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Snow Cover Depletion in the North Nashwaaksis Stream Basin, N.B.*

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The following report on snow cover depletion deals with only a small part of an overall program to predict runoff from snowmelt. When an adequate means of snowmelt-streamflow forecasting is available, the basis will be established to estimate suspended sediment and bed load movements for a certain region by measuring the meteorological parameters causing snowmelt.

One of the main variables which has to be estimated during periods of runoff is the amount of area actually contributing to runoff. Most of the snowmelt equations, for example UNITED STATES CORPS OF ENGINEERS (1965) generalized snowmelt equations, compute the amount of melt in inches of water equivalent per day for a snow-covered area.

To commence studies in this region to estimate the amount of snow cover, a flight was made over the North Nashwaaksis Stream Basin near Fredericton, New Brunswick (Figure 1). This basin was chosen for the study as it has been designated as a representative watershed for the International Hydrological Decade (reported in Maritime Sediments, 2-ii 79-81, April 1966). Consequently, the basin has accurate measurements of the major hydrometeorological elements for the last 10 months.

On 5 April 1966, photographs of the basin were taken from a height of approximately 1500 feet above ground from a light aircraft as it made a circuit around the basin divide. The aircraft was not equipped to take vertical _hoto_ra_hs so oblique ones were taken for the initial phase of the study. Most of the basin is forest covered, and it was difficult to determine surface conditions from the oblique photographs where the cover was dense. To overcome this difficulty, it is suggested that future flights be made at a higher altitude and than an attempt be made to take vertical photographs.

Since the only areas that could be interpreted easily were the open areas, this study was limited to snow cover depletion in open fields. In the forested areas that could be examined adequately in the photographs, it was observed that the ground was completely covered with snow.

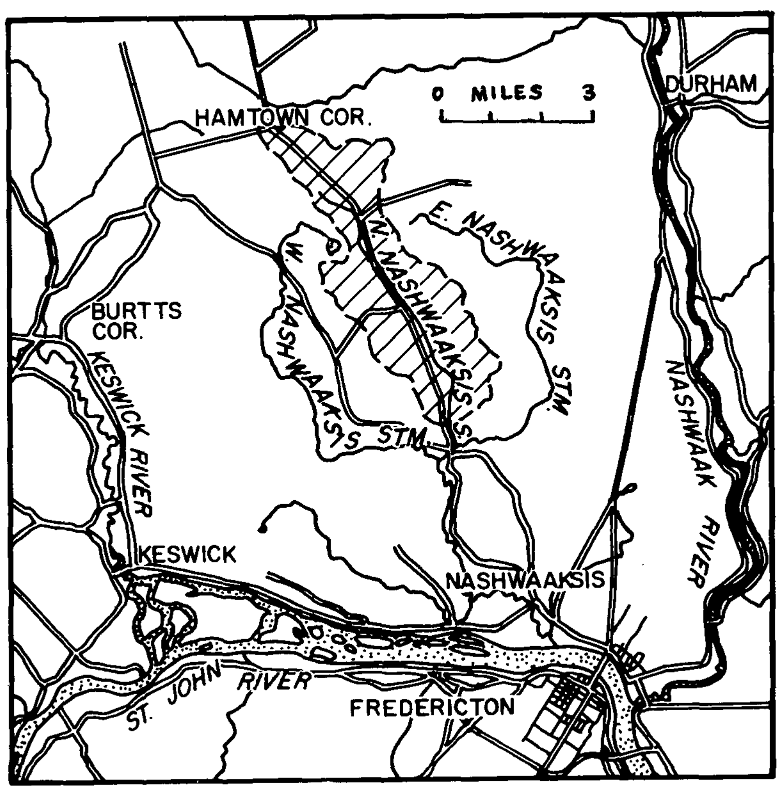

Figure 1. Location of the North Nashwaaksis Stream Basin, New Brunswick

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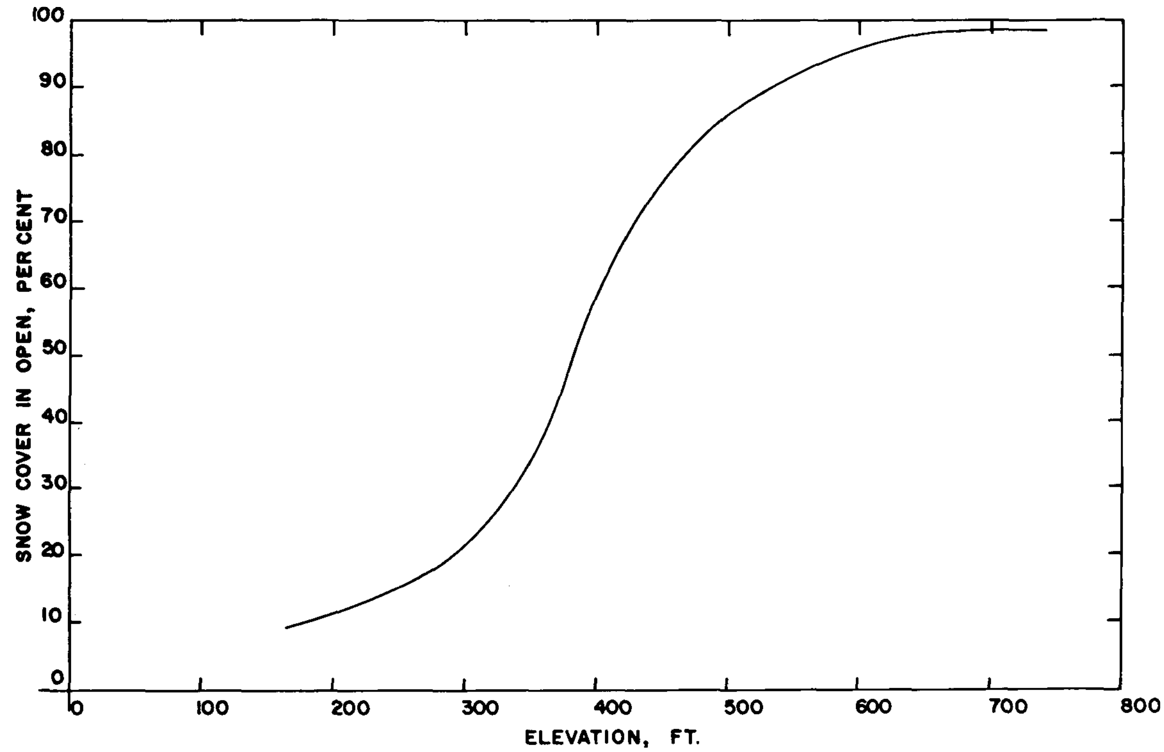

Figure 2. Snow cover in open areas vs. elevation, North Nashwaaksis Stream Basin, New Brunswick, 5 April 1966.

For each photograph, the approximate area covered by snow in the unforested parts of the basin were determined by examination of the prints. The elevation of the centre of each photograph was obtained from a topographic map, and a plot of percent of open area covered with snow versus elevation prepared (Figure 2). From this plot it may be seen that the snow covered areas in open fields vary from about 10% at an elevation of 150 feet to about 95% at 800 feet, for the day of 5 April 1966.

The average difference in temperature between the lower elevation and the upper would be about 3.0°F, assuming a lapse rate of 4.6°F/1000 feet. This lapse rate would represent a condition between the dry adiabatic lapse rate and the saturated adiabatic lapse rate. No measurements are available to verify the above estimation.

With this change in temperature it may be expected that more precipitation will fall as snow at the high elevations especially during the beginning and end of a snow accumulation period. An average difference in temperature in order of 3.0°F would also result in more melt at the lower elevations than at the higher elevations for the early part of the snowmelt season.

As further work is carried out in this study and as more hydrometeorological data is accumulated, attempts will be made to derive indirect methods of estimating snow cover for both open and forested areas (U.S. CORPS OF ENGINEERS, 1956, 1960; GARSTKA et al, 1958). The next steps in the study will be as follows:

1. Take vertical photographs from a higher elevation.
2. Make a flight once a week during the snow cover depletion period of the snowmelt season.

In conclusion it may be stated that

1. Reasonable estimations of snow cover depletion can be made by the use of inclined photographs for unforested areas.
2. Relatively small changes in elevation have a marked influence on the snow cover depletion for unforested areas.

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