FILE REPORT NOR-Y-44

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FOREST HYDROLOGY IN CANADA: MORE WATER PROBABLY NOT WANTED.

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Northern Forest Research Centre
Environment Canada
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FOREST HYDROLOGY IN CANADA: MORE WATER PROBABLY NOT WANTED

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Increased water yields from forested lands after they have been clear harvested is a natural resultant of commercial timber operations. This occurs whether the cleared areas are few and large (40 or more hectares) or numerous and small (.8 to 1.6 ha.) (Bates and Henry, 1928; Martinelli, 1964). It is not necessary to distribute clearings over the entire drainage either: a 46% increase in annual yield resulted from clearcutting only the moist site zone in Arizona, approximately 31% of the total drainage (Rich, 1965).

Increased water yields have been termed an improvement or a benefit of forestry operations. This is perhaps a natural outgrowth resulting from why and where watershed research has been conducted. Much has occurred in the United States and that in response to water shortages. Thus it is natural that increased yield to meet short supply would be termed "improvement". Improved yield and increased yield have become almost synonymous words which is unfortunate. The Canadian program started as one with the goal of improving water yield, a goal which nearly everyone interpreted as increasing yield (Jeffrey, 1967). Several of Canada's major rivers flow North toward the polar region, eastward or parallel to lines of latitude across great expanses of flat prairie. It is doubtful that increased yields to either of these rivers would be an improvement.

Canada's Rivers are Flood Prone:

Eastward and northward flowing river systems are more subject to spring snowmelt flooding than their south-flowing counterparts, although, even in these flooding has resulted from forest clearing (Anderson and Hobba, 1959). This is a result of three physical features: the normal progression of snowmelt-ice breakup from south to north; the low elevational gradient; the prevailing climatic patterns.

Ice breakup occurs first in the southern portion of northward flowing streams and last at the mouth. For instance, on the Mackenzie-Slave River at Lake Athabasca, (elev. 180 m lat. 59 N.) the average date for ice breakup is May 1 while at Aklavik, 2260 km downstream, (elev. sea level, lat. 69 N.) breakup doesn't occur until June 1. On a river of perhaps more immediate importance, the Saskatchewan, ice breakup occurs at Edmonton, (elev. 820 m. lat. 53 N.) on April 15 and at Lake Winnipeg, (elev. 270 m. lat. 53 N.) 10 days later on April 25. Even on a river which flows predominantly south, the Fraser, the north flowing reach between Mt. Robson Provincial Park and Prince George shows the same trend: breakup starts on March 20 at Mt. Robson; April 1 at Prince George (Allen, 1964).

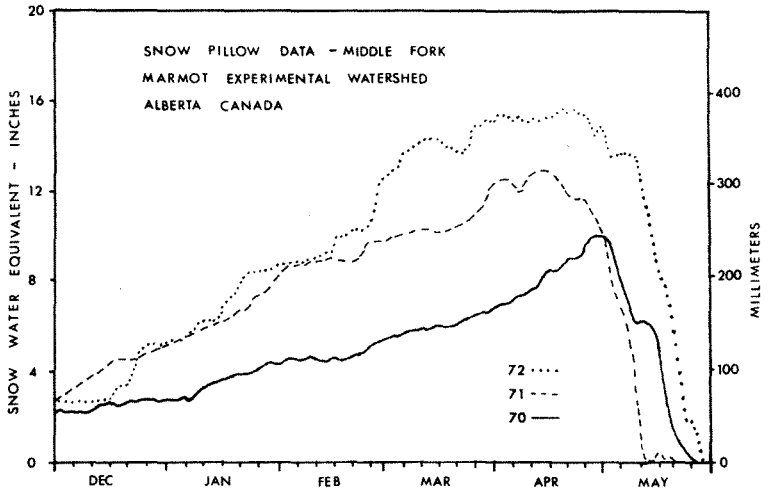

Figure 1. Snow accumulation and melt as indicated by snow pillow recorder, Marmot experimental watershed, Lat 50° 58'N. Long., 115° 11' West, Elev. 1750 m, 1970-1972. Data courtesy of the Eastern Rockies Forest Conservation Board.

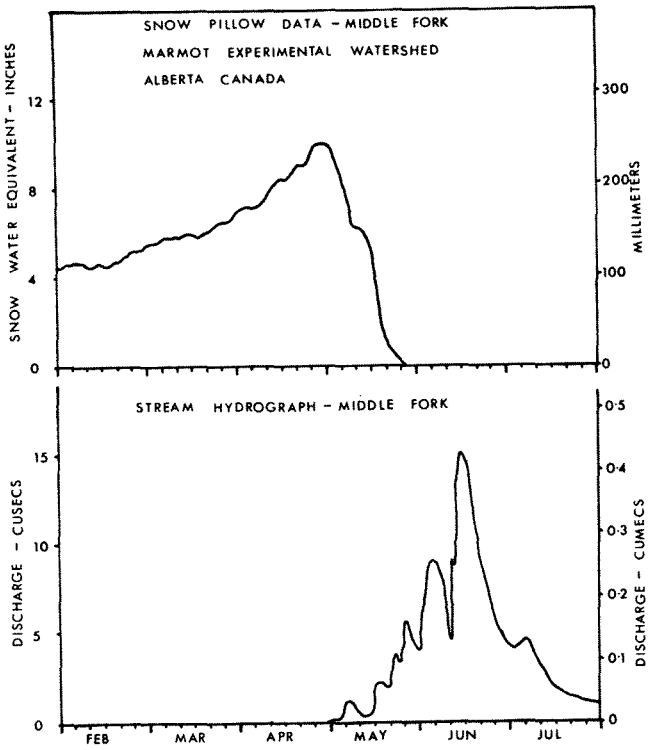

Figure 2. Marmot-middle fork hydrograph and snow water equivalent-time graph, 1970. The coincidence of release of snowmelt water and time of hydrograph rise is quite apparent.

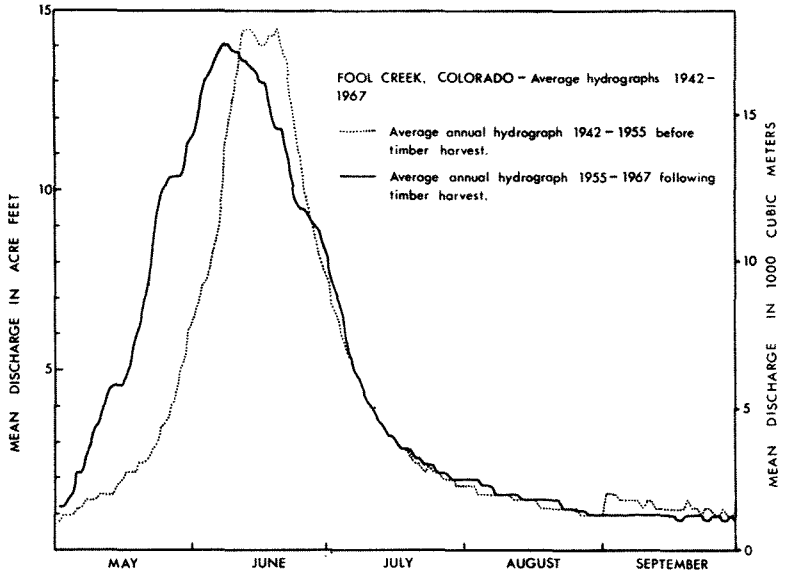

Figure 3. Before and after harvest cutting hydrographs, Fool Creek watershed, Fraser, Colorado. Data courtesy of U. S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

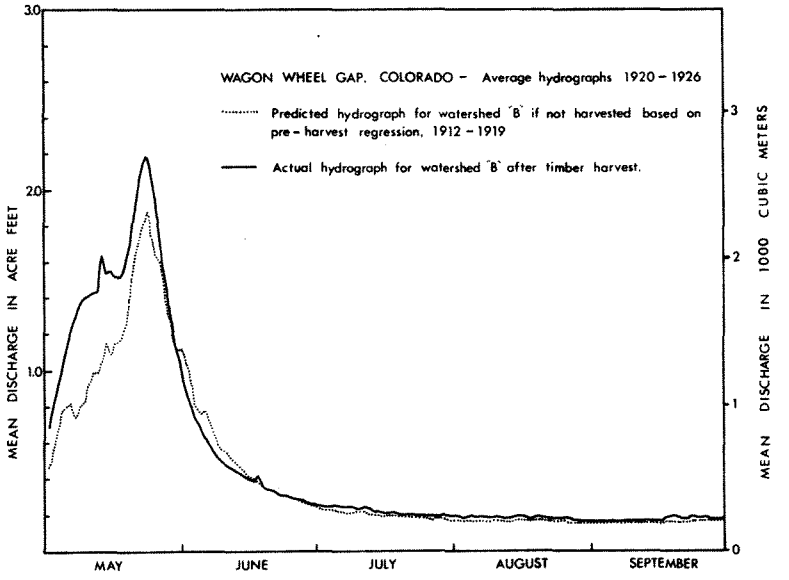

Figure 4. With and without harvest cutting hydrographs, Watershed "B", Wagon Wheel Gap, Colorado.