

FOREST SERVICE MANAGEMENT REQUIRES CONSIDERATION OF KNOWN
WATERSHED PROPERTIES TO ENHANCE WATER QUALITY AND RESOURCE VALUES

by

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The intent of this paper is primarily to demonstrate that activities of man on the forested watersheds of the Nation have an appreciable effect on the available water resource. It will be brought out that these activities are subject to guidance in accord with a reasonable plan or design. Additional information concerning the water supply in Mississippi, Forest Service organization and objectives and other related items will also be discussed. From this development, it will become apparent that the net size of the water resource about which the Water Resources Research Institute is doing research is primarily determined by forested watersheds.

The Water Resources Research Institute, I think we all will agree, is interested in (1) The total and available water supply, (2) Uses to be made of the available supply, and (3) Condition and conditioning of used water. Increasingly, we realize and appreciate the direct relationship between finesse in handling the water system and overall society success. The relationship becomes more acute with increasing population and industrial growth.

National Forest Administration is devoted to the management of the 186 million acres in the National Forests. This amounts to one-fourth of the Nation's forested lands or one-twelfth of the total land area. The basic objective in managing these lands is to provide maximum benefits to the greatest number of people. The Forest Service, in the Department of Agriculture, besides administering the National Forests, has two other major areas of responsibility:

1. Carrying on research in all phases of forestry at several widely scattered centers throughout the nation, and,
2. Cooperating with the individual state Forestry agencies in providing on-the-ground aid, such as management assistance and fire protection for privately-owned woodlands.

In these ways the Forest Service fulfills the responsibility with which it is charged, for promoting the conservation and best use of the nation's forested lands.

Your U. S. Forest Service in Mississippi is directly responsible for the management of 1.1 million acres of forested watershed and is indirectly concerned with the 16 million acres of privately owned forested watersheds in the State. This paper is devoted, primarily, to the water supply aspects of the system with only passing references to water use and used water condition.

Mississippi's average annual supply of water from precipitation is around 130 million acre feet. This precipitation is received in misty drizzles and beating outbursts, in short spurts and in prolonged storms. Part of this water supply leaves the watershed as surface run-off. The remainder is retained on site at least temporarily. Surface run-off in excess of current needs is lost unless it is stored in an impoundment. Part of the portion retained on site is lost through evaporation. The remainder infiltrates the soil and is available for plant growth, sustaining stream flow, or ground water recharge. Avoiding excess surface run-off and increasing the proportion retained on site is feasible within limits.

Soil texture controls basic infiltration capacity and is determined by individual particle size. Larger particles are associated with larger voids into which water can more readily flow. Particle size, and therefore texture, is an inherent characteristic that varies from site to site. While soil texture cannot be changed, the influence of soil texture on infiltration capacity may be appreciably modified. The extent of modification is rated in terms of hydrologic condition. Good hydrologic condition is one objective of management.

Hydrologic condition is affected by use, abuse, lack of use or protection from abuse. It is a qualitative value determined primarily by the amount of litter on top of, and organic matter incorporated in, the surface layers of the soil. Litter and organic matter, therefore, must modify infiltration capacity. An overlying layer of litter protects the soil from raindrop impact. This is important for, if soil particles are flying around from raindrop impact, smaller particles will fill in the voids between larger particles, reducing infiltration rates. This layer also takes in large quantities of moisture which is subsequently slowly released to infiltrate the soil. This litter serves as a food supply for soil organisms that create subterranean channels. Such channels increase infiltration rates. These organisms break down the litter and mix it with the surface layers of the soil. In this form it is called decomposed organic matter. It decreases bulk density and increases infiltration rates. The root systems from the plants that produce organic matter must eventually serve as a food supply for soil organisms, contribute additional decomposed organic matter, and finally leave additional subterranean channels when the plants die. Obviously, a forested watershed has many of the attributes needed to improve hydrologic condition.

Forest areas produce wood for pulpwood and sawtimber. They supply food and cover for wildlife and in some areas for domestic livestock. Forested areas are used for recreational activities by many people. Developing good hydrologic condition improves water yields. Each of these --- timber, wildlife, grazing, recreation, water --- are valuable natural resources. For the value to be realized, these resources must be utilized. Several of these resources usually exist in the same area at the same time and the resulting multiplicity of use requires maximum coordination.

Use, and the installation of improvements necessary for use, leads to the deterioration of hydrologic condition as follows: Harvesting timber reduces the supply of litter for soil protection, as a food supply for soil organisms, for incorporation in the surface layers of the soil. Eliminating shade accelerates oxidation of previously deposited litter leading to the same results. Access roads expose mineral soil with resulting raindrop splash and plugging of the pores. Transporting the harvested timber places a great load on the soil. This leads to compaction and reduces the number and volume of voids in the soil. Grazing animals not only consume part of the litter supply, they also compact the soil. Recreation sites cover small areas, but these areas receive concentrated use which results in severe compaction. Hunters often damage temporary roads which have been rehabilitated and this can cause erosion.

All of these uses cause people to be in the forest. Since people are the primary cause of forest fires, use, then, also increases the risk of fire. Damage to hydrologic condition from fire varies inversely and geometrically with moisture condition. Fire can eliminate all deposited litter and incorporated decomposed organic matter. It can destroy living plants, eliminating the source of supply of new litter deposits. It can kill the soil organisms that create subterranean channels. Fire can be a useful vegetative management tool in selected areas under prescribed conditions of fuel moisture and weather. This is referred to as prescribed burning and may be used to prepare seed beds, reduce fuel supplies, eliminate undesirable species and control brownspot disease in longleaf pine. Prescribed burning is detrimental to hydrologic condition and can be tolerated only on coarse textured soils or reasonably level terrain.

The Multiple Use Act of 1960 called for judicious use of some or all of these resources. Judicious use entails protecting hydrologic condition. Forest vegetation complexes are developed over long periods of time. Any changes resulting from use will have long range effects. Maximum use accompanied by minimum deterioration of hydrologic condition requires sound management and planning. Obviously, long range plans are needed that are flexible to allow for change in light of new information or changing values.

The Forest Service, then, is very much interested in research results concerning the water resource. Answers are needed to questions such as: "How much water is needed and where?" "When will the need exceed currently available supplies?" "What value will be placed on water yields?" "Will this value exceed values for competing resources?" "Do Forest Service management practices need to be altered?" "When?" The list could go on and on. Many of the answers will be forthcoming from current studies. New research, instigated as questions become crystalized and needs become vital, will contribute still more answers.

At the beginning of this paper, I stated that one of the interests of the Water Resources Research Institute was the extent of the total and available water resource. I went on to say that the hydrologic condition of our watersheds determines to a large extent how much of the total supply will be retained as a useable water resource. From the foregoing discussion, it is apparent that Forest Service activities contribute much

in developing desirable hydrologic condition.

I think it is worthwhile to re-emphasize that Forest Service resource management policy, while being directly applied to National Forest lands, is also filtered down indirectly to privately owned forest areas. The Division of State and Private Forestry offers technical training to State Forestry Agencies. The State Agency, then, offers technical assistance to individual landowners. National Forest lands serve as demonstrations for adjacent landowners.

In summary, then, the Forest Service is charged with promoting the conservation and best use of the Nation's forests, amounting to one-third of the total land area. Hydrologic condition of these forested watersheds determines in large measure the quantity and quality of the available water resource.

Forest Service management is dedicated to producing optimum supplies of quality water. The Forest Service and the Water Resources Research Institute then, must hold mutual interests in the needs and opportunities associated with the water resource.