

Snow Surveys Get Early Start in Region

Interest Develops After Severe Water Shortage in 1934

(Editor's note: The following article, in which the work of the snow surveyors is discussed, was prepared by R. A. Work, Portland. The article explains the southern Oregon federal-state-private cooperative snow survey activity.)

By R. A. WORK

Head, Water Supply Forecast Section Soil Conservation Service, U.S. Department of Agriculture, and Professor of Irrigation Water Forecasting Oregon State College

To focus clearly on the beginnings of snow surveys in southern Oregon, some little-known history covering establishment of the Medford Irrigation Experiment Station ought to be related.

The Fruit Growers League, then under leadership of Eddie Carlton, Alfred and Leonard Carpenter, and Albert Burch, with collaboration from O. O. (Ole) Alenderfer and others, had created an Experiment Station committee in the late 20's for initiation of research work in drainage, irrigation, and pear production problems on "sticky" soils.

The work planned for the Medford station was intended to supplement the outstanding work in pear breeding, blight control, fruit keeping quality, entomology and so on which was then being carried on at the Experiment Station near Talent by Professor F. C. Reimer and Louis Gentner.

The committee secured federal appropriations to the bureau of agricultural engineering in 1929 and later, in 1931, also to the bureau of plant industry for this cooperative work. M. R. Lewis and the writer were assigned by W. W. McLaughlin, then chief of the division of irrigation to cooperate with Oregon State college, with the Fruit Growers and other agricultural interests at Medford. Later, in early 1932, W. W. (Bill) Aldrich joined us.

The initial studies of '29 and '30 were directed towards orchard drainage problems, although in 1930 Lewis and I undertook some duty of water studies, made possible by generous cooperation from Chester Fitch and from Dave Wood of the Palmer corporation.

In 1931 the committee recommended establishment of the irrigation experiment station. After an extensive search for a suitable and available orchard, the committee selected a 20-acre partition of the old Billy Budge tract just south of Medford.

In those days dollars really were dollars and not easy to come by either. In consequence, some fascinating financing took place. The county court, headed by Judge Alex Sparrow agreed to budget \$3,500 annually towards the total agreed purchase price for the orchard, providing the government could meet the operating and research expense, and assuming necessary buildings would be provided from some source.

Attorney's Ruling

The whole proposal nearly dead-centered when the state's attorney general ruled that no county court could commit any future court to meet annually continuing purchase obligations. However, through the good offices and energy of Raymond Reter and Pinnacle corporation, who agreed to escrow the property, in a way of speaking, without any charge for interest on deferred payments and without obligating any future county court to continue the payments, George Coddling, then county attorney, worked out an acceptable agreement.

The building site and part of the entry road then was acquired from Pinnacle corporation on a deferred payment plan. Under the plan the interest-free payment could be deferred for several years until the orchard transaction was completed. The wizardry which followed involved the floating of a private 6 per cent loan from a fourth party to pay a contractor of first part for erecting buildings on land which belonged to a third party and was mortgaged to a second.

A further small difficulty with maintaining buildings then owned neither by county nor federal government soon was solved, and the station was fully operative and in production by early 1932. The crop returns, credited to OSC, were ploughed back to meet the operating costs.

In 1934, a severe irrigation water shortage developed at



SOIL SAMPLE—Early efforts by Oregon cooperative snow surveys to improve accuracy of seasonal water supply forecasts included physical collection of soil samples from earth beneath snowpack. The samples were weighed, oven-dried and reweighed, and the moisture percentages computed. This picture was taken about 1938 in Crater Lake National park. Left to right are R. A. Work, R. W. Childreth and G. F. Sturdevant.



SAMPLE SOIL—Soil moisture sampling today by SCS snow surveyors through improved electrical resistance method is shown above. At left is J. N. Washichek, assistant snow survey supervisor for Colorado, and R. T. Beaumont, water supply forecasting section, SCS, Portland. The picture was taken by the SCS at Jackson, Wyo., in 1937.

snowshoe harness. Two members of that party snowshoed, but one traveled on an eight-foot pair of ash skis.

By 1937 the southern Oregon snow survey network had become well established. In that year the first numerical forecasts for the irrigation season were published by Oregon State college and bureau of agricultural engineering. However, the Rogue valley Pear-O-Scope, in March 1935, published an assessment of the water supply outlook for Rogue River valley jointly prepared by Olin Arnespiger, Clinton Smith, and the writer.

There were interesting experiences in those days of the earlier snow surveys. I scarcely qualified as a "fire-side forecast" method. One side event involved Alvin Copeland and another snow surveyor in the winter of 1936.

Copeland and his companion, with some assistance, had hand-logged and split-shaken a little snow survey cabin on the north shore of South Lake at the head of Rogue river's middle fork. For winter entry, a gable entrance was provided under the ridge pole 7 or 8 feet above the ground surface.

Travel Light

Early in 1936 these two snow surveyors skied from Ft. Klamath into the Seven Lakes basin to measure snow. They were traveling light and fast with only a hand axe.

nent in Medford business circles engage in snow surveys, most for free and all for experience—Aub Norris, Dwight Houghton, Arnel Butler, John Day, Bob Norris, John Neidermeyer, Paul Culbertson, and others, numbered among the finest of companies.

About 1937, Ralph Stevenson, Moore Hamilton and others interested the Oregon state legislature in providing funds whereby the Oregon Agricultural Experiment station could participate in snow survey research, not only around Medford but elsewhere in Oregon where the water users were looking for the best forecasts of runoff that could be provided.

Continues Cooperation

The state has continued its dependable cooperation all through the years. In fact, the list of longtime local cooperators in the field work of the Oregon Snow Survey includes importantly the California Oregon Power company, the Medford, Rogue River valley, Talent, and Grants Pass Irrigation districts, the county watermasters, the forest service, park service, corps of army engineers, U.S. geological survey, Indian service, fish and wildlife service, as well as many others. Some provided funds and others provided assistance or facilities.

In 1939 the bureau of agricultural engineering ceased to exist. Its functions were distributed to other federal agencies. Its snow surveys were assigned to the Soil Conservation Service, where the activity continues. That shift brought some disassociation of our particular group from the Medford Branch station, although it was possible to maintain headquarters there until another reorganizational shift sent the Western States Snow Survey headquarters to Portland and centered administration of SCS state activities under the respective state conservationists.

In 1941, during the conduct of some basic research work with snow by the Medford station, W. T. (Jack) Frost, then park ranger at Crater lake, became greatly interested in the work. Jack transferred over to the snow surveys in 1942 and subsequently became well known in southern Oregon as the snow survey supervisor and water supply forecasting section, SCS, Portland. The picture was taken by the SCS at Jackson, Wyo., in 1937.

Bob Beaumont, a meteorologist and ex-Navy commander from University of Washington, joined our Medford staff in 1949 and Manes Barton, a crack statistician, came to us from the Forest Service flood survey group in 1951.

No Sideline Activity

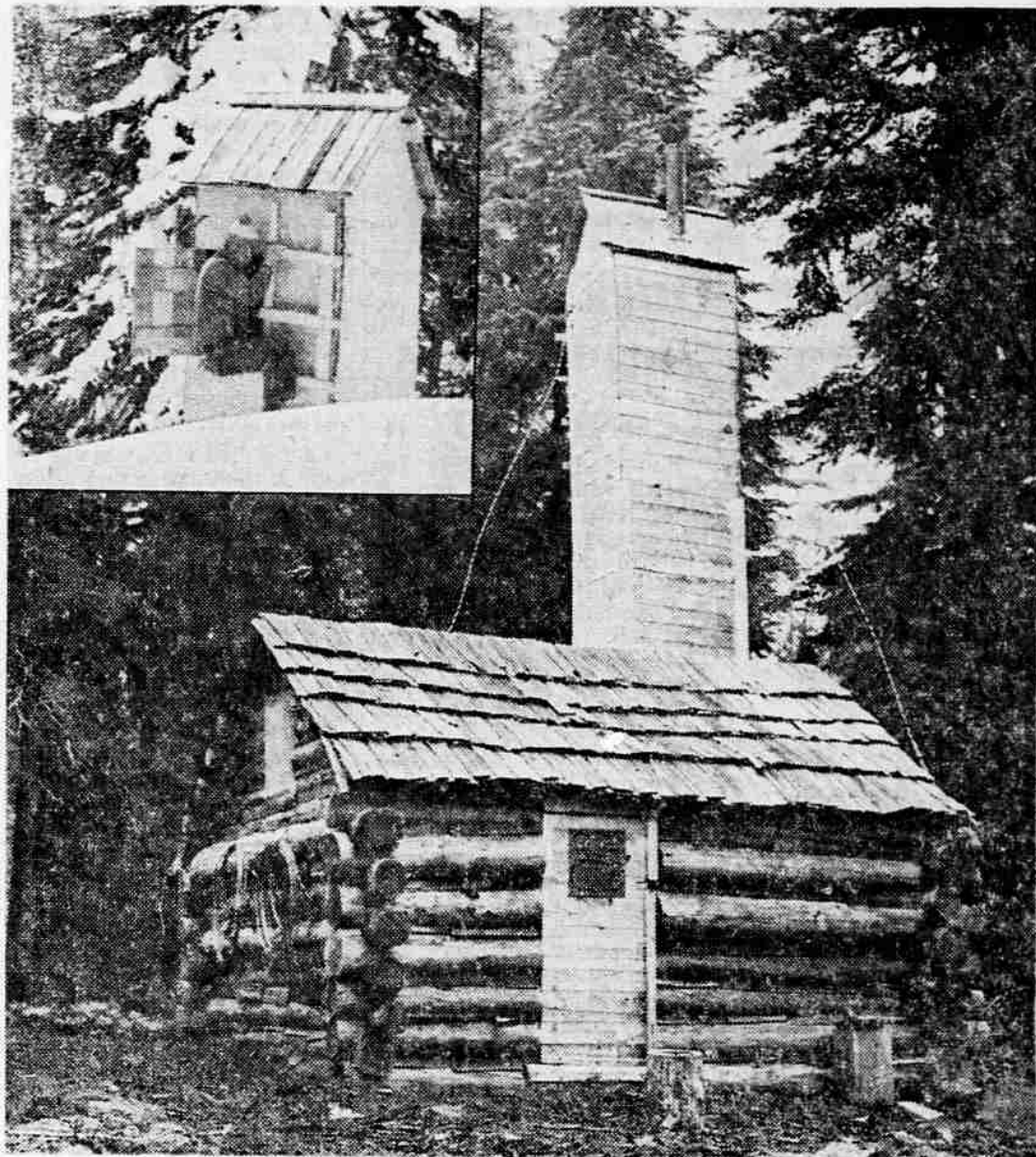
Recently a casual acquaintance commented, "My, you folks must have a big turnover of people in that snow survey job. Looks rough to me." The record shows quite the contrary. In our opinion, it would be difficult to find a professional group with greater stability or esprit de corps. The Western States Snow Survey supervisors with whom it is my privilege to associate aggregate about 160 man-years experience in snow surveys for their small group of 11 men. This is not a sideline activity with these men.

The job has somewhat expanded since 1935 along with the needs. There were then but four of us full-time engineers to supervise snow surveys in the West. It was Mr. McLaughlin's policy to appoint as collaborators officials of state agencies conducting snow surveys in various states.

George D. Clyde, now governor of Utah, but then in charge of the snow surveys in Utah, once held such an honorary appointment with our group prior to his becoming chief of the irrigation division of the soil conservation service. In the opening days of Governor Clyde's administration, he faced an extremely serious prisoner rebellion at Point of Rocks State prison. Governor Clyde with characteristic decision met that situation quickly and forcefully by applying a precept which all snow survey supervisors live by—"Never ask any man to do that which you yourself have not done or are not willing to attempt." He personally went into the prison grounds and settled the matter.

Manpower Shortage

Shortage of manpower during the war years stimulated our efforts to find over-snow machines whereby fewer men could do the work of many. I recall having a letter from E. M. Tucker in 1944 who asked if we could help him in some fashion to bring a machine to Medford from Grass Valley, Calif., to test it on Crater lake's snow.



SHELTER CABIN—The old snow survey shelter cabin built by the department of agriculture in the Seven Lakes Basin area in 1935 was used by Oregon cooperative snow surveyors until about 1943. Miller entering the cabin. The picture of the cabin, taken in about 1938, was taken by the Soil Conservation Service.

He came, and snow surveyors later, including Antarcica's Fuchs and Hillary, came to reckon his Sno-Cat as old reliable itself.

The first Sno-Cat used in Oregon's snow surveys was based at Medford. We named her "Chinook," which means "snow eater." That particular machine stayed in service for 11 years and traveled more than 15,000 miles on snow surveys and in rescue work. "Chinook" was one of the two Sno-Cats used in the National Geographic 1948 winter conquest of the Oregon Cascades from Green Springs summit to the north toe of Mt. Hood.

About this time in the record, E. P. Leavitt, then superintendent of Crater Lake National park, reckoned the annual value of Crater lake's "white gold" at one million dollars per season.

Annual Snow Crop

The snow surveyors who kept the snow survey books that year on that million dollar crop were no end impressed, but even so, carried on at the same old rate of pay. Crater Lake's park's annual snow crop and that of the adjacent National Forests now is without doubt far more valuable in view of the steadily increased water use of recent years.

A further basic use for snow survey data came to light in 1949. Rogue valley water users had reacted quickly to Langmuir's and Schaefer's announcement of measurable effects observed from seeding the atmosphere with artificial nuclei.

Robert Kent, then manager of TID, and Copco were the first to recognize the potential to irrigators and power companies for use of this scientific tool. After two seasons' work, the TID project was terminated, as the district felt the results were not encouraging.

Copco's carefully considered and well-planned snowpack project followed immediately in a differing part of the watershed. Different procedures were used for seeding.

Group Collaborates

The Medford snow survey group collaborated with the Oregon Agricultural Research foundation from the beginning to provide objective evaluations of results of the TID and Copco projects. Bob Beaumont, and later Manes Barton, found evaluation procedures which are now widely used what may now well be the longest continual record of cold seeding for snowpack increase anywhere on the globe as that activity is now in its 10th consecutive season.

The original seasonal runoff forecast formulae at Medford were based on the strong relationship between the April 1 snow survey and resultant runoff, with adjustment for precipitation departure from normal during April and May.

After accumulating a few years of March 1 surveys,

those were found even more dependably related to the runoff in the short water years. Still later, in 1943, the forecast procedure for Umpqua river was qualified to recognize the annual river base flow factor. This factor allows the forecaster to consider water stored underground which sometimes shows up months later as river flow. This procedure also was adopted in the Klamath basin.

Valuable Tool

A valuable tool for such assessment is found in measurements of flow from deep-seated springs. About 1944, the formula incorporated an evaluation of the fall soil priming factor as deduced from rainfall records. However, use of the rainfall data is necessarily quite restricted due to scarcity of reliable records from stations actually located in the water-producing areas of the upper watersheds.

Jack Frost and the rest of us spent a good many hours through the years with Harry Olsen and Ernie Price, Copco's veteran water authorities, in studying these and other relationships and exchanging views as to their meaning. In fact, the Southern Oregon Water Forecast committee first constituted in 1936 has never missed its annual spring meeting.

This group, although sponsored by the Snow Surveys, took its strength from the irrigation district managers, watermasters, foresters and other technicians who brought

in their data, observations and interpretations for a general good "picking over."

Needs for Forecasts

Needs for seasonal water supply forecasts are so clearly defined that we snow surveyors sometimes tend to overlook explanations needed to keep public supporters fully informed of our activities.

By seasonal water supply is meant, of course, the dry summer period beginning April 1 and terminating Sept. 30, this being the period of greatest agricultural water need, and of least runoff.

There are now more than 24 million acres of irrigated land in the west. Probably not less than 80 per cent of this acreage relies directly or indirectly for water supplies upon winter snow quietly sifting down in secret forest aisles. Power lines hum and the spinning wheels of industry reflect each melting flake. Growing municipalities absorb the runoff from snow melt.

Competition between the uses of water for farming, recreation, power generation and other beneficial purposes is growing steadily, but is more evident now than a quarter-century ago.

Natural Resources

Development and use of the natural resources of the west has come to the point where water, the limiting factor in these developments to begin with, has become of greatest concern. To satisfy all of these needs now and in the future, calls for the greatest skill and cooperation possible

in water management. Water management is fundamentally based on foreknowledge of the flow expected during the irrigation season from year to year. This, then, is the basis for need of the snow surveys and resultant forecasts of streamflow yet to come.

Seasonal runoff forecasts are not directly comparable to those for the "water-year." A few of the latter type have been provided in southern Oregon since 1950 from non-agricultural sources. Such a comparison would be difficult to attempt since the seasonal and water year flows are for different periods which lack a fixed relationship, one to the other.

Anyone dealing with events of the future would be gifted indeed to estimate precisely the exact magnitude for each of a series of events. This is more especially true with the forecasts of river flows, wherein much of the success rests with a cooperative climate and watershed.

Heavy Rains

Suppose heavy rains occur in June-greater than before recorded? This produces much more water than expected. Likewise, a long virtually rainless period with attendant pronounced evaporation and transpiration markedly reduces the river flow below that foreseen from the snow survey.

There follows the snow survey record of accuracy in pioneering the forecasting of the irrigation season flow each year for North Fork of Rogue river. This is the fork which tributaries most generously towards the down river flows of the main river for irrigation, power and recreation. Values for each year express the error of the forecast as per cent:

1937, 32.2 per cent; 1938, 12.2 per cent; 1939, no forecast; 1940, no forecast; 1941, 7.8 per cent; 1942, 23.7 per cent; 1943, 4.8 per cent; 1944, 7.3 per cent; 1945, 13.7 per cent; 1946, 13.4 per cent; 1947, 15.6 per cent; 1948, 8.4 per cent; 1949, 0.4 per cent; 1950, 1.4 per cent; 1951, 1.3 per cent; 1952, 6.7 per cent; 1953, 6.1 per cent; 1954, 4.8 per cent; 1955, 2.5 per cent; 1956, 7.3 per cent; 1957, 5.3 per cent; 1958, runoff record not available; average 1937-1951, 9.4 per cent.

Naturally, we'd as soon forget 1937, but the moving finger, having writ, leaves the record forever. It could be conceded that snow survey records then were scanty and of short projection on that watershed. The record in the most recent decade is noticeably better, with no error greater than 9 per cent.

This is one of the more reliable rivers to forecast; thus, the snow surveys errors of forecast are somewhat greater on some other local streams. However, the water users of southern Oregon can be assured that Oregon State college, the state engineer's office and the soil conservation service will mutually continue to seek improvements in techniques and practices for improved forecast accuracy, and for continued effort to establish tight cooperation, so far as available resources and situations will permit and encourage.

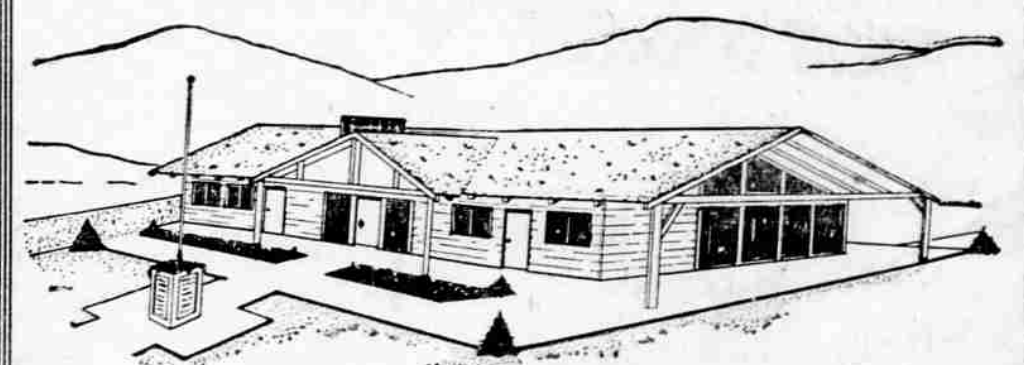


SNO-CAT USE—Tucker Sno-Cats were first used in snow surveys during the war years. Above an early model is shown at the rim of Crater lake. E. M. Tucker, inventor and founder of the Tucker Sno-Cat, is at left, and W. T.

(Jack) Frost, snow survey supervisor of Oregon, is at right. The Sno-Cats were shipped to Medford from Grass Valley, Calif. Later Tucker moved his plant to Medford. (Soil Conservation Service Photo.)

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