considered conclusive evidence, though tending to corroborate a theory of greater snowfall above the 5,500 foot level, for it is not probable that the exact climatic, geographic, and topographic conditions can be duplicated anywhere closely enough to make conclusions by analogy justifiable. The problem is too local.

At the elevation of Paradise Inn snow usually disappears during the summer. Above this elevation are the great permanent snowfields, each covering several square miles, that feed a score of glaciers with ice as they creep down the valleys in summer, and contribute to the torrents of water that issue from beneath the glaciers during the warmth of the day. Mr. F. E. Matthes in his report for the United States Geological Survey on the "Glaciers of Mount Rainier" indicates that these névés are conspicuous between 8,000 and 10,000 feet elevation, while above that level the snow layer is perceptibly less, the air being too cold to carry enough moisture to cause the great precipitation received lower down.

With ascent above Paradise, the lowering temperature favors snowfall at times when rain occurs at the inn. Autumn and spring rains at Paradise are apt to be snow in the region of the snow fields. Even in winter southerly winds caused by a pronounced low pressure area carry warm rains up the slope as high as or higher than the inn. There seems to be little reason to doubt that the maximum annual snowfall will be found to occur higher up the slope than the 5,500-foot level.

Since the record at Paradise Inn covers only a part of one season, it is impossible to establish the comparative relation of the snowfall here to that at other points on the mountains of the Pacific slope. Furthermore, there is a scarcity of records on the extensive system of mountains reaching from Arctic regions southward beyond the latitude of prevailing westerly winds. Some reference to the possibilities seems desirable, however.

In the State of Washington it would seem that for the Cascades, Mount Rainier should show the greatest snowfall. The Olympics, which occupy nearly all the region between Puget Sound and the Pacific Ocean, show a greater average precipitation to their southwest than obtains for any station near the Cascades. The 12-year average for Clearwater, elevation 135 feet, and located a few miles from the seacoast, is 128 inches. A 9-year record at Quiniault, about 25 miles inland at an elevation of 300 feet, but where the country is mountainous, shows an average of 135 inches. These stations have considerably greater precipitation than has thus far been obtained at any station in the Cascades at any elevation. At Longmires Springs, on the south slope of Mount Rainier, elevation 2,761, a 5-year record yields an average of 78 inches; Yale's 10-year average at 375 feet elevation, farther south, yields 94 inches; at Snoqualmie Pass, elevation 3,000 feet, a 3-year record averages 87 inches; the 9-year record at Goat Lake at 2,900 feet elevation averages 94 inches; Cedar Lake's 14-year record at 1,546 feet averages 107 inches. No measurements have been made at equal elevations in the Olympics, but it is evident that at corresponding elevations precipitation is considerably greater than in the Cascades.

The factor of temperature must modify somewhat the proportion of precipitation that occurs as snow. In comparing mean temperatures at stations on or near the coast with those at approximately similar elevations near the Cascades the mean temperature for the most of the three winter months for the more inland stations is the colder, but in all other months of the year the monthly mean temperatures for stations on the west slope of the Cascades are the higher. During the months of greatest precipitation, November and December, the mean temperatures are very similar in both regions. It is true that extremes of temperature are greater for the Cascade stations; however, in view of the foregoing, one is not safe in minimizing the snowfall on the Olympics as compared with the Cascades, based upon the consideration of temperature, especially in view of the fact that Mount Olympus exceeds 8,000 feet in elevation. But very few official readings of snowfall depths have been made for the Olympics. These are for moderate elevations only, and while affording no basis for comparisons, they indicate a very heavy snowfall. Judgment may well be reserved as to which range has the greater snowfall. The obtaining of daily readings of snowfall in the rugged Olympics is still of the future and probably not of the near future.

As one proceeds northward from Washington on the Pacific slope, the period without precipitation in summer soon practically vanishes. There is no so-called dry season in southeastern Alaska and it appears that the quest for a greater snowfall than in Washington should be pursued there rather than to the south, where the season of snowfall is shorter. One can not hope to point out the region of greatest snowfall in a territory so vast as Alaska with records so few and at low elevations only. Precipitation records in the southeastern portion of the Territory show a 12-year average of 151 inches at Loring, and a five-year average of 165 inches at Ketchikan. A parallel record covering only 20 months shows that the precipitation at Jumbo Mine, elevation 1,500 feet, exceeds that of Ketchikan by 19 per cent, which would make the average for Jumbo Mine approximate 190 inches. These stations show a heavier precipitation than has been measured elsewhere on the Pacific slope, and it seems probable that with ascent of the mountains, which in some cases rise almost out of the ocean, and lie close to the paths of storms from the North Pacific, a greater snowfall will be found than for any other region of the continent.

With the further development of the Mount Rainier National Park, it will become possible gradually to extend the survey of snowfall on the mountain, and an unusual opportunity will be afforded for the study of variations in precipitation with elevation and exposure.

ON SEVERE WINTERS.[1]

By G. HELLMANN.

[*Reprinted from* Science Abstracts, Sect. A, June 29, 1918. § 624.]

A "character number" to express the degree of severity of any winter is obtained in the following way: The mean temperature in degrees centigrade for each day of the months November, December, and January is taken; of these the negative values are selected and added together; the result, viz, the sum of the negative daily means, is the character number. Of the last 150 winters in Berlin, 24 are classified as "very severe." The most severe was the winter of 1829–30, and that of 1788–89 was almost as severe. The winter of 1916–17 comes out only as a moderately severe one. Since the middle of the nineteenth century the number of very severe winters has been much reduced; in the period 1788 to 1845 that number was great, namely, 17. A very severe Berlin winter is associated with the presence of a prolonged snow covering, and a westerly position of the continental high-pressure system.—*R. C[orless.]*

[1] Preuss. Akad. Wiss., Berlin, 1917, 52: 738-759.

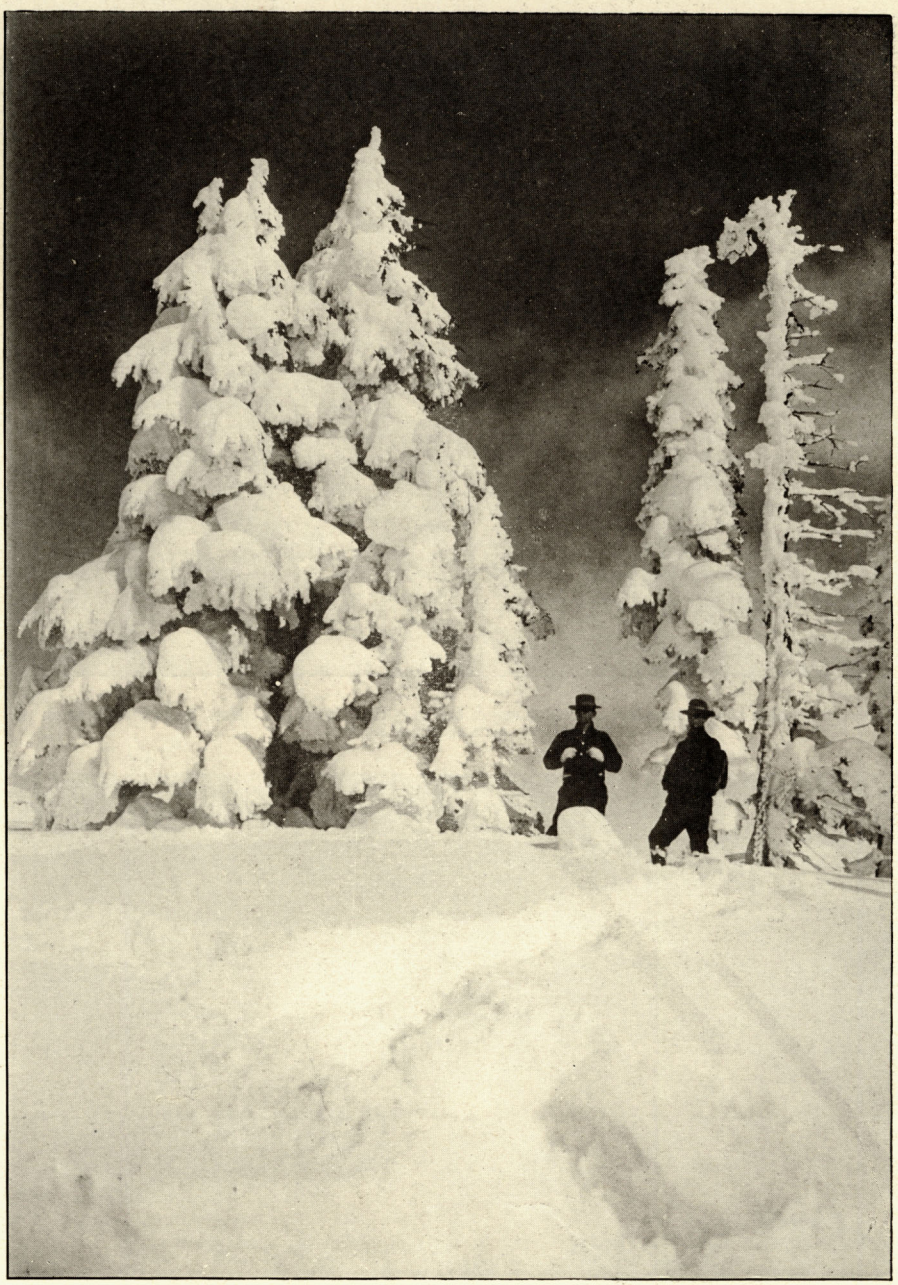

FIG. 2.—Showing snow on trees at Paradise Inn, Mount Rainier, March, 1917. Elevation about 6,000 feet.
(Photo. by J. B. Flett, National Park Ranger.)

FIG. 3.—Snow on bridge over Edith Creek, Mount Rainier. Top rail of bridge is 4 feet in height. Note figure of woman on the bridge. (Photo. by J. B. Flett, National Park Ranger.)

FIG. 4.—Paradise Inn, March, 1917, looking north toward summit of Mount Rainier. This was taken about time of deepest snow. (Photo. by J. B. Flett, National Park Ranger.)

FIG. 5.—Paradise Inn, Mount Rainier, at time of maximum snow depth, April 2, 1917, looking southwest. (Photo. by A. H. Barnes.)