

UNIVERSITY OF NEVADA

AGRICULTURAL EXPERIMENT STATION
MOUNT ROSE OBSERVATORY

J. E. CHURCH, JR.
S. P. FERGUSSON

DEPARTMENT OF METEOROLOGY

S. P. FERGUSSON

RENO, NEVADA, U. S. A.,

June 6, 1913.

Professor Gordon H. True, Director,
Nevada Agricultural Experiment Station,
Reno, Nevada.

Dear Sir:

In accordance with your request of May 20,
I hereby present the annual report of the Department
of Meteorology for the year ending June 30, 1913.

Very respectfully yours,

J. E. Church, Jr.
Meteorologist.

JEC B

Reno, Nevada, May 27, 1913.

Department of Meteorology
Report for the Year Ending June 30, 1913.

So far as funds have been available, the active prosecution of the problems under investigation by this department have been continued.

Projects

These problems are:

- (1) The Forecasting of Frost from Mountain Tops.
- (2) The Relation of Mountains and Forests to the Conservation of Snow.
- (3) The Temperature Survey of the Agricultural Lands of the State.

The solution of the first problem necessarily requires great perseverance. The mechanical equipment on Mount Rose is still causing some trouble, and some radical readjustment of the cylinders of the meteorograph may have to be made to assure uniform movement of the record sheet. Most other features of the equipment are now running normally. With one re-winding every five or six weeks the standard pendulum clock in the observatory has run continuously since January under all conditions of storm and wind by which the tiny building is beset. The original price of the clock was \$12.00. Yet during this period the clock has lost on an average only two minutes a month, which, under the circumstances is a very excellent performance. An anemometer has been made with the

supporting arms passing around the back instead of through the cups, with the result that slugs of ice can no longer form within the cups and wreck them. The battery system is still a problem, and mechanical registration of sunshine may yet be necessary. Kite flights have been inaugurated to determine the meteorological error of Mount Rose. Heretofore the ruling of the continuous meteorograph sheets has been a serious problem. However, a ruling machine has been devised by which ruling may be easily and speedily done. An analysis of the data has been begun and will now be carried forward continuously to a conclusion.

Owing to uncertainty regarding the future of the Snow Studies, no attempt was made to employ an observer at Lake Tahoe until after the Legislature met, and then the regular observer could not be obtained. However, snow measurements on Mount Rose have been conducted each month throughout the winter and interesting evidence has been gathered on the movement of snow fields under the impulse of the wind. Considerable progress has been made in the preparation of a preliminary bulletin on The Conservation of Snow: Its Dependence on Mountains and Forests, and several short bulletins in the form of magazine articles have been published.

The snow sampler has been still further improved by using lighter material and employing shellac exclusively in place of oil to prevent rusting and the adherence of snow. By this means the adherence of snow has been almost entirely eliminated and with the result that one man unaided is now able to drive the sampler to depths exceeding twelve feet.

Because of uncertainty regarding the amount of snow in the Tahoe Basin available for irrigation and power this season, the Truckee River General Electric Company and the Reclamation Service cooperated with the department in making a snow survey. Seventeen days were consumed in the work. Former courses were carefully followed and compared. According to data obtained there was from 25 to 30 per cent more snow in the basin this year than last, or 72.9% of normal. From the data obtained last year in the course of the regular snow studies, Mr. L. O. Murphy, Hydrographer of the Truckee River General Electric Company, forecasted the summer level of the lake within one-tenth of one foot of the level actually attained.

Since this basin is large, the method of surveying by typical slopes has been devised, a sufficient number of typical slopes being chosen throughout the basin. New courses were added to the old, particularly along the main crest of the Sierra Nevada. Courses on Mount Freel in the Carson Range should also be added to increase the total measurements in the eastern half of the basin.

The Temperature Survey will be continued in the Truckee Meadows and at Fernley another season before any stations are removed to new locations. Altho the data have not yet been fully analyzed, it is plainly evident that the higher slopes are, ~~in general, more free from frosts than prevalence of cold waves~~

in general, more free from frosts than the lower. This difference also appears during the prevalence of "cold waves" in winter. When the air has been thoroly mixed by high winds, the difference in temperature on the various slopes is practically indistinguishable.

By the aid of thermometers and observation of clouds and wind, considerable accuracy was attained last season in forecasting the degree of temperature to be expected on the following morning. To increase the accuracy of such forecasts, Professor Fergusson is installing a meteorological laboratory at the University largely at his own expense, where, by means of instruments of precision, the relation of cloudiness and humidity to the retardation of falling temperatures can be determined.

Except for a series of early frosts, the present season resembled last, when fruit of all kinds escaped serious injury. Even as it was, most the apple blossoms would have escaped injury this season except for a single frost of 22.8°F. which destroyed buds as well as blossoms. Several orchardists who were planning to heat their orchards considered them safe because the buds were small, and so were not prepared for the abnormally low temperature that occurred.

Publications

Several magazine articles and news bulletins have been prepared during the year. The former were necessary in order to protect data that had been gathered as early as 1909-10 but had not been published partly because the results were radical and verification was desired, and partly because my time and strength were being fully absorbed in teaching. The latter were reports

of snow surveys on Mount Rose and in the Tahoe Basin. The magazine articles appear in the following list:

General

The Progress of Mount Rose Observatory, 1906-1912:

Science, N.S., Vol. XXXVI, No. 396, pp. 796-800.
December 6, 1912.

Snow Studies

The Conservation of Snow: Its Dependence on Forests and Mountains: Scientific American Supplement, Vol. LXXIV, No. 1914, pp. 145, 152-155, September 7, 1912.

The Conservation of Snow: Its Dependence on Mountains and Forests: Official Bulletin of the International Irrigation Congress, Vol. I, No. 6, December, 1912; reprinted in Engineering and Contracting, Vol. XXXIX, No. 6, pp. 155-157, February 5, 1913.

Das Verhältniss des Waldes und des Gebirges zur Erhaltung des Schnees: Die Meteorologische Zeitschrift, Vol. XXX, No. 1, pp. 1-10, January, 1913.

Temperature Survey

Trailing the Frost Belt in Nevada Snows (title not our own): Popular Mechanics, February, 1913, pp. 256-258.

Articles have been requested for publication by the Techno-Photographisches Archiv, Berlin, Germany, in Science Conspectus at the Massachusetts Institute of Technology, and in the Trans-

actions of the International ^{Irrigation} Congress. These articles either await publication or being prepared.

Cooperation.

Like other departments, this department has sought to cooperate both within and without the University. Except for restrictions due to fiscal regulations, the U. S. Weather Bureau, through Prof. A. J. Henry, In Charge of Rivers and Floods, and Mr. H. S. Cole, Section Director for Nevada, would have entered into occasional cooperative snow measurements. However, voluntary assistance has been rendered by both the Bureau and the Department. To aid the Weather Bureau in inaugurating snow surveys in the Carson and Walker River Basins, the sampler was loaned to Mr. Cole, with the result that two samplers were ordered for trial with a view of placing the sampler regularly in the service. Data from the Temperature Survey have also been loaned to the local office in order that a news bulletin could be prepared, directing the ranchers how to interpret the daily temperature reports. Among other activities, the Weather Bureau has assumed the task of issuing local and individual forecasts of frosts.

In orchard heating the department was cooperated with Karl R. Wundt, Frost Prevention Expert, and F. B. Headly, Superintendent of the Truckee-Carson Experiment Farm, in inaugurating a competitive contest of orchard heaters at Fallon.

Agricultural Meteorology

The activities referred to above are only a portion of those under way or planned, and represent pioneer work in Agricultural Meteorology, in which the underlying principles of climate in its relation to crops and fruits will be determined locally and applied to the welfare of the State.

This work does not duplicate that of the Weather Bureau but rather precedes and supplements it. For this reason the study of Meteorology in the Experiment Stations is now being welcomed and heartily supported by the Office of Experiment Stations.

Plans.

The problems in hand are blocked out rather than exhausted. The problem of the Relation of Mountains and Forests to the Conservation of Snow has already indicated that with the proper planting and pruning of the fir and similar trees one-fourth of the season's snowfall may be conserved two weeks longer than usual. Yet the exact relationship of elevation to precipitation, the value of cliffs and talus slopes as opposed to timber screens, the relative value of various forest covers, the relation of temperature to run-off (the ranchers have been puzzled this season because the water has come down so slowly)- these and many other minor questions must be settled before the fundamental features of this problem can be determined, and the purpose of the Adams Act fully met.

Likewise the problem of Forecasting Frost from Mountain Tops is just emerging from the mechanical stage into that of analysis and discussion.

The Temperature Survey must naturally be a work of many years, for it embraces the more elevated agricultural lands of the entire State.

Among other projects awaiting opportunity, is the forecasting of frost locally and the study of the relation of cloudiness and humidity to the retardation of radiation to the end that greater accuracy can be obtained.

The causes of frosts and thermal belts have often been discussed but no final word on this question has yet been spoken. The Truckee Meadows offer ideal conditions for investigating this problem, and apparatus has already been accumulated toward beginning this work actively when other problems permit.

In December, Professor Fergusson was called to Dayton, Ohio, to testify in a patent case defended by the Wrights, and used the opportunity afforded to spend a brief time at Blue Hills Observatory to prepare further equipment for the work and to consult with Director A. C. True and other officials of the Office of Experiment Stations and of the Weather Bureau at Washington, regarding the future of the department. At Pittsburg, Professor Fergusson was one of the speakers at a series of meet-

ings called by prominent men to advance the interests of World Meteorology, and at Boston, was invited to address the Boston Scientific Society on the Relation of Snowfall to Irrigation, and the Meteorological Work Being Conducted at Mount Rose Observatory. Particular interest was shown in the long-time records of weather being obtained. He was also invited to build two large cellular kites to be used in procuring photographs of the volcano of Kilanea in the Hawaii Islands. These photographs are to be used in preparing a model of this volcano for Harvard University.

J. E. Church, Jr.

Meteorologist.

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