[Snow Survey of Cottonwood Creek, Idaho, 1917]

I read this with a great deal of interest.

Weather Bureau Office
Boise, Idaho

April 17, 1917.

Chief U.S. Weather Bureau,

Washington, D.C.

(Thru Official in Charge, Boise, Idaho.)

Sir:

Referring to letter of authorization No. 405 W. dated March 3, 1917, relative to the snow survey of Cottonwood Creek watershed, I have the honor to report as follows:-

It was intended to start the survey on March 1st. but continued storms prevented work until one week later.

On March 6th I traveled from Boise to Arrowrock by stage, and was fortunate enough to secure transportation by team and sled from there to Cottonwood Creek.

In direct contrast to the condition of last year, the ice on Arrowrock reservoir was frozen less than 1 foot thick near the dam, increasing to about 2 feet in thickness at the back-water, 12 miles above. Thin spots and air-holes in the ice were numerous near the lower end of the reservoir, and the entire surface was covered with an uncertain layer of snow or slush. The ice has been used very little for travel this winter.

While at Cottonwood Creek I stayed with Herman Schultz, our special assistant for the work.

For locations reference is again made to contour map of the U.S. Geological Survey, the same designations being used as in last years report.

We took measurements over the lower east ridge and the upper mile and a half of the creek below the forks on March 7 having fair crust upon which to travel. Along the creek ice had formed depressions beneath the snow, from 1 to 3 inches deep. We took measurements the next day up the west fork of the creek, and back over the lower north ridge. Footing and crust were bad.

It stormed all day March 9th, but we followed our broken trail up the west fork, working back over the upper west ridge. There was heavy wind, rain, and sleet, that day, and for two hours we worked in dense fog.

On March 11 we successfully surveyed the lower and middle west ridges. Crust was poor, the footing desperate, but we adopted a system of "long hauls and short rests," and forced our way.

On March 12th, we took readings up the east fork of the creek, making five miles by 2 p.m. Fresh snow was 15 inches deep at that point, with crust loose beneath. Knowing that it would be well nigh impossible to reach the top of the watershed next day, even with part of the trail broken, and that work would be impracticable in loose snow of increasing depth, we suspended operations, and hung our equipment up in a tree.

The next day, March 13th, I walked to Arrowrock, and took the stage to Boise. One of the worst wind and snow storms for many seasons took place that day. Traveling on web snowshoes in the fresh snow was enough to keep me busy, but it was with fascination that I watched the formation of drifts b the high wind, and at times, heavy snow. Often drifts were built a foot high within the space of five minutes.

Schultz had been instructed to call me by telephone as soon as enough crust formed on the snow for us to work. Fre-

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quent storms kept the snow in bad condition until March 26th.

On March 29th I again went from Boise to Arrowrock by stage, walking from there to Cottonwood Creek. This was done in the face of unsettled weather, and on the warmest day of the month. The snow, by noon, was of the consistency of mush. When at the mouth of Cottonwood Creek, that evening, I walked into thunderstorm, it seemed that I was completely without luck.

However, we awoke the next morning with the weather clear and cold, and the snow frozen hard. Quickly taking blankets and supplies for two days, we made off up the east fork of the creek, securing our instrumental equipment where we had left it March 12 th. The Forest Service cabin was in good condition,with plenty of dry wood inside. We had to dig down 10 feet to get in the door,then another 10 feet at the rear to reach a special contrivance that locked the door from within. But, we accomplished it all by nightfall.

On March 31st we took measurements down the upper north,upper and middle east ridges. Snow fell at intervals on the higher elevations but the crust was good and work pleasant.

On April 1st we again took supplies for two days, going up the east fork, and finishing the course up the creek from where we had first left our equipment. It snowed lightly nearly all day. Walking was good. We made the trip easily,and I chopped wood to help make up for what we had been forced to use.

It stormed all that night,and on the morning of April 2nd there were 8 inches of fresh snow. We split a good supply of Dry wood,cleaned out the cabin,and looked it as we had found it. Then we started down the north ridges. It was necessary to work in one of the stiffest and coldest winds I have ever experienced. Snow was falling, and dry snow filled the air. We finished the trip all right,

but the wind, and later, when the sun came out, the glare on the snow, put our eyes in bad shape, altho we had veiling and smoked glasses.

On April 3d we finished measurements along the lower end of the creek, the middle west ridge, and the lower north ridge, rounding out our collection, and comparing with conditions when we suspended work on March 12th.

On April 4th I walked to Arrowrock, going by stage to Boise.

The pictures inclosed are numbered in about the order taken, and may show some details, interesting, but not considered of enough importance to mention therein.

I carried a note book,ruled for elevation,and for direction,angle and character of slope. Our measeuremtns reached a total of 372 each being complete to the ground, and carefully taken. Drifts were avoided as much as possible. The measurements were distributed so as to have each 1000 feet of elevation represented by its proper share, according to area; at the same time trying to get readings at each 100 feet of elevation, and at all directions,angles, and characters of slopes. We traveled over the same courses as in the three previous years, often taking readings on the same spots. To cover these courses at least 80 miles walking is necessary, but with the snow in fair condition it may be done easily in ten days.

Here are the tabulated results of this year's work:

Elevation Feet	Average Depth Inches	Average Water Content Inches	Percentage of Water	Area Square Miles	Water Supply Acre- feet
3000-4000	36.7	9.91	27	5.704	3,030
4000-5000	40.8	11.04	27	9.812	5,777
5000-6000	50.1	14.59	34	8.504	6,640
Over 6000	73.4	24.59	30	2.284	2,997
Total					18,444

These figures show a relationship between depth and water content

that is inconsistent when compared with the records of other years. It is due to the fact that the measurements up to about 5500 feet elevation represent conditions as they were about March 12th, the remainder, conditions about April 3d. During the latter part of the survey I found a considerable decrease in depth, with a slight increase in water content, from depth and water content of three weeks before. In this interval the weather had been mostly cloudy and stormy, the flow of the creek light and even. Therefore, I felt safe to assume the the total water content for each date was practically the same, altho the depths differed, and, considering the approximations unavoidable in the other factors of the survey, believe it best to take the above as the water supply on hand March 15th.

Being interested, I secured several measurements showing accurately the difference in density between the upper and lower layers of snow. In a mean depth of 94 inches, the upper 68 inches showed a density of 32 per cent, the lower 26 inches a density of 48 per cent.

The condition of the snow was everywhere drifted and uneven, but there were fewer large and fantastic drifts than last year.

The greatest depth we measured, of what we considered normal fall, was 115.5 inches, at an altitude of 7200 feet on the upper north ridge.

As at time of last year's survey, the creeks gradually came to be found running under the snow at about 5000 feet elavation, or where the snow approached a depth of 6 feet.

There were a considerable number of snow-slides this year. I noticed them to be of two kinds - those started by the weight of light, loose, bulky snow, and those caused by rain or warm weather loosening what was generally heavy or settled snow. The latter were the larger and more destructive.

Wherever there was a foot of snow, the ground was unfrozen. Below 5000 feet elevation the soil was generally wet; above, it was dry.

A note was made of the occasional uneveness or oscillation in the snow surface, being most pronounced in the higher elevations, but found on all depths of snow. I believe this condition to be due to the action of both wind and sun, because, it was apparent on all slopes, and greatest on south slopes where the appearance of drifts and trees bespoke a high wind velocity.

Such study, as was possible, of conditions of the snow under trees showed, as last year, a great loss by evaporation of fresh snow on the conifers (picture 2),being most on the longer needled ones. When I was on the first trip there were few depressions under any trees. Examination showed that recent heavy snow and high winds had drifted existing depression full. When I returned, depressions, unless at the higher elevations where snow was still daily falling and being blown about, were as much in evidence as last year. All of which proves how actual this loss is. If a conclusion may be warrented from observation alone, I should say however, that there is a larger saving than loss in the small based but tall balsam and red fir timber, such as is typical above 6000 feet elevation, because of the shade they furnish.

There were very few trees injured by the action of this season's snow.

The following equipment was used:

1 72-inch snow tube, with spring balance, alpenstock, tamper and oil.
Shovel, weighing 2 pounds.
Compass.
Aneroid barometer, and contour map.
Thermometer.
Specially ruled note book.
Small piece of measuring stick.

We were much pleased with the new 7w-inch tube. Altho slightly heavier than the 50-inch tube, used last year, its increased length was

a time saver, and it lifted cores more readily. We discarded the wooden buffer for the top, after the first day. Any place a man can force that tube, he can do so with his gloved hand. The side slots on the tube are really essential, as the action, or position of the core may be readily seen. The tube, for our work, needs just one thing - some kind of handle at the top, for it always turns or pulls out hard, because of slight freezing.

A band around the tube at the top, riveted, and supporting two projections, each not over an inch long, would do very well, and also furnish a buffer.

Oil was a perfect remedy for snow sticking to the tube by freezing.

Ordinarily, where the bottom is not reached, the tube will take out all but about 8 inches of the core. We used the tamper in all kinds of snow, and at all temperatures, I find that it does not furnish a solution to the problem of lifting a complete core. Its use causes the core to expand and stick about 18 inches below the top, not affecting the bottom. If used energetically, about 3 inches are lost by being pushed out the side slots. I do not know of a failure to get a complete core where the bottom of the snow was reached. Our method of proceedure in deep snow was to put down the tube, dig out around it for 2 or 3 feet, lift and weigh what core we could get, then put down the tube in the trench until we reached the ground, lift up and weigh the remainder of the core. The shovel for excavating, at the same time light and strong, I made out of sheet steel, #0 guage, 10 x 12 inches, mounted on a light axe handle.

I had a No.6 hardened screw set in the center shank of the revolving dial, opposite the screw already there, flattened both sides of the shaft, where the screws touch, and the spring balance gave good service. We were very careful with it, tho.

The hardened shank and larger screw are an improvement over the ones on the spring balance used last year.

Two tubes, of the model and diameter of the one used this year, one 72 and the other 100 inches in length, with a dependable spring balance, adjustable, and with capacity for either tube, seems to me the best equipment to be had at present for such snow as we find on this watershed.

The aneroid barometer, used in connection with the contour map, is indespensible in securing even approximate elevations.

I believe that the best woodsmen often err slightly in their directions in traveling over large and mountainous areas, and have also found that a good compass was a factor for personal safty.

During this aurvey we were extended every courtesy by the office of the Supervisor of the Boise Forest, and by Mr.Hedrick, in charge of the Cottonwood Ranger Station.

I discovered that the term "snow blindness" is not aa myth, but saw enough beforehand to more than compensate for any such slight inconvenience.

Very respectfully,

Edwin H,Jones

Assistant Observer.

C/ F.H.C.

MWR. 44 (April, 1916) pp. 216–17.

Alfred H. Thiessen, Snow Surveys in City Creek Canyon, Utah, 1914, 1915, and 1916.

"The rainfall during the summer of 1915 was very small, which accounts for the comparatively small run-off during that year. If the rainfall during this coming summer is near the average, the run-off will be about the same as that of 1914, and it may be more, as the ground is now thoroughly soaked, and the run-off from the watershed area will in consequence be increased".