Physical Transfer Processes in Subarctic Soils Influenced by Forest Fires

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Many parts of interior Alaska have a fire-dominated environment. Annually about one million acres of forest land are burned throughout the state. The more intense burns occur in the black spruce (*Picea mariana*) forests which are characterized by a thick organic layer and a shallow mineral soil underlain by permafrost. The result of a fire in a black spruce setting is the immediate destruction of the tree layer, lichen and moss, and surface organic layers. The degree of disturbance depends upon the intensity of the burn which is related to wind, temperature, humidity, soil moisture, type and quantity of fuels, and topography. This change in the surface boundary caused by fire is reflected in several heat and mass transfer processes of interest.

The trend over the past three decades in Alaska has been an increase in the number of fires, but a decrease in the total acreage burned (Barney, 1971).

Time	No. of Fires	Total Acreage Burned	Average Acreage/Fire
1940-1949	1138	12.4×10^6	10,906
1950-1959	2583	10.7×10^6	4,137
1960-1969	2380	6.4×10^6	2,674

Lightning accounts for only 30% of the individual fires; however, these fires account for almost 80% of the area burned. More efficient methods of fire prevention and control are reflected by the substantial reduction in total acreage burned in the last decade.

Wright and Heinselman (1973), in discussing the ecological role of fire, listed six generalized effects: influence on the physical and chemical environment; regulator of dry matter accumulation; controller of plant species and communities; determinant of wildlife habitat patterns and populations; controller of forest insects, parasites, fungi; controller of major ecosystem processes and characteristics. Many of these categories overlap and therefore are not completely separable. Discussion in this paper will deal only partially with the influence on the physical environment and more specifically with the thermal and moisture regimes of the near surface soils.

The objectives of this study were to examine the soil moisture and temperature conditions in a burned area and in an unburned area in a black spruce forest. Presented in this paper are the results of one year of data collection; identical data for an area burned in 1971 are also included.

The preliminary results of this study indicate that major changes do occur in the physical system resulting from fire manipulation, both in the thermal and moisture regimes. An understanding of heat and mass transfer dynamics is vital to any meaningful understanding of biological and chemical system dynamics, as well as the hydrologic system. Changes in the hydrologic system are more apparent at the air/ground interface, although almost all facets are influenced.