INTRODUCTION

Of all the ecosystem components, water i perhaps the most sensitive to the disturbance o vegetation and soils on the land surface. Water i not only a valuable resource product from forest and rangelands, but is also the principal carrier o nutrients through the soil-plant-water-atmospheri continuum. Water responds to disturbance through a variety of characteristics including: tim ing and quantity of flow, physical parameters, sucl as temperature, sediment content, dissolved ox ygen; and biological and chemical constituents an characteristics.

Effects of various land treatment measures an disturbances have been best characterized fo water quantity and timing. Interest in water as response indicator of forest cover alterations date to the early 1900's; timing, peak discharge, wate yield, and sediment were the principal hydrologi responses of interest in research programs aimed a improving water yields from forests and range lands.

In the 1960's, the emphasis shifted markedly to utilization of chemical, physical, and biological water quality parameters as indicators of nonpoint sources of pollution resulting from silviculture activities. Since prescribed burning is probably the most widely used treatment in management of forests and rangelands and is an important part of the Forest Service's new fire management policy, it is appropriate and timely to assemble our current knowledge of effects of fire on water.

Research on effects of fire on water interfaces closely with and probably overlaps some of the research discussed in the Effects of Fire on Soils, A State-of-Knowledge Review GTR WO-7. Nonetheless, an understanding of the cycling processes on the land surface is basic to an understanding of the hydrologic responses to disturbance observed at the stream and lake level.

In this review, studies of wildfire and prescribed burning have been utilized for an assessment of fire effects. However, in areas typified by low acreage burned (Northeast United States, for example), little information is available. For such areas we have utilized information from studies not involving fire to obtain estimates of responses that may be anticipated from burning. We felt this was necessary because of widening interest in these regions for the use of fire for silvicultural purposes and for wildlife habitat improvement.

Where possible, we have included information on effects of wildfire suppression activities, such as mechanical fireline construction and aerial application of retardant chemicals. Discussion of fireline construction activities is especially pertinent for Alaskan permafrost situations. The scope of this review has been expanded to include effects of post-wildfire and post-prescribed burn activities, such as erosion control fertilization, since these are integral parts of fire management programs.

Field studies to determine the effects of fire on water resources have generally used three principal approaches:

Unit watershed or catchment study.—This involves establishment of the relationship among several watersheds for precipitation input, stream discharge, timing, temperature, and water quality during a calibration or pretreatment period. Responses to treatment on one or more watersheds for these parameters are compared to the pretreatment period and one or more untreated control watersheds.

Lysimetric or runoff plot study.—This study uses an approach similar to the unit watershed or catchment study but on a small plot scale. An area is physically delineated where precipitation input can be determined for a unit area or applied artificially. Discharge can be collected and measured or depth and duration of flow can be measured. Changes in quantity and quality of water following treatment of this known area of land can be readily determined.

Tension lysimetry study.—In this approach moisture is pulled from the soil through porous cups or plates under tension.

A discussion of the advantages and disadvantages of the various approaches is beyond the scope of this review; refer to Hewlett (1970) and Hewlett et al. (1969) for discussions of the merits of various approaches for studying water responses to management practices and other perturbations.