JEC
Returned for your files
JB
12-8-14

July 17, 1914.

Professor S. B. Doten, Director,
Nevada Agricultural Experiment Station,
Reno, Nevada.

Dear Sir:

As requested in your letter of recent date, I am submitting the report of the Department of Meteorology for the year 1913-14.

Yours truly,

Encls.
JEC Bl

Department of Meteorology

J. E. Church, Jr.
S. P. Fergusson

The activity of the Department of Meteorology during the year has been confined to the following projects: (1) Forecasting Frost from Summits of Mountains; (2) The Study of Snow; and (3) The Temperature Survey of the Agricultural Lands of Nevada and Experiments in Orchard Heating.

(1) Forecasting Frost from Summits of Mountains.

During the year continuous records of temperature, pressure, wind direction, and humidity on Mount Rose have been obtained by means of the meteorograph now perfected. Continuous records of wind velocity have also been obtained, buth the records obtained during the winter are vitiated more or less by the action of ice and snow feathers which retard the cups of the anemometer.

Continuous records have also been obtained at the base stations at Truckee and Fallon, but unfortunately most of the records accumulated at Truckee were destroyed by the partial destruction of the observer's home by fire.

The analysis of such data as have been gathered since 1910 is now progressing according to the following plan: (1) A careful comparison of simultaneous records from Truckee, Mount Rose, and Fallon is being made to detect the most obvious coincidences or differences. (2) The instances where a change of phase or condition occurs are to be studied separately in their relation to other meteorological elements in order to determine the causes of the change. (3) The relation of changes of

of condition to the normal diurnal and annual periods of the principal elements will probably be the final stage of the investigation. The diurnal and annual periods are being computed for four months of the year (one for each season) from readings of the records made every two hours of temperature, pressure, humidity, and, when possible, of the direction and velocity of the wind.

Owing to the necessity of making minor improvements in the meteorographs and designing and constructing apparatus for the prosecution of the other projects, progress in the analysis of the data must necessarily be slow. The difficulty of obtaining a suitable location from which to make kite flights to determine the meteorological error of Mount Rose also retards the work.

2. The Study of Snow

The Study of the Snow during the past season has comprised two problems distantly related to each other:

(1) The Influence of Mountains and Forests on the Conservation of Snow; and

(2) The Forecasting of Water for Irrigation.

Through the generosity of the Board of Control and the Director, continuous observations at Lake Tahoe have been resumed by the former observer, Arthur L. Smith, while periodic observations have been continued as usual on Mount Rose.

Observations on the conserving power of pine and fir forests have been conducted in still greater detail to test the accuracy of earlier observations. Owing to the very heavy precipitation, the data obtained will have an unusual value in determining the relative behavior of forests in conserving deep and shallow snows.

Measurements of the evaporation of snow on the ground under serious conditions of exposure and protection have been carried on with only infrequent interruptions throughout the winter. Annoying breaks in the record, due to the filling up and burying of the evaporation pans by storms, have been largely avoided by placing canopies of canvas over the pans. These canopies have been especially valuable in dense forests where snow sifting down from the trees inevitably falls into the pans.

Special evaporation pans have been devised by Mr. Smith to determine the rate of evaporation of the snow held in suspension by the trees.

The influence of air and soil upon the snow cover has been measured at frequent intervals by the use of thermometers inserted through sampler holes. That the coldest part of the snow cover lies usually midway between the top and bottom of the snow has been noticed both in the deep drifts on the rocks of Mount Rose and in the shallow snow in the forests at Lake Tahoe.

The approximate altitude of maximum snow fall for the Sierra Nevada locally seems to have been established by a snow survey conducted last spring at various elevations above 9,000 feet

on Mount Rose and above 8,200 feet on Mount Tallac. However, the conslusions reached should be verified.

Advantage was taken of the great depth of snow encountered last winter to perfect the snow sampler for feasible driving at depths of twenty feet. This has been accomplished by making the sampler lighter, yet more rigid, by making the cutter more tapering and providing it with lateral teeth for breaking up hard snow, and by the use of a wrench upon which the observer can stand and utilize his entire weight in driving. A sampler of this pattern has been made for the Gletscher-Kommission of Switzerland for use in the Alps.

The seasonal survey of the Lake Tahoe Basin, upon which the forecasting of water for irrigation has beem based, has now been continued the fourth season. The survey has usually been made in two weeks by two men working together, and the forecast of the level of the lake has been within one or two tenths of one foot of the level actually attained, assuming that the ~~same~~ dam was not open. The present season two surveys were made, the first one as early as February to settle doubts regarding the amount of snow fall in the high mountains, the second one in April, to quiet apprehension of flood on the part of property owners around the lake. The forecast will probably be five-tenths of one foot above the maximum lake level; for the snow has passed off so slowly that it has been subjected to unusual loss by evaporation, while the evaporation of the water

over the surface of the lake has continued unabated.

The value of the forecast is shown by the fact that as early as February assurances could be given the power companies and ranchers that the scarcity of water that had prevailed during the previous two years would give place to a season of unusual abundance. More exact forecasting will probably require further investigation of the precipitation over the basin and the determination of the loss of water due to evaporation on snow and water surfaces, the ultimate object being finally to reduce the snow survey to the least possible effort.

3. Temperature Survey of the Agricultural Lands of Nevada and Experiments in Orchard Heating

The temperature survey of the Truckee Meadows is nearing completion. Two year's data have been tabulated and verify the statements previously made in Bulletin No. 79.

Experiments in orchard heating are being continued at Church's orchard without expense to the department. The results plainly indicate that orchards in the average fruit belts of Nevada can be protected at moderate cost. Indeed, the present season all fruit except the earliest ~~will~~ would have escaped unharmed despite the fact that the buds were started one month early by unusually fair weather in the month of March had it not been for one frost of 26° F. that occurred in April. But even so, the orchards will bear a ~~small~~ fair crop of apples. From the experience of this season it appears that temperatures of 28 to 31 degrees F. will not work commercial injury to unheated orchards.

Publications

The following papers have been published or accepted for publication during the year:

Recent Studies of Snow in the United States: Quart. Jour. of the Royal Met. Soc. XL, 169 (Jan. 1914).

The Retarding Effects of Various Types of Forests on the Sudden Melting of Snow: Engineering Record, June 13, 1914.

Snow Survey of the Tahoe Basin, a Study in the Rapid Survey of Large Areas of Snow at High Elevations: Engineering Record (to be published.)

Keeping the Frost Away from the Fruit: Farm and Fireside, Saturday, March 14, 1914.

Forecasts of Water Supply, in the Reno Evening Gazette during the winter and Spring.

Reprint of The Progress of Mount Rose Observatory (Science, December 6, 1912) in Jahresbericht des Sonnblick Vereins for 1912.

Aside from the work of preparing preliminary bulletins I and II, on Projects and performing routine duties, the following plans have been outlined for the coming year:

1. To study tamarack and mountain hemlock forests with reference to the conservation of snow.
2. To continue the study of evaporation of snow and extend it to various slopes.
3. To study the relation of air temperature to the variations in temperature in snow.

4. To inaugurate a study of the influence of mountain slopes upon the conservation of snow.

5. To perfect, if possible, the method of forecasting the water supply.

6. To extend the temperature survey to other valleys of the State.

7. To prepare an exhibit in Agricultural Meteorology for the Educational Division at the Panama-Pacific Exposition (as requested by Dr. A. C. True), if the necessary funds can be obtained.

The greatest gain of the entire year has been the obtaining of material with which to build a cabin cruiser sufficiently large and staunch to house the observer and carry him to any point on the lake irrespective of weather. This means the carrying on of measurements at distant points by a single party and brings the various slopes around the lake within easy reach.

It is also planned to erect an inexpensive wireless station at Contact Pass on Mount Rose to avoid the alarm felt at the continued absence of the oberver and to call help in case of distress.

It seems fitting in closing to pay a tribute to the memory of President Stubbs, who with far vision urged on the work in its infancy, when the observers might otherwise have ceased their efforts, and to thank the Board of Control and Director S. B. Doten, who helped install the first instruments on Mount Rose, for their generous support of the work.