

Every man engaged in practical horticulture as his chief vocation, should be a thorough meteorological observer, with a full equipment of the best scientific instruments to be obtained. \* \* \* When the horticulturist is fully equipped and trained as a meteorologist he should then join the corps of voluntary observers connected with the State and National Weather Services, thereby adding his quota to the general fund of knowledge for the benefit of the public.

But, after all, those who serve the public thus gratuitously are recipients of direct benefit in the form of scientific knowledge, and the satisfaction resulting from serving their State and nation.

We are just beginning to study some elementary lessons in the costly school of experience; to learn how to retain our vast patrimony of soil fertility and how to handle the rainfall so as to dispose of the surplus and provide for the storage of moisture for occasional seasons of deficiency. The tendency of the climates of all mid-continent regions is toward extremes. The means may be constant through long periods, but the wide departures and sharp reactions are the special features of the climate that test the hardy qualities and vitality of all forms of animal and plant life.

I have only attempted to suggest some of the possibilities of advancement in this branch of the public service, along these economic and educational lines. To make this service most valuable to the public there is required the active cooperation of a large number of intelligent observers. Large masses of facts and figures should be collected and tabulated, and experts should give them careful study to find out what they mean. There is mighty little in any of the books to help us in the solution of the many intricate problems that perplex us. We must closely study the facts and question nature. The text-books of meteorological science are mainly in the fields, groves, forests, and on the mountain tops. All the elements are vocal with instruction; the revolving old earth and the great dome of the sky above are thickly set with object lessons for our study.

OBSERVATIONS AT HONOLULU.

Meteorological observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, Meteorologist to the Government Survey.

Pressure is corrected for temperature and reduced to sea level, but the gravity correction, -0.06, is still to be applied. The absolute humidity is expressed in grains of water, per cubic foot, and is the average of four observations daily. The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10. Two directions of wind, connected by a dash, indicate change from one to the other; also same for force. The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

Table with columns: November, 1895. Pressure at sea level (9 a.m., 3 p.m., 9 p.m.), Temperature (6 a.m., 2 p.m., 9 p.m., Maximum, Minimum), Humidity (Relative: 9 a.m., 9 p.m., Absolute), Wind (Direction, Force), Cloudiness, Rain measured at 6 a.m. Rows 1-30.

Mean temperature: 6+2+9+3 is 73.1; the normal is 74.1; extreme temperatures, 85° and 59°. \*Omitted from original report.

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Table with columns: December, 1895. Pressure at sea level (9 a.m., 3 p.m., 9 p.m.), Temperature (6 a.m., 2 p.m., 9 p.m., Maximum, Minimum), Humidity (Relative: 9 a.m., 9 p.m., Absolute), Wind (Direction, Force), Cloudiness, Rain measured at 6 a.m. Rows 1-31.

The monthly summary for December is: Mean temperature, 6+2+9+3 is 72.3; extreme temperatures, 81° and 59°. A thunderstorm occurred on the 30th at night.

THUNDER AND LIGHTNING IN DECEMBER.

Mr. John Butterworth, voluntary observer at Detroit, Oreg., writes as follows:

At 12.05 p. m., December 23, while in the midst of a driving snow-storm at Niagara, we were astonished to see a vivid and long-continued flash of lightning, followed quickly by a long and loud peal of thunder. As thunder in Oregon is unusual its occurrence in connection with a snowstorm is worthy of record.

Mr. C. Scholz, voluntary observer at Mammoth, Kanawha Co., W. Va., writes that a terrible storm passed over that place between 4.15 and 6 p. m. of December 26; winds of hurricane force doing great damage to timber; lightning observed in the southwest, followed by thunder; snow from 7 p. m. to 9 p. m., after which it cleared up, followed by heavy frost.

FROSTS IN SOUTHERN CALIFORNIA.

Attention has been called to the statement made in the MONTHLY WEATHER REVIEW for September, 1895, page 341, on the authority of Mr. James Boyd, of Riverside, Cal., to the effect that "as a matter of fact the thermometer has seldom been known to fall between sunset and sunrise more than 10° in a cold wave, or from 7 to 8 o'clock at night to the same hour next morning." It seems that this statement represents a popular belief in that section of the country and, that relying upon its truth, many agriculturists are liable to feel at ease in regard to their crops, and omit to take precautions against frost when there is really more danger than they apprehend. In order to give more precise information on this subject the Editor has examined the meteorological records for Riverside, as furnished by our voluntary observer, Dr. F. M. Gardner, beginning with November, 1894, when records for 9 p. m. (Pacific time) as well as the maximum and minimum began to be reported. A table giving the fall from the maximum of the afternoon to the minimum of the following morning shows that the diurnal range may, in extreme cases, be as large as 60°, and is rarely lower than 10°. Of course, the greater part of this fall occurs in the afternoon. The fall

from sunset to the minimum of the following morning is but a small part of the total range, and the fall from 9 p. m. until the following minimum is still less. Those who wish, from observations taken at 9 p. m., to determine the probability that freezing temperatures will occur next morning may be guided by the following table which shows:

1. The greatest fall recorded at Riverside between 9 p. m. and the following minimum.
2. The number of times the fall was 10° F. or more.
3. The number of times the fall was 5° or less.
4. The lowest minimum temperature.

The temperatures recorded by thermometers depend so much upon their exposure that it is best for each agriculturist to keep a record of his own thermometer and not depend too much upon those of distant neighbors. A station on a hillside will show generally smaller ranges than one in a low level valley.

Month.	1	2	3	4
1894, November.....	0	0	0	0
December.....	15	13	5	32
1895, January.....	13	5	13	29
February.....	15	10	14	37
March.....	25	9	8	30
April.....	13	7	9	38
May.....	17	8	12	38
June.....	18	8	14	42
July.....	19	18	4	42
August.....	15	12	4	50
September.....	15	17	2	50
October.....	23	19	3	43
November.....	23	13	4	39
December.....	13	13	2	29
	19	11	2	22

In preparing this table no account is taken of an occasional gap in the continuity of the record, due to the omission of a morning or evening observation. On two occasions, February 11 and December 17, the morning minimum was higher than the 9 p. m. observation, and in many cases, scattered rather evenly throughout the months December to May, the minimum was sensibly the same as the preceding 9 p. m. temperature. It would seem as though the rate of cooling after 9 p. m. must depend entirely upon the clearness of the sky and the wind. If, as is usually the case, there be no wind, then the clearness, that is to say, the formation of fog, haze, or cloud must control the temperature, and as this clearness depends upon the moisture in the air, it would seem that horticulturists could make good use of some form of hygrometer in connection with their thermometers, unless the aspect of the sky suffices.

**BLIZZARDS AND SCHOOLS.**

A letter from Mr. Oliver Gibbs, Jr., of Ramsey, S. Dak., is published in the current number of Northwest Weather Crops, published by the Minnesota State Service. He calls attention to the fact that—

The blizzard always comes on a day that opens mild and cloudy, like a "down-east" January thaw. On such days, any time in the winter, it is the safest thing to watch out and stay close at home. Keep an eye on the thermometer, and if it turns suddenly cold and the mercury be-

gins to fall rapidly, have everything safe and snug and a line strung from house to barn as soon as the north wind gives warning.

School teachers in country districts should have an understanding with the directors and the pupils that on such days there will be no school. Many lives were probably saved in this town in 1888 by not opening the schoolhouses on the day of that year's blizzard, though the morning was mild and inviting everybody out by the softness of the air.

To put it in another form, the blizzard and the tornado are both immediately preceded by a hot blast of air.

**SNOW ROLLERS.**

The phenomenon of snow rollers was observed by the passengers on the Flint River division of the Flint and Pere Marquette Railroad on December 10. They report that in large level fields hundreds of snow balls, some of them of colossal size, were rolled together by the action of the wind. The fields were covered with them.

A similar phenomenon is reported from Spokane, Wash. The Spokesman Review, of December 23, published at that place, says:

The wind has been playing strange with the snow in the vicinity of the waterworks on both sides of the river during the last few days, producing hundreds of snow cylinders of uniform size and as perfectly formed as though they had been cast in a mould.

These cylinders are from 12 to 16 inches long and from 6 to 10 inches in diameter, and are hollow, except in the middle. The hollow in each end is funnel-shaped, being widest at the end where the cylinder is quite thin, growing smaller as it nears the middle where there is a solid space. E. E. Alexander, whose farm is near the waterworks on the south side of the river, says there are hundreds of these cylinders near his place and also in the neighborhood of Minnehaha Park.

"It is a strange and beautiful spectacle," said Mr. Alexander yesterday, "and I never saw anything of the kind before. I judge that the conditions under which these cylinders are formed are exceedingly rare. Most of them seem to have been formed Thursday night. For a time the wind blew from the southeast, then it suddenly changed to the southwest, and where there were fence posts or inequalities in the ground these drifts were broken into small sections, which the wind gathered up and started to rolling. The snow was just soft enough to ball, and as these little masses were pushed slowly along by the wind they began to roll, gathering more snow as they went, till the cylinders were formed. They rolled all the way from 20 to 100 feet, and looked like things of life as they sped along until stopped by their own weight. They could only roll about so far, when they became so heavy that the wind would no longer move them, and this accounts for their uniform size."

**MOTION OF THUNDERSTORMS AGAINST THE WIND.**

The voluntary observer, Mr. A. E. Ackworth, of Mardela Springs, Wicomico County, Md., writes as follows:

The phenomenon of a cloud rising against the wind is a common one in this section when the cloud forms in the northwest with a surface wind blowing from southeast, moderate to fresh. It is chiefly confined to the afternoon, and has all the phenomena so well described in the WEATHER REVIEW for October last by Mr. Bruner.

Another peculiarity of these storms is that they rarely come up against the tide, and are almost entirely confined to those of northwest, rarely north and never from northeast unless formed by the junction of the two branches of a cloud that has formed and split at southwest; one part going by west and north to northeast, the other by south and east to northeast.

Another peculiarity is that whatever course the first thunderstorm of the year takes will be that of a majority of them.

In this section the southwest seems the main point of their formation. Yet a cloud forming southeast and coming over from the east is attended by the heaviest rainfall.

**METEOROLOGICAL TABLES.**

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

For text descriptive of these tables see p. 427.