received some type of water management treatment for forestry purposes in the South. One can only speculate about the effects of these projects upon hardwood growth, fish and wildlife habitats, streamflow, and soil-water levels.

^{1/} Ford, E. C. Upstream flood damage. J. Soil and Water Conserv. 19(6): 231-234. 1964.



Hardwood Growth and Development

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Growth of forest trees and useable volume resulting from their development provide the base upon which wood-using industries are founded. In natural stands, growth and development are controlled by the species and genetic make-up of individuals becoming established under specific environmental situations which influence not only the rate of growth but ultimate size and shape of the individuals. Resultant stands do not necessarily reflect our best interests in terms of species composition, growth rates, or stem size and shape.

For everyday appraisal, we evaluate production of stands in terms of numbers of trees (stocking) per acre and basal area, and volume in convenient units such as cords and board feet. Individuals are measured in diameter at specified points on the bole, form class, merchantable and total heights. These measurements, meaningful to us in comprehending the