Like the St. Bernard hospice in the high Alps of Switzerland, Greenland Ranch also serves as a traveler's relief station. The immense barren tracts of the Southwest have no natural oases similar to those of the Great Sahara of Africa. However, they contain, separated by long distances one from the other, small springs and waterholes which lie concealed by surrounding scant bushgrowth, reedy vegetation, and quiete or desert grass. The chief evidences of human occupation are the long, long roads which lead from one watering place to another. Greenland Ranch has saved the life of many a lost traveler or prospector who has staggered within its borders with parched throat and speechless swollen tongue. At the rear of the ranch there are four mounds—graves of those who have perished of thirst or heat before they were able to reach the ranch.

Blessed with abundant precipitation, residents of the eastern United States little appreciate the value of water. Until one has seen the desert portions of the Southwest he can not fully understand the significance of generous rainfall. In the West water is wealth. With the aid of irrigation, desert portions of Arizona and California have been made "to blossom as the rose." Marvellous transformations have been enacted in the Imperial Valley of California, and in the Salt River Valley of Arizona. But because of excessive heat and the salt and alkali in the soil it would be a much greater miracle to transform Death Valley into an agricultural region.

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WEATHER RECORDS AT LOOKOUT STATIONS IN NORTHERN IDAHO.

By J. A. LARSEN, Forest Examiner.

[Priest River Forest Experiment Station, 1920.]

Records which furnish information regarding weather conditions on mountains have always been of interest to the public and to scientists. To the United States Forest Service these are of great use in constructing the ground work for better forest fire protection. Students of climate, botany, ecology, and animal life are always eager for such data.

The tables given below have been prepared from records of air temperature, relative humidity, and air movement at Forest Service fire lookouts in northern Idaho during the summer of 1919. The instruments used are standard maximum and minimum thermometers of the United States Weather Bureau pattern, the Robinson anemometers and sling psychrometers. The thermometer shelters were improvised from wooden boxes placed at regular height above the ground and oriented so that the instruments were shaded from the sun at all times. The instruments at the Experiment Station lookout were housed in a regular Weather Bureau shelter. The data for the lower stations with which the mountain records are compared are supplied by the United States Weather Bureau cooperative stations at Wallace, Kooskia, Spokane, and Priest River Forest Experiment Station.

The lookout points at which these records were taken are as follows:

Lookout.	National forest.	Elevation (feet above sea).	Observer.
Coolwater	Selway	6,930	Gerald Gill.
Monumental Buttes	St. Joe	6,979	Eugene Harpole.
Sunset	Coeur d'Alene	6,424	Paul Wickward.
Mount Silcox	Cabinet	6,840	Louis F. Rosenthal.
Experiment Station	Kaniksu	6,000	G. W. Simmons.

The figures in Tables 1 and 2 represent fairly well the average air temperature conditions in northern Idaho during the warm and clear days which usually occur from the beginning of July until the middle of September.

TABLE 1.—*Air temperature on lookouts and at low stations, summer, 1919 (° F.).*

Lookouts and cooperative stations.	July.			August.			September.			Dates missing.
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	
Coolwater, elevation 6,930.	71.1	51.1	61.0	69.4	51.8	60.8	62.1	42.2	52.1	Sept. 21–30.
Kooskia, elevation 1,261.	92.8	50.1	71.4	86.2	51.3	68.8	71.9	40.8	56.4	
Monumental Buttes, elevation 6,979.	71.3	47.2	59.2	72.6	49.1	60.8	59.9	39.5	49.7	Sept. 18–30.
Wallace, elevation 2,770.	85.9	48.5	67.2	83.3	42.5	66.3	71.1	35.6	53.4	
Priest River Experiment Station lookout, elevation 6,000.	69.3	51.9	60.6	68.6	51.0	59.8	57.3	41.6	49.9	Aug. 5–12.
Priest River Experiment Station, elevation 2,300.	86.1	42.3	64.2	84.8	47.8	62.9	72.0	41.1	56.5	Sept. 20–30.

TABLE 2.—*Diurnal march of air temperature on the mountain and at the valley station, August, 1919 (° F.).*

Location and elevation.	A. M.						P. M.					
	2	4	6	8	10	Noon 12	2	4	6	8	10	12
Valley, 2,300	42.7	40.4	39.5	50.4	64.5	76.7	82.4	83.3	78.5	61.2	51.0	46.1
Mountain, 6,000	54.4	52.8	54.6	59.2	61.3	64.3	67.2	65.7	61.2	57.7	56.5	55.3

The data in Table 1 show that the maximum air temperatures are in every instance higher at the low than at the high stations; the differences vary from 10° to 17° and in one case is as great as 21°. The minimum temperatures are in every case lower in the valleys than on the mountains, but the differences are not as pronounced as in case of the maxima; they vary in most cases 2, 3 and 4° and are not above 10°. These inversions are no doubt due to the rise of the heated air from the valley land at night to higher levels and a simultaneous downward flow of cold air along the

gulches and draws which settles over the low land. Naturally the greater horizontal air circulation on the mountains both day and night brought out in Table 4 is also influential in equalizing the air temperature on the mountains.

Data on wind velocity for low stations are available for Spokane and Priest River Experiment Station. These are compared with air movement on the mountains in Table 3.

TABLE 3.—*Wind movements on lookout stations, 1919 (except as otherwise noted).*

[Miles per hour.]

Station and elevation.	July.		August.		September.		Dates
	Average.	Maximum[1]	Average.	Maximum.	Average.	Maximum.	
Coolwater, elevation 6,930	8.2	12.7	8.1	10.2	9.9	16.2	Sept. 21–30.
Monumental Buttes, elevation 6,979	13.0	28.6	15.0	29.6	15.5	27.5	July 1–7. Sept. 18–30.
Sunset, elevation 6,424	9.6	15.9	10.2	14.9	12.6	21.5	
Mount Silcox, elevation 6,840:							
1917	13.0	18.8	11.5	23.1	12.4	21.6	July 1–12.
1918	12.7	26.7	20.0	38.0	14.3	31.0	Sept. 20–30.
Priest River, Experiment Station, elevation 6,000	9.5	16.1	8.9	14.3	10.6	22.4	Sept. 24–30. Aug. 5–12. Sept. 20–30.
Priest River, Experiment Station, elevation 2,300	3.5	5.6	3.1	4.7	2.8	4.4	
Spokane, Wash., elevation 1,943	5.9	27.0	5.6	28.0	5.3	30.0	

[1] The highest for any one whole day.

The average daily wind velocities at the mountain stations are from two to three times that shown by the low stations and the maximum daily movement at Priest River Experiment Station conforms to this relation, but at Spokane the maxima are as great as those on the mountains. The explanation for this is most likely due to the fact that at the Experiment Station in northern Idaho the wind is obstructed to some extent by the north and south trend of the mountains, but at Spokane the wind from all directions is less obstructed.

Comparative wind movement for different parts of the day for high and low stations are given in Table 4. On the mountain there is very little difference in movement by night and by day—only a slight increase in the afternoon—but in the valley the air is almost still at night and shows the maximum movement in the afternoon.

For comparison of the relative humidity at high and low stations it is necessary to have simultaneous observations. These are not always easy to obtain. Such records were taken at Priest River Experiment Station for 1917 and given in Table 4.

In keeping with the air-temperature relations at high and low stations shown in Table 1 the relative humidity on the mountain is lower at night and greater during the day than at the low station. In August the air at 8 a. m. in the valley showed 13 per cent greater relative moisture than on the mountain; at 1 p. m. the valley air was already 23 per cent and at 5 p. m. 14 per cent drier than on the mountain. These relations naturally depend upon the weather conditions; during rainy, cloudy, or windy weather the differences in temperature, wind, and humidity are less pronounced than in clear weather.

TABLE 4.—*Diurnal changes in wind movement and relative humidity on the mountain and in the valley, Priest River Experiment Station, summer, 1917.*

Time of observation.	Location and elevation.	July.		August.		September.	
		Wind (miles per hour).	Relative humidity.	Wind (miles per hour).	Relative humidity.	Wind (miles per hour).	Relative humidity.
			Per cent.		*Per cent.*		*Per cent.*
8 a. m.	Mountain 6,000	[1] 10.9	75	8.4	60	8.1	71
8 a. m.	Valley 2,300	[1] 0.9	66	0.8	73	0.8	87
1 p. m.	Mountain	9.9	70	7.9	49	8.0	62
	Valley	3.6	32	3.1	26	2.5	47
5 p. m.	Mountain	11.4	65	9.7	46	7.3	56
	Valley	3.9	34	3.2	32	2.3	57

[1] Average movement between the hours of observation.

It is assumed that the extent or degree to which these variations take place will depend somewhat upon the general relation of mountains to plains or bodies of water and whether the land is barren or forested, and the position of the stations in relation to wind gaps or principal divides, but the data do not admit of such comparisons.

From a standpoint of forest fires these differences in weather condition at high and low stations in summer explain why the fires burn better at higher than at lower elevations at night. The greater air movement fans the flames, supplies more oxygen, and the higher temperatures keeps the relative humidity lower so that there is less atmospheric moisture to dampen the dead needles and moss. The high-air temperature and low humidity at lower elevations during the afternoons produce more critical conditions than prevail on the mountains at this time of the day.

The mountain vegetation in this region probably works more energetically than that on the flats and at lower points, not only because of the longer hours of sunshine per day on the mountain but also because of the more moderate temperatures at night. The greater transpiration which takes place at higher elevations on account of decreased atmospheric pressure and increased wind must be somewhat counterbalanced by the higher relative humidity which prevails on the mountain during the day.

The vegetation on the lower slopes and flats is more exposed to injury by frost at night and to severe draft by day than that on the mountain, but fortunately the air movement at the lower elevations in the afternoon is only about one-third as great as that on the mountain.