FORECASTING THE RUNOFF OF THE COLUMBIA RIVER BASIN

A Radio Talk
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In 1933 the series of talks on snow surveying was inaugurated with the "Biography of Snow Surveying". This was followed last March by "Snow Surveying and the Boulder Canyon Dam."

Next in immediate public interest is "Forecasting the Runoff of the Columbia and Upper Missouri River Basins" primarily for the control of floods and navigation and secondarily for irrigation and power. Today's talk will be confined to the Columbia Basin, seat of the Northwestern Inland Empire. At another time we may step over the Continental Divide to the Upper Missouri and even to the Bow River in Canada, where snow survey systems have already been established.

The figures involved in the Columbia are gigantic: for example, the Columbia and Colorado together drain almost equally the entire western slope of the Rocky Mountains from New Mexico into Canada(a distance of approximately 1300 miles) and furnish an annual waterflow between them of approximately 169,000,000 acre-feet, but at the ratio of 9:1, the wet Columbia

flowing 151,500,000 acre-feet, while its arid sister flows only 17,500,000 acre-feet.

The tremendous flow of the Columbia is furnished by three principal tributaries--the upper Columbia with the Kootenay(53 million acre-feet)the Clark Fork-Pend Oreille (19 million acre-feet), and the Snake(45 million acre-feet). The combined system covers with a more or less complete network the entire arid region of Idaho, Oregon, and Washington and thus guarantees to these states a permanent foundation for agricultural and power development. The chief problem especially downstream will be the lifting of water to the high lands, and its solution may be the power ability of the stream itself.

The three tributaries mentioned supply 77 percent, or about 117 million acre-feet, of the total annual flow of the Columbia at the Dalles, and their individual basins are so large and their flow so abundant that at least two of them have become centers for a series of great reclamation projects. Of the tributaries, the Spokane has long been the source of interstate power.

The problem of forecasting the summer, or April-July runoff of the Columbia is virtually the problem of forecasting the runoff of its individual feeders, for the interests served are on the tributaries rather than on the main stream. However, the collective

forecast for the feeders would represent the forecast for the main stream. This is shown by the record of 1913-1921, during which time the maximum annual variation between the collective runoff of the major feeders and the runoff of the main stream at the Dalles was within seven percent and the maximum variation for April-July within 11 percent, altho divergencies of 20 to 35 percent frequently occur between the tributaries themselves. Furthermore, on the basis of fragmentary records a similar closeness of agreement prevailed throughout the preceding decade.

However, forecasting for even the individual feeders is far more complex than on the Colorado. Precipitation during April-July grows relatively heavier with increase in distanc3 from the Pacific Coast, and the snow cover on the upper Columbia watershed melts slowly during this period, thus catching and untimately transmitting to the stream the bulk of the precipitation. Therefore, the snow cover April 1 rapresents only the minimum rather than the probable flow of the stream.

The lower Columbia drains the Cascade and Coast Ranges, which are here of low elevation and transmit the bulk of their snow immediately to the streams. For instance 57 percent of the runoff of the Willamette is in December-March and 27 percent in April-July, Furthermore, the precipitation on this watershed is

relatively light during April-July and adds little to the summer flow in the lower stream. On the other hand, the Columbia above the Dalles flows only 17 percent in December-March and 61 percent during April-July.

Consequently, the upper and lower Columbia are complementary to each other, and whatever late spring and summer rise occurs in the Columbia will be due to the snow on the Continental Divide. On the other hand, except for the influence of the chinook, the high water in winter should be due to heavy precipitation in the Cascade and Coast Ranges and should occur mainly in the Lower Columbia and its immediate tributaries, for the bed of the upper Columbia is too capacious to be overflowed in its low water season except under abnormal conditions.

The prevention and utilization of floods will doubtless be made a part of the investigation of the natural resources of the State of Washington authorized by its last Legislature. In such prevention, snow surveying must play a basic part.

As a part of a forecast news service, in coming seasons the results of snow surveys with forecasts of streamflow will be issued on March 1 or April 1 and even in January or February if the news warrants.

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