Research Technical Completion Report
Project ~~A-012-Ida~~
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A Microclimatic Profile Between the Snake River Canyon and Clearwater Mountains, Idaho

Project Investigator **R. L. Day**

Water Resources Research Institute
University of Idaho
Moscow, Idaho
September, 1968

RESEARCH TECHNICAL COMPLETION REPORT
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PERIOD OF INVESTIGATION - July 1965 to July 1968

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Water Resources Research Institute
University of Idaho
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TABLE OF CONTENTS

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ABSTRACT

Temperature and relative humidity records have been kept at a maximum of 18 sites, and precipitation records at 8 sites, along a 75-mile profile between Wawawai, Washington, elevation 675 feet in the Snake River Canyon, and Crater Peak, elevation 6400 feet in the Clearwater Mountains, Idaho. Most distinctive microclimatic feature is the extreme development of nocturnal temperature inversions during summer and early autumn. Mean inversions between non-contiguous hilltops and bottomlands may reach 20 to 30 degrees. Greatest recorded on a specific day has been 42 degrees. Mean temperatures, length of frost-free season, nocturnal relative humidities, natural vegetation, and land use are all strongly influenced by these inversions. None of the six official Weather Bureau stations in the vicinity of the profile is located to show these inversions. Diurnal temperature and relative humidity patterns differ greatly at individual sites along the profile and are analyzed and compared. Precipitation normally varies by a factor of at least 3½ along the profile, but may reach several times this value during individual months. Maximum snow depths range from none at Wawawai to 14 feet at Lost Lake near Crater Peak during specific snow seasons.

A MICROCLIMATIC PROFILE BETWEEN THE SNAKE RIVER CANYON AND CLEARWATER MOUNTAINS, IDAHO

I. Objectives

Objectives of this study are (1) to measure and describe the microclimatic patterns along the 75-mile profile; (2) insofar as possible, to interpret the anomalies which are discovered; and (3) to show exactly what portion of the total climatic story the available U.S. Weather Bureau records, as published in Climatological Data for Idaho and Washington, actually bring out. Fulfillment of the latter objective may prove of value in proper interpretation of such records on a broader scale, as well as provide a better knowledge of microclimatic deviations which may be useful in locating Weather Bureau cooperative stations.

II. Setting

The 75-mile profile between the Snake River Canyon at Wawawai, Washington, and the Clearwater Mountains of Idaho presents an unusual opportunity for the study of an intricate pattern of both regional climates and microclimates. Altitudes along the southwest to northeast-oriented profile range from 675 feet above sea level at Wawawai to 6400 feet on Crater Peak. Natural vegetation varies from steppe bunch grasses (poa-agropyron association) at Wawawai through prairie bunch grasses (Idaho fescue-agropyron association) in the Palouse Hills around Moscow, to three successive climax forest associations (ponderosa pine-Douglas fir, cedar-hemlock, and mountain hemlock-Englemann spruce-subalpine fir) east and northeast of the prairie. The anomalous presence of subalpine firs on certain bottomlands near the eastern

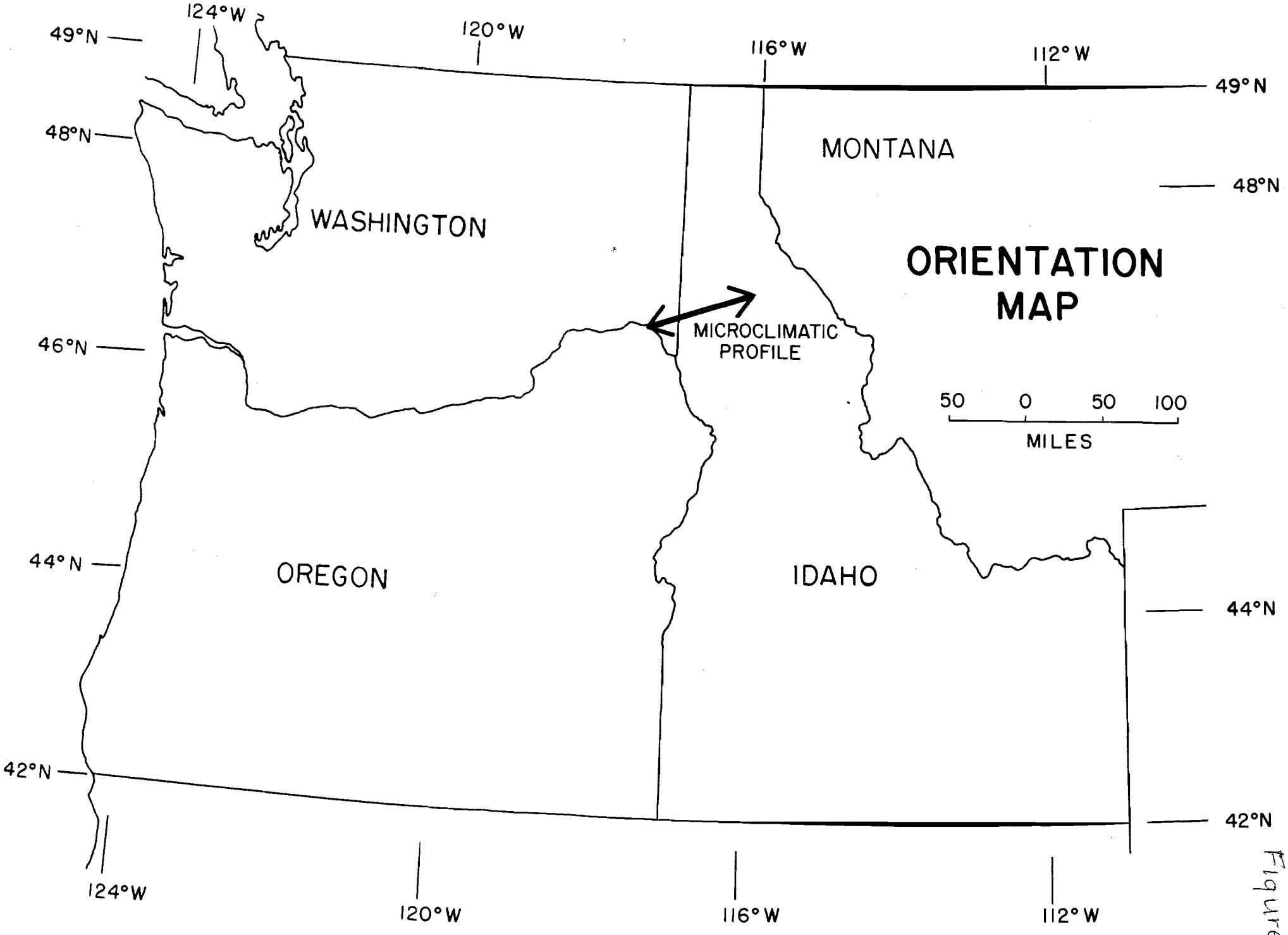
edge of the Palouse Hills agricultural area, plus occasional occurrences of damaging summer frosts in the bottomlands well within the agricultural area around Moscow, where the normal frost-free period is given as 146 days by the U.S. Weather Bureau, suggest microclimatic deviations of considerable magnitude.

III. Station Sites

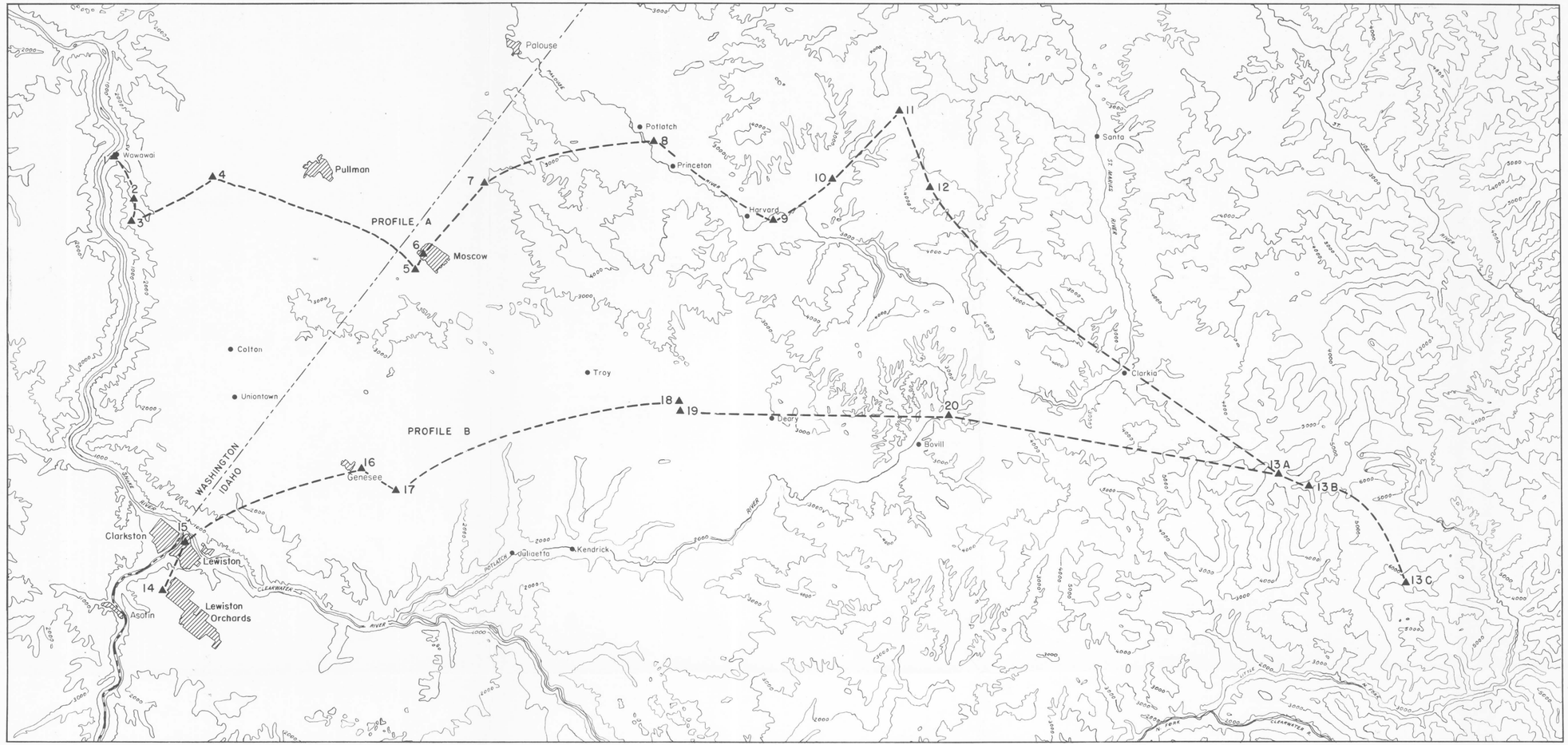
Figure 1 shows the location of the microclimatic profile within the Pacific Northwest, while Figure 2 maps the profile in detail, depicting the exact location of each station.

Approximately the southwestern half of the area represented in Figure 2 lies within the Columbia Plateau sub-division of the Intermontane Physiographic Province, while the much more dissected northeastern half is within the Northern Rocky Mountain Physiographic Province. Average altitude of the plateau surface is about 2500 feet above sea level, although the actual hilly character of the plateau surface is not brought out on this map with its 1,000-foot contour interval. Average relief is about 250 feet. The 3,000-foot contours south and north of Moscow outline larger topographic features predating the Columbia River basalt flows which have virtually surrounded them. These topographic highs are composed of Beltian (Pre-Cambrian) metamorphics, mainly quartzites, and granidorites of Cretaceous age. The Snake and Clearwater Rivers have cut canyons nearly 2,000 feet deep into the Columbia River basalts since the latter came into place during the Miocene period. Most of the higher mountains on the northeastern (right-hand) edge of the map are composed of Beltian metamorphics.

Two profiles are designated on the topographic map (Figure 2). Basic


124°W
120°W
116°W
112°W
49°N
48°N
46°N
44°N
42°N
MONTANA
WASHINGTON
OREGON
IDAHO
ORIENTATION MAP
MICROCLIMATIC PROFILE
50 0 50 100
MILES

Figure



AREA OF MESOCLIMATIC TRANSECT

1 Wawawai, Snake River Canyon, 675'
2 Wawawai Canyon Slope, 1500'
3 Rim above Wawawai, 2500'
4 Union Creek Flat, 2436'
5 South Palouse Flat (1 mi. S. of Moscow), 2540'
6 Moscow, University of Idaho, 2610'
7 Viola Hill, 3150'
8 Potlatch Valley Flat, 2510'
9 Harvard Valley Flat, 2590'
10 1 mile S. of Giant White Pine, 2760'
11 Emida Ridge (N-S Ski Bowl), 3700'
12 Bald Mountain Lookout, 5330'
13 A Freezeout Mountain, circa 5950'
13 B Crater Peak, circa 6400'
13 C Moses Butte, circa 6150'
14 Lewiston Airport (WB), 1416'
15 Lewiston Downtown (Tribune Office), 760'
16 Genesee Flat, 2660'
17 Genesee Hill, 2900'
18 Subalpine Fir Meadow, 2635'
19 Hilltop near Fir Meadow, 2865'
20 Purdue Creek Valley Flat, 2880'

Key Map

N

PROFILE ROUTES

SCALE 1:250,000

5 0 5 10 miles

Contour Interval 1000 feet

USGS PLANIMETRIC BASE MAP

profile represented in Figures 3 through 12 is designated here as "Profile A". "Profile B" includes a supplementary series of stations which serves to check the representativeness of stations used in Profile A. Also, existence of these added stations results in a much more complete micro-climatological coverage of Latah County.

Much experimentation was done before the sites shown on Figure 2 were finally selected. Stations were established at many temporary test sites which were subsequently abandoned. Early morning, midday, and evening temperature traverses were made on several occasions to determine temperature patterns under diverse conditions. Permanent sites were chosen after the chief investigator was fully satisfied that they depicted the full range of temperature-humidity-precipitation conditions existing between the lowest portion of the Snake River Canyon at Wawawai and the highest readily accessible mountains to the northeast. All sites except those on the mountaintops can be reached by all-weather roads throughout the year. The highest accessible site during the winter months is Emida Ridge, elev. 3700 feet, adjacent to the North-South Ski Bowl. The road up Bald Mountain (5330 feet) is usually open to automobile travel from late June to late October. The season of accessibility to the higher mountains east of Clarkia, namely Freezeout (5950 feet) and Crater Peak (6400 feet) is about one month less, from approximately July 10 to October 10 in an average year.

The character and special significance of each site is briefly summarized below. Numbers correspond to those given on Figure 2 only. First, numbers 1 through 13C, along Profile A:

1. Wawawai - Lowest (675 feet) and warmest, in the daytime, of all available sites. Instruments variously located 100 to 200 yards from the Snake River within the steppe bunch grass vegetation zone (poa-agropyron association). Situated adjacent to the U.S. Dept. of Agriculture's Plant Introduction

Station, where plants being considered for possible agricultural use in California are studied. Also, until recently this was an area of soft fruit production.

2. Wawawai Canyon (1500 feet) - Found experimentally to be in the warmest readily accessible portion of the thermal belt along the sides of the Snake River Canyon. Actually, Wawawai Canyon is tributary to the main Snake River Canyon, and the station lies about half-way up this tributary canyon, about 3 miles southeast of the Snake River. This site is also within the steppe bunch grass vegetation zone. The entire area is in grass and on a moderately steep slope.

3. Rim Above Wawawai (2500 feet) - This station is actually on a ridge between the Snake River Canyon and the tributary Wawawai Canyon. Land surrounding the station is planted in wheat, barley, and peas. Natural vegetation is still steppe bunch grasses, since precipitation averages only slightly greater than in the canyons. The precipitation catch here is more seriously affected by wind than at any other station.

4. Union Creek Flat (2436 feet) - This is the farthest west bottomland site available on the plateau above the Snake River Canyon. It is surrounded by the Palouse Hills rising about 250 feet above the station. Vegetation is transitional between the steppe and prairie bunch grasses.

5. South Palouse Valley Flat (2540 feet) - Representatvie bottomland site in the heart of the Palouse Hills agricultural area one mile south of Moscow. Site open and grassy, with South Hills Trailer Court nearby. This site is within the prairie bunch grass (Idaho fescue-agropyron) vegetation zone. The frost-free season much shorter than at most sites in the Moscow area.

6. College of Mines Building, University of Idaho, Moscow (2610 feet) - Located on north slope and closely hemmed in by buildings and trees, but this is the only campus site available for a weather station. Temperatures are found to be representative of those found in other closely buildup portions of Moscow, including both downtown and residential areas on surrounding hills. Temperatures seldom vary more than 2° either by night or day from those recorded at other test sites in the city of Moscow. Nearby trees interfere with the precipitation catch during strong west or southwest winds.

7. Viola Hill (3150 feet) - Located atop a narrow ridge four miles north of Moscow overlooking U.S. Highway 95. Open ponderose pine woods surround the station. Insofar as could be determined, this is the warmest hilltop location anywhere in the Palouse Hills around Moscow during the summer season.

8. Potlatch Valley Flat (2510 feet) - Located on broad bottomland of

Palouse River one mile east of the village of Potlatch. Character of site is similar to South Palouse Valley and Genesee Flats. Originally this area was in ponderosa pine forest, but it is now open agricultural land.

9. Harvard Valley Flat (2590 feet) - Just beyond the eastern edge of agriculture, along U.S. Highway 95A, the land surrounding this site is entirely in hay and pasture. Climax vegetation was Douglas fir-ponderosa pine forest. In addition to trees of these species still found in the vicinity, dense strands of western larches and lodgepole pines exist nearby.

10. One mile south of Giant White Pine (2760 feet) - This station is located in the last open land before entering the stretch of some ten miles of uninterrupted forest along U.S. Highway 95A. Trees up to 175 feet tall grow within one mile to the north of this station. Climax vegetation is western hemlock and western red cedar. Also abundant are the following sub-climax species; western white pine, western larch, Douglas fir, and grand fir. Englemann spruce are found on low ground along streams. No agriculture is carried on here; all open land is in pasture.

11. Emida Ridge, near North-South Ski Bowl (3700 feet) - This station is situated on a narrow ridge, the northwest slope of which was clear-cut and burned over about 1960. An open grand fir forest occupies the southeast slope of the ridge and almost overshadows the station, which is on the upper edge of the clearcut slope. Climax vegetation was western hemlock and cedar, and a few of the latter are still present. This is the highest elevation which can be reached by all-weather road between the Clearwater and Coeur d'Alene River Valleys of northern Idaho.

12. Bald Mountain (5330 feet) - Station is located adjacent to the U.S. Forest Service Fire Lookout Tower, in a clearing about 100 yards across on the summit of the mountain. A climax forest of Englemann spruce and sub-alpine fire surrounds the clearing.

13A. Freezeout Mountain (c. 5950 feet) - Station is located on a protected portion of ridge about 100 feet below the actual summit of the mountain. Mountain hemlocks about 50 feet tall grow along the ridge. The north slope of the ridge is densely forested, but the south slope is open and grassy, with dense bunches of bear-grass.

13B. Crater Peak (6400 feet) - The station is placed in a meadow three-fourths surrounded by a mountain hemlock-subalpine fir-Englemann spruce forest. This meadow is protected from the prevailing west-southwest winds. It is open to the east. The meadow is on the very summit of the mountain and slopes away gradually except to the east where there is an abrupt drop.

13C. Moses Butte (c. 6150 feet) - This easternmost station was in place

experimentally for only one month in the summer of 1967. It is actually located on a ridge extending north from the rocky butte which rises about 300 feet higher. Instruments were placed in a meadow surrounded by forest similar in character to that on Crater Peak.

Other stations were experimentally located as follows for short periods of time but are not marked on Figure 2:

Crater Lake (c. 5600 feet) - Situated in a deep cirque one-half mile northeast of Crater Peak. Instrument shelter was set up on the shore of the lake. Spruce-fir forest covers all slopes surrounding the lake.

Pinchot Marsh (c. 5600 feet) - A small, forest-surrounded meadow located in a shallow depression on a relatively broad ridge sloping eastward about 3 miles east of Crater Peak. A bear wallow has produced a small marsh in part of this meadow.

Air Drainage Slope (c. 5400 feet) - A small opening on the northeastern slope of the same ridge about three miles east of Pinchot Meadow (six miles east of Crater Peak) forms a natural air drainage channel at night.

Northeast and Southwest Slopes, Freezeout Mtn. (c. 5900 feet) - Open, grassy slopes, with scattered fir trees and rock outcrops on the northeast exposure, about 100 feet below the mountain summit.

Along Profile B, as marked on Figure 2, are the following stations, numbers 14 through 20:

14. Lewiston Airport (1416 feet) - U.S. Weather Bureau office in the airport terminal building. This station is situated on open, flat ground in the steppe bunch grass vegetation zone.

15. Lewiston Downtown (760 feet) - Instruments are located on the roof of the two-story high Lewiston Morning Tribune Building in the downtown business district of Lewiston. Surrounding area is mostly in buildings and pavement.

16. Genesee Flat (2660 feet) - Station is located on broad bottomland one-half mile northeast of Genesee village, in a site similar in character to those on the South Palouse and Potlatch Valley Flats. The entire surrounding area is in wheat, barley, and peas, but was originally in prairie bunch grass (Idaho fescue-agropyron).

17. Genesee Hill (2900 feet) - Location of this station is actually on the edge of a broad, flat upland which stretches away to the southeast. The site is three miles east of Genesee village and all surrounding land is in grain and pea crops. Original natural

vegetation was prairie bunch grass.

18. Subalpine Fir Meadow (2635 feet) - This site is situated 6 miles east-northeast of Troy along Highway 8 in a grassy meadow closely hemmed in by a rather dense growth of tall subalpine firs. Hills rise about 250 feet above the site both to the north and south. The flat broadens to the northeast but pinches out into a tree-clogged ravine on the downstream side to the southwest. Air drainage out of the meadow must be almost nil. An intermittent stream, known as Dry Creek, runs through the meadow.

19. Hilltop near Subalpine Fir Meadow (2865 feet) - This station is located on a hilltop one-half mile southeast of, and directly overlooking, the subalpine fir meadow. The hilltop was in planted grass until 1968, when it was plowed. Original natural vegetation was ponderosa pine and douglas fir. Extensive patches of these and other trees, mainly western larch and lodgepole pine, remain within a short distance of the hilltop.

20. Purdue Creek Valley Flat (2880 feet) - Station is located 2½ miles north of Bovill, along Highway 15 on a narrow flat adjacent to a perennial stream, Purdue Creek, just above (east of) the junction of this stream with the Potlatch River in its much broader bottom-land. Low rolling hills rise about 100 feet above the flat, with much higher hills at a greater distance. Extensive forests of lodgepole pine partly surround the grassy flat which is used as pasture.

IV. Instrumentation

The chief investigator initiated this microclimatic study in 1963. By the spring of 1965, eight stations had been equipped with either thermographs or hygrothermographs as well as six's type maximum-minimum thermometers. The maximum-minimum thermometers are necessary to maintain a check on the thermograph settings. Six of the stations also were equipped with 4-inch diameter clear plastic measuring rain gauges. Two of the thermographs and one of the hygrothermographs were purchased by the College of Mines, at the University of Idaho. The remainder of the equipment represented the personal investment of the chief investigator.

In 1963 and subsequently the University of Idaho, with the aid of

National Science Foundation matching funds, equipped a meteorogical station at the College of Mines Building, on the campus, with the following:

Thermograph
Hygrograph
Maximum and minimum thermometers
Standard Weather Bureau instrument shelter
Recording rain and snow gauge
Eight-inch measuring rain and snow gauge
Evaporation pan and hook gauge
Protective enclosure for the above instruments
Remote recording Aerovane for wind direction and velocity
Microberograph

On July 1, 1965 the present research was accepted for funding by the University of Idaho Water Resources Research Institute, and during the next two years, five hygrothermographs, four recording rain and snow gauges, four standard 8-inch measuring rain and snow gauges, and two evaporation recorders were purchased with Institute funds. Additional hygrothermographs and maximum-minimum thermometers were purchased by the principal investigator, until by the summer of 1967 eighteen stations were being maintained, including the one on the University of Idaho campus.

Thermographs, hygrothermographs and maximum-minimum thermometers are placed in small, portable louvered shelters, six of which were constructed by the University of Idaho physical plant with Water Resources Research Institute funds, while the remainder were fabricated by the Chief Investigator. The Institute shelters measure 15 X 15 X 18", while those constructed by the Chief Investigator measure 12 X 13½ X 15". These dimensions are much smaller than those of the standard Weather Bureau shelters, but tests have shown that the temperature and humidity readings obtained in these small shelters actually correspond more closely to those existing in the free atmosphere than is the case with readings secured in the standard shelter.

Unless a strong wind is blowing, temperatures may be as much as two to three degrees too high in the standard Weather Bureau shelter on a sunny day in summer. Response to temperature and humidity changes is also noticeably dampened, as well as delayed, in the Weather Bureau shelter. In summary, the small shelters designed by the Chief Investigator have been found to be not only convenient to move about, but the records obtained through their use have been more accurate than would have been the case with the much larger standard shelters.

All the portable instrument shelters are mounted at normal eye level (about five feet above the ground) on single 2 X 4" posts, which are as portable as the shelters.

V. Temperature Analysis

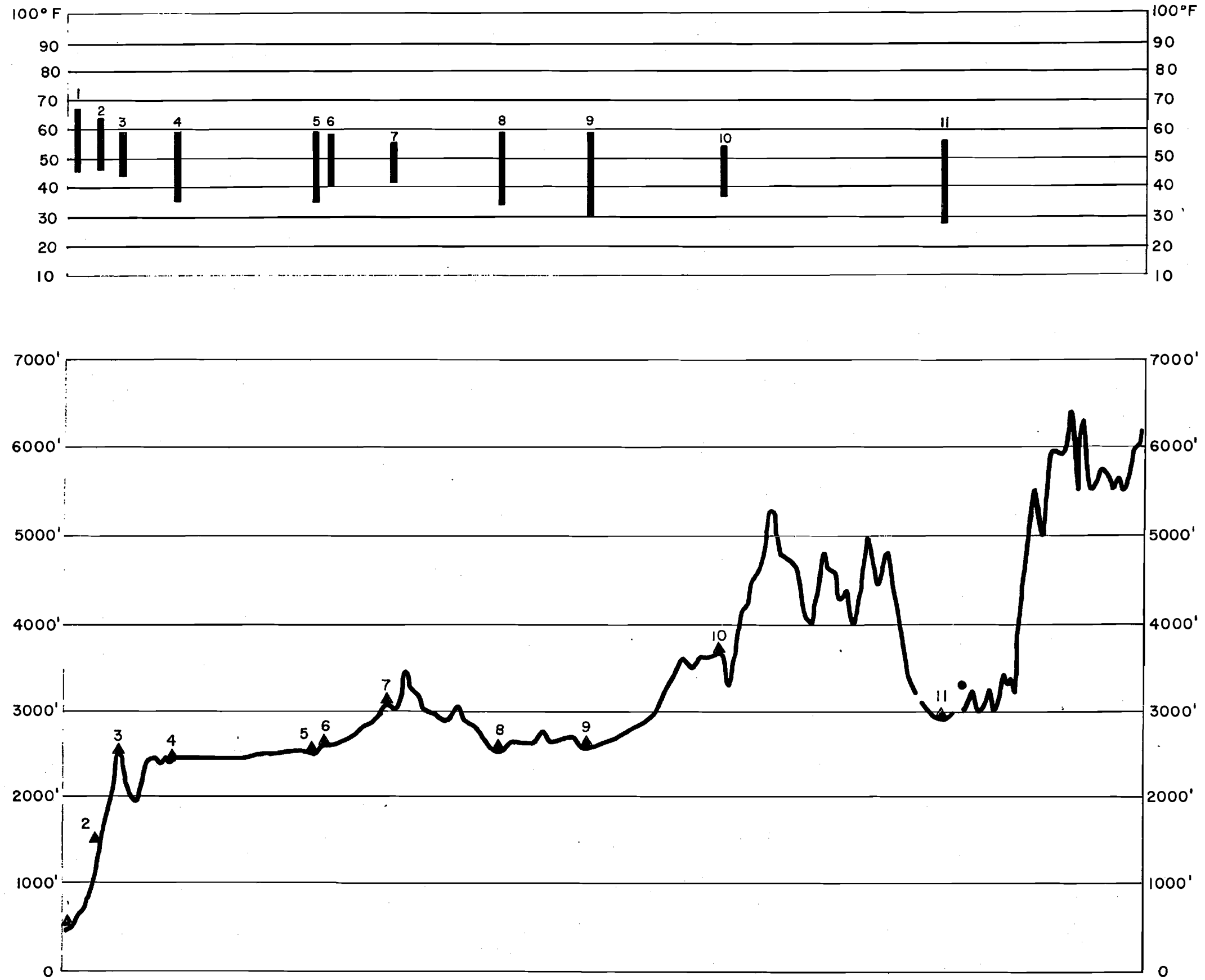
Annual Means - During the two-year period of 1966-67 for which temperature records are most complete, the mean temperature varied from 56.8°F at Wawawai (elev. 675 feet, the lowest station) to 45.4° on Emida Ridge (elev. 3700 feet, the highest station for which a year-round record is available). Mean lapse rate in this 3,000-foot interval was, therefore, 3.8°F/1,000 feet, or 0.5° more than the normal. The lapse rate actually averaged even more than this at the time of the diurnal maximum temperature when the mean temperature difference between the two stations over the two-year period was 14°F, for a mean lapse rate of 4.7°/1,000 feet. During August and September 1967, the only two full months for which records are available on Crater Peak, elev. 6400 feet, this mean daytime lapse rate of 4.7°/1,000 feet also was found to exist between

Wawawai and the peak.

The mean nocturnal lapse rate is less, about 3° per thousand feet, but is interrupted by mean inversions along the way. Figure 3 depicts the mean maximum and minimum temperatures for the year 1966 at 12 stations along the main profile (Profile A on Figure 2). Most pronounced are the mean inversions of 7° between Viola Hill and South Palouse Flat near Moscow through a vertical distance of 600 feet, and 9° between Emida Ridge and Purdue Creek Flat where the difference in elavation is 800 feet. Other available records also indicate a mean inversion of 9° between the subalpine fir meadow and nearby hilltop only 250 feet higher. Through a similar vertical distance between Genesee Flat and Hill the mean inversion is 6°. Locations of both of the latter pairs of stations are shown along Profile B in Figure 2.

Summer Temperatures - The most distinctive feature of the microclimatic pattern along the profile is undoubtedly found in the magnitude of the nocturnal temperature inversions on clear, calm summer and early autumn nights. The most extreme development of these inversions occurs during the hottest, driest weather. During the period of available records, the month of August 1967 brought the highest mean temperatures, the lowest mean relative humidities, the smallest incidence of cloudiness and precipitation, and temperature inversions of greatest magnitude. Mean temperatures during August 1967 were apparently within about 1° of the warmest on record for any month. Precipitation could hardly have been lower, totalling only a trace at all stations, except for Crater Peak where 0.03 inch fell. Sunshine amounted to 89% of the possible at Spokane, Wash., nearest station for which the U.S. Weather Bureau main-

MAXIMUM - MINIMUM TEMPERATURE PROFILE



SNAKE RIVER CANYON, WASH.– CLEARWATER MTNS., IDAHO

AVERAGES FOR YEAR 1966

1 Wawawai, Snake River Canyon 675'

2 Wawawai Canyon Slope 1500'

3 Rim above Wawawai 2500'

4 Union Creek Flat 2436'

5 South Palouse Flat 2540'

6 Moscow, University of Idaho 2610'

7 Viola Hill 3150'

8 Potlatch Valley Flat 2510'

9 Harvard Valley Flat 2590'

10 Emida Ridge 3700'

11 Purdue Creek Flat 2880'

● Off direct line of profile

10 0 10 20 miles

wood/chirumbio

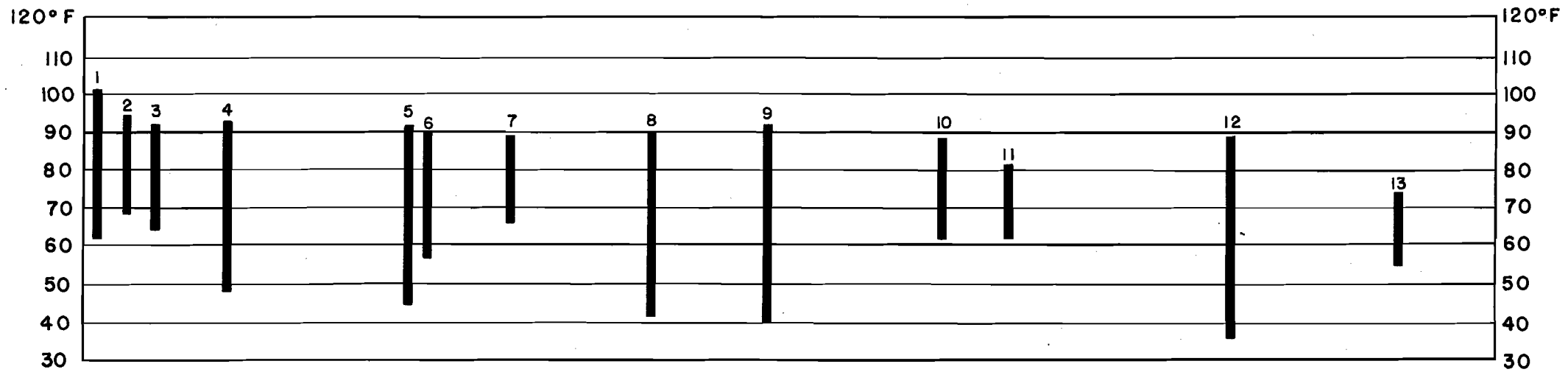
tains such records. Lowest relative humidity of the month was 7% at Lewiston Airport and 6% at Spokane Airport, with average daily minima being 12% at Lewiston Airport and about 14% at Spokane Airport. These Weather Bureau figures are used here to indicate relative humidity levels because of the inadequate responsiveness of the hair elements on the hygrothermographs used in the present study when the relative humidity drops below 25%.

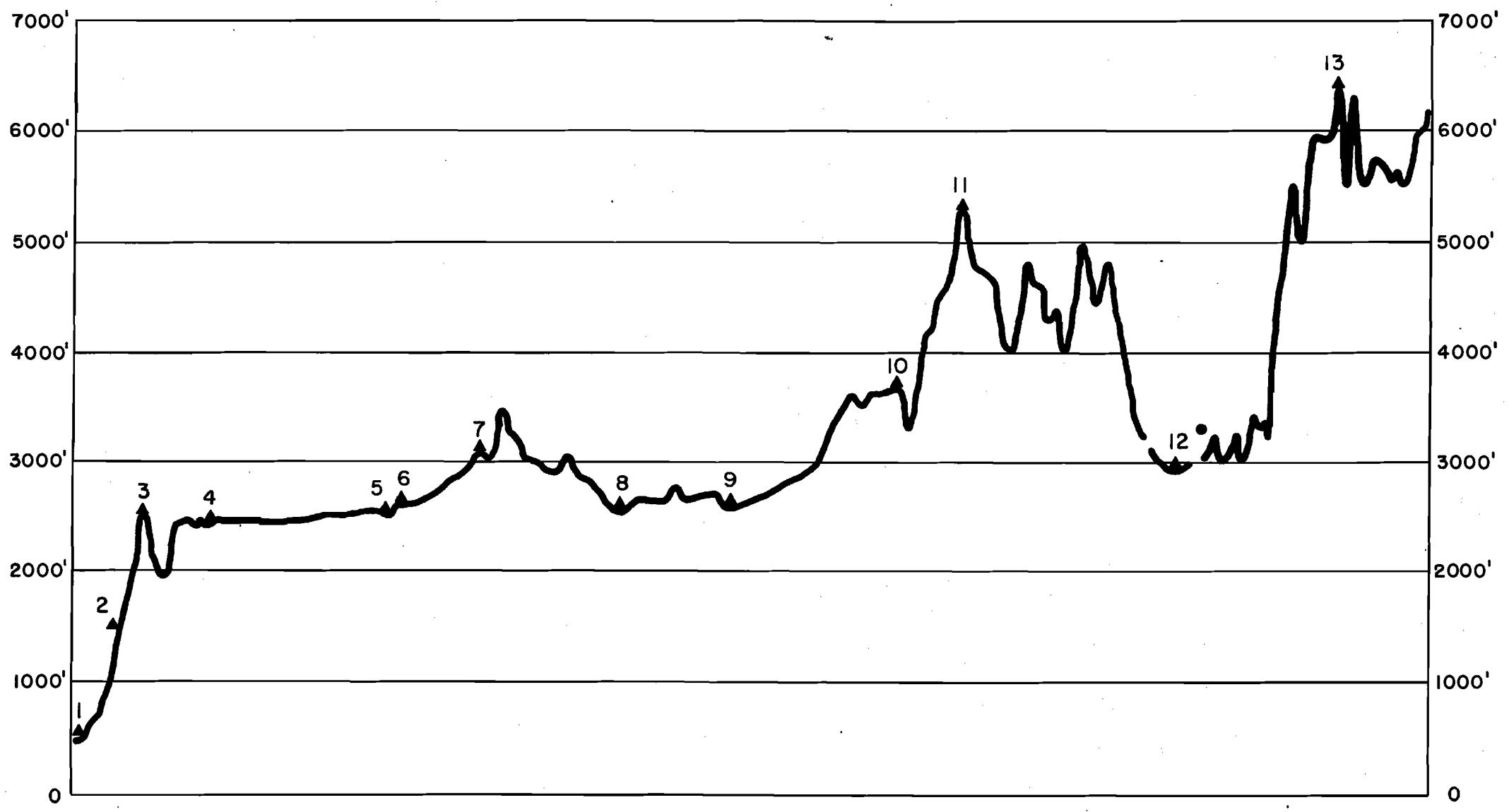
Mean daily maximum and minimum temperatures at stations along the profile between Wawawai, Wash., and Crater Peak during August 1967 are depicted on Figure 4. The mean inversion between Viola Hill (3150 feet) and South Palouse Flat (2540 feet) near Moscow during this month was 22°, with the mean minimum at the former station being 66° and at the latter 44°. By way of comparison the official Weather Bureau average minimum for Moscow was 51°, recorded at the University of Idaho experimental farm about one and one-half miles east of Moscow where the instrument shelter is located on a bench some distance up a hillside. A 22° mean inversion also existed between Emida Ridge (3700 feet) and Harvard Valley Flat (2590 feet); 20° between the subalpine fir meadow and nearby hilltop 250 feet above; and 15° between Genesee Flat and Hill, where the vertical distance is also about 250 feet.

Mean inversion was much less in the Snake River Canyon, specifically, 6½° between the warmest portion of the thermal belt at 1500 feet and the canyon bottom at 675 feet. Still this was the largest mean temperature inversion which has been recorded over a month's time (the other mean inversions were also the largest recorded during the period of records). Air drainage down the Snake River Canyon toward the

fig 4

MAXIMUM - MINIMUM TEMPERATURE PROFILE





SNAKE RIVER CANYON, WASH.–
CLEARWATER MTNS., IDAHO

AVERAGES FOR AUGUST 1967

1 Wawawai, Snake River Canyon 675'

2 Wawawai Canyon Slope 1500'

3 Rim above Wawawai 2500'

4 Union Creek Flat 2436'

5 South Palouse Flat 2540'

6 Moscow, University of Idaho 2610'

7 Viola Hill 3150'

8 Potlatch Valley Flat 2510'

9 Harvard Valley Flat 2590'

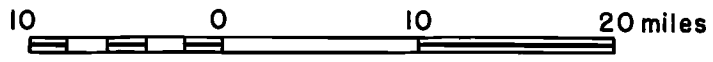
10 Emida Ridge 3700'

11 Bald Mtn. Lookout 5330'

12 Purdue Creek Flat 2880'

13 Crater Peak circa 6400'

● Off direct line of profile



c.h.wood

Columbia Basin of central Washington apparently limits the pooling of cool air in the canyon bottom.

Of special interest is the fact that the mean minimum temperature of 62° on the summit of Bald Mountain (5330 feet) during this month of August 1967 was exactly the same as in the bottom of the Snake River Canyon at Wawawai (675 feet). This contrasts with the situation during both the summers of 1965 and 1966 when the average minimum on the mountaintop was 10° lower than at Wawawai.

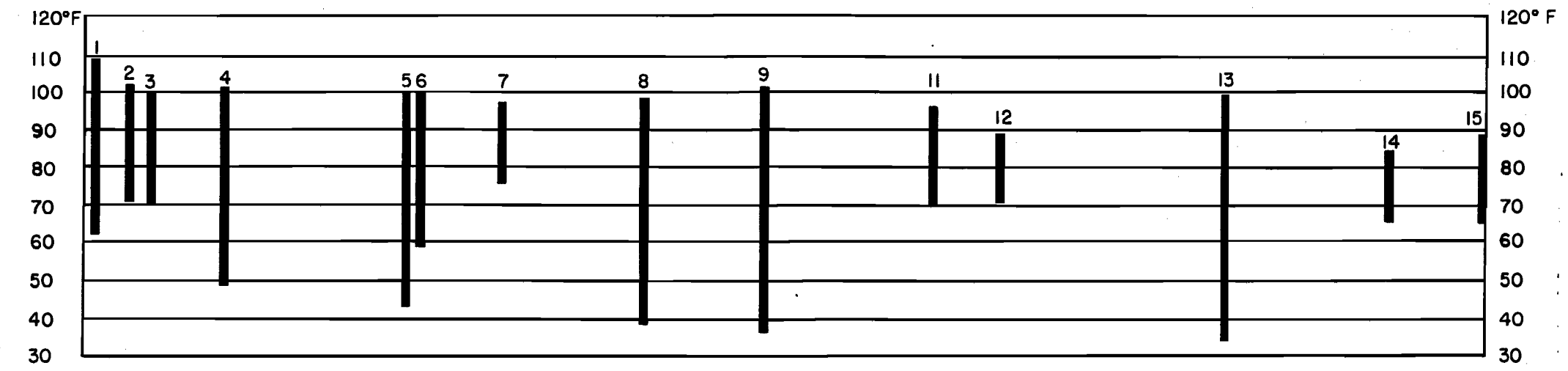
Turning to a specific day, namely August 17, 1967, even greater temperature inversions are in evidence (Figure 5). On this date minimum temperatures varied from 76° on Viola Hill (3150 feet) to 34° at both the subalpine fir meadow (2635 feet) and Purdue Creek Flat 2½ miles north of Bovill (2880 feet). This matched the 42° difference in minimum temperatures recorded between Wawawai (24°) and Purdue Creek Flat (-18°) during the winter cold snap on February 16, 1966 (Figure 8). It exceeded by 2° the previous record inversion related spread recorded on August 24, 1966 when the minimum was 74° on Viola and 34° at Purdue Creek Flat.

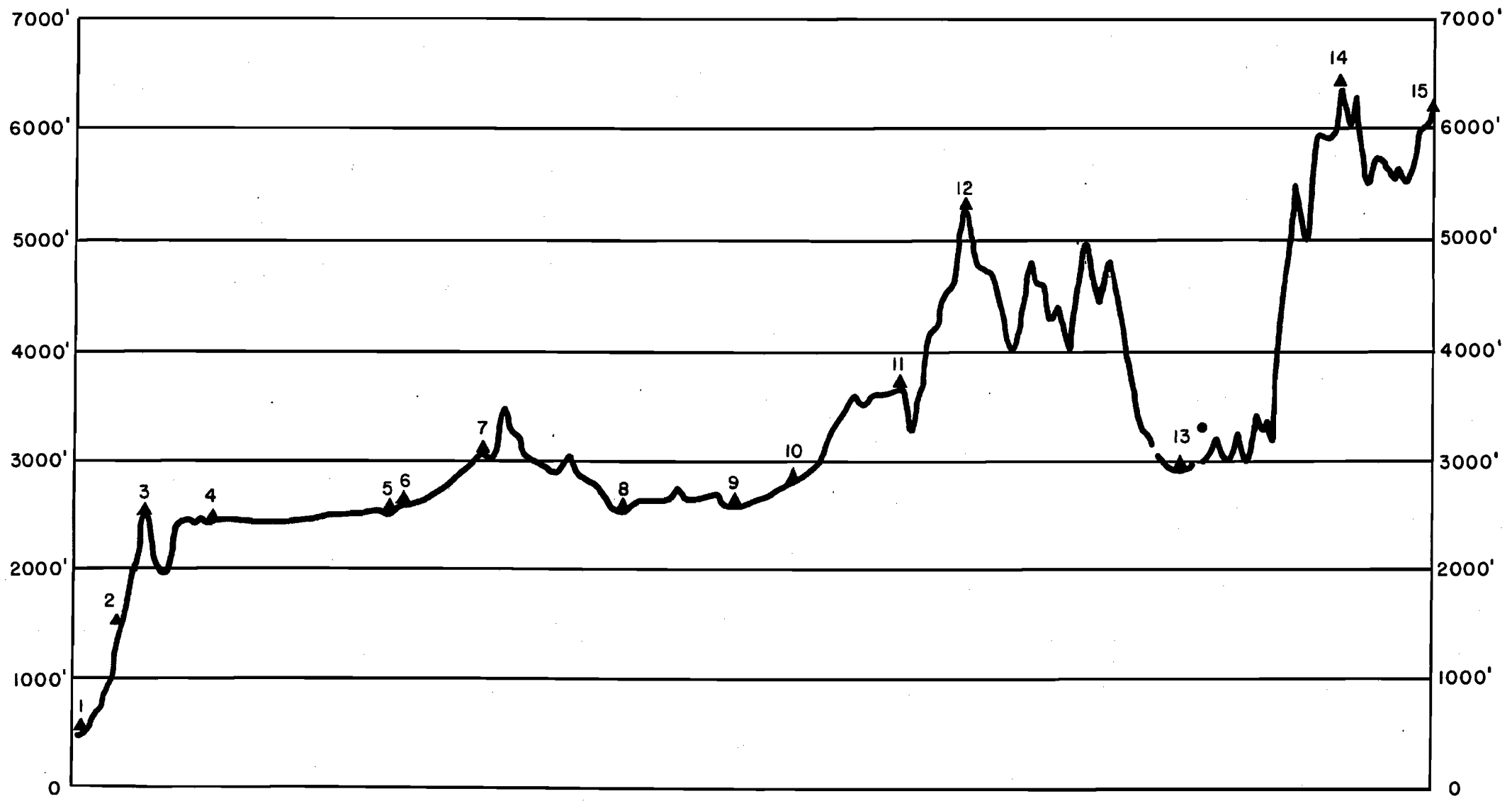
The magnitude of the August 17, 1967 inversion between immediately adjacent hilltops and valleys was as follows: Viola Hill (3150 feet) - South Palouse Flat (2540 feet), 33°, or between 76° and 43°; Emida Ridge (3700 feet) and Harvard Valley Flat (2590 feet), 31°, or between 70° and 39°; subalpine fir meadow (2635 feet) and the nearby hilltop (2865 feet), 26°, or between 34° and 60°; and Genesee Flat (2660 feet) and Hill (2900 feet), 23°, or between 44° and 67°. Inversion in the Snake River Canyon between Wawawai and the thermal belt amounted to 10° on this night.

Figure 6 presents a comparison between the free air temperatures

fig 5

MAXIMUM - MINIMUM TEMPERATURE PROFILE





SNAKE RIVER CANYON, WASH.– CLEARWATER MTNS., IDAHO

AUGUST 17, 1967

1 Wawawai, Snake River Canyon 675'

2 Wawawai Canyon Slope 1500'

3 Rim above Wawawai 2500'

4 Union Creek Flat 2436'

5 South Palouse Flat 2540'

6 Moscow, University of Idaho 2610'

7 Viola Hill 3150'

8 Potlatch Valley Flat 2510'

9 Harvard Valley Flat 2590'

10 1 mile S. of Giant White Pine 2760'

11 Emida Ridge 3700'

12 Bald Mtn. Lookout 5330'

13 Purdue Creek Flat 2880'

14 Crater Peak circa 6400'

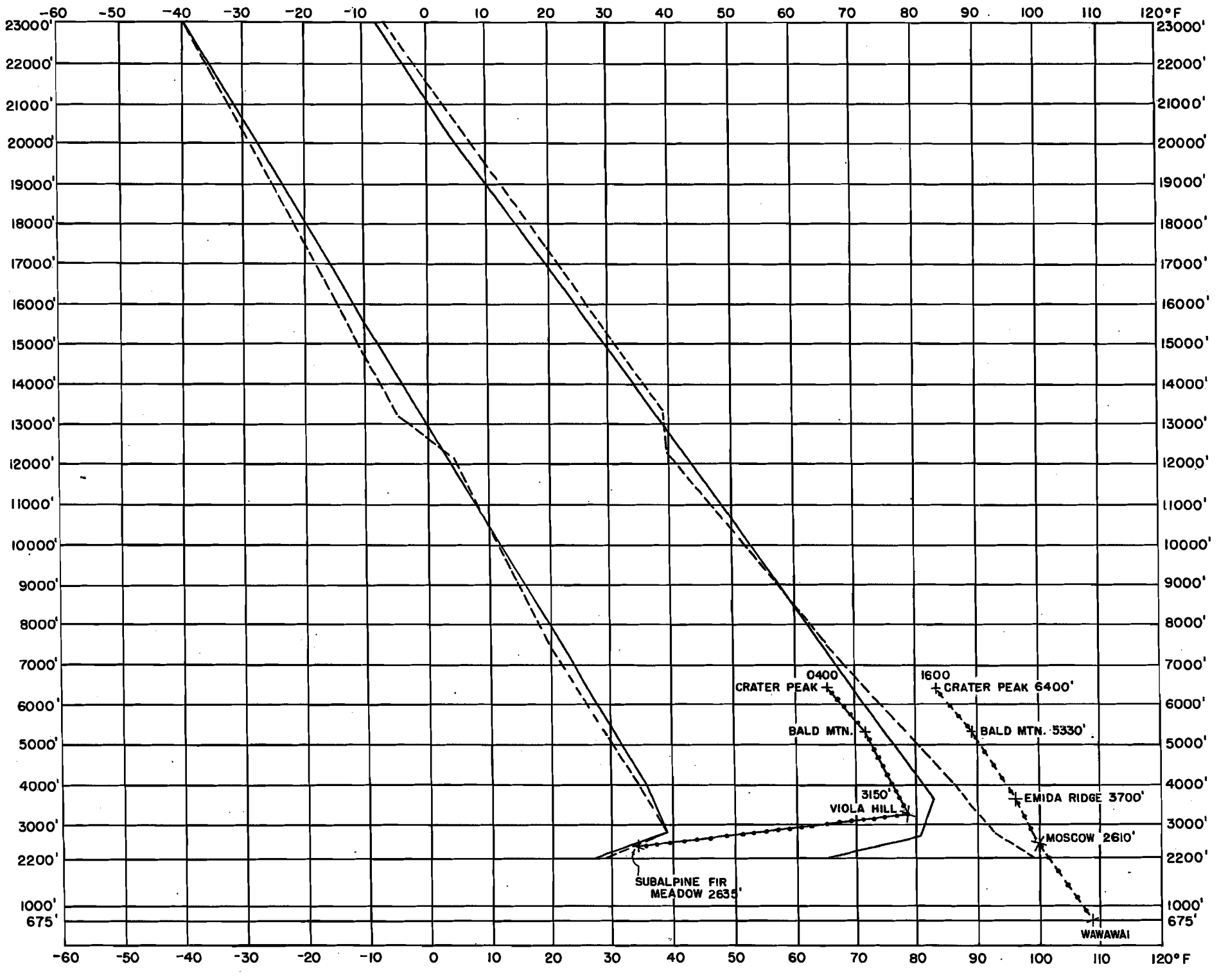
15 Moses Butte circa 6150'

● Off direct line of profile

10 0 10 20 miles

wood/chirumblo

PSEUDO - ADIABATIC CHART - SPOKANE, WASHINGTON
AUGUST 17, 1967



----- 1600 DEW POINT AT LEFT, AIR TEMPERATURE AT RIGHT (SPOKANE, WASH., RADIOSONDE)

——— 0400 DEW POINT AT LEFT, AIR TEMPERATURE AT RIGHT (SPOKANE, WASH., RADIOSONDE)

-•-•-• 1600 AIR TEMPERATURES ALONG PROFILE BETWEEN WAWAWAI AND CRATER PEAK

-•••-• 0400 AIR TEMPERATURES ALONG PROFILE BETWEEN SUBALPINE FIR MEADOW AND CRATER PEAK

recorded by radiosondes released by the U.S. Weather Bureau at the Spokane (Washington) International Airport on August 17, and the temperatures registered at corresponding times at certain key stations along the profile. The magnitude of the temperature inversion at the subalpine fir meadow (and Purdue Creek Flat, where the temperature was the same) is shown most impressively on this adiabatic chart. It will be observed that the free air temperature did not become as low as that at the subalpine fir meadow until an altitude of 14,000 feet was attained by the radiosonde. Free air temperature at the top of the inversion at Spokane was -83° at an altitude of 3700 feet above sea level. It will be noted that the nocturnal temperatures on the mountain summits were 4° to 5° cooler than at corresponding altitudes in the free air. On the other hand, the afternoon temperatures were 10° to 12° higher than at the same altitude in the free air. By contrast, it has been noted that temperatures on the mountain summits are almost identical with those recorded at corresponding altitudes by radiosonde when the mountains are enveloped in cloud. The effect of radiational cooling on clear nights and solar heating on sunny days on isolated summits is therefore well shown in Figure 6.

Also noteworthy on this adiabatic chart is the large spread between air and dew point temperatures. These spreads indicate relative humidities in the free air to be 17% at 3700 feet, the altitude of Emida Ridge; 18% at 5330 feet, the altitude of Bald Mtn.; and 19% at 6400 feet, the altitude of Crater Peak. For comparison, relative humidities indicated by the hygrothermographs at these three locations were 22%, 15% and 27%, respectively. When the hygrothermographs have been

checked with the sling psychrometer during periods of very low humidity (10% - 20% level), the most reliable instruments have averaged about 5% too high, while the less reliable instruments have read about 10% too high. The last two hygrothermographs purchased read 15% to 20% too high at times of low relative humidities; these instruments were considered completely unusable.

A noteworthy characteristic of minimum temperatures at bottomland sites is the significant decline which occurs between Union Creek Flat at elevation 2436 feet near the west end of the profile, and Purdue Creek Flat 45 air line miles east and only about 450 feet higher in altitude. The mean difference in minimum temperatures between the two sites for the year 1966 was 8° (Figure 3). Actually, most of this drop took place within a distance of 30 air line miles, for the minimum at the subalpine fir meadow, only 200 feet higher than Union Creek Flat, averaged but a fraction of a degree higher than that at Purdue Creek Flat. In terms of frost-free season, this contrast in minimum temperature was related to the difference between 121 such days at Union Creek Flat in 1966 and only 20 days at both Purdue Creek Flat and the subalpine fir meadow. In specific cases the difference in minimum temperatures in the two areas may approach or even exceed 15°. For example, on August 17, 1967 (Figure 5) minimum at Union Creek Flat was 48°, while that at both subalpine fir meadow and Purdue Creek Flat was 34°. Average difference in minimum temperatures for the month of August 1967 was 12°, or 48° and 36°, respectively (Figure 4).

The decline in mean maximum temperatures is much smaller, amounting to only about 2° between Union Creek Flat and Purdue Creek Flat throughout the year (Figure 3).

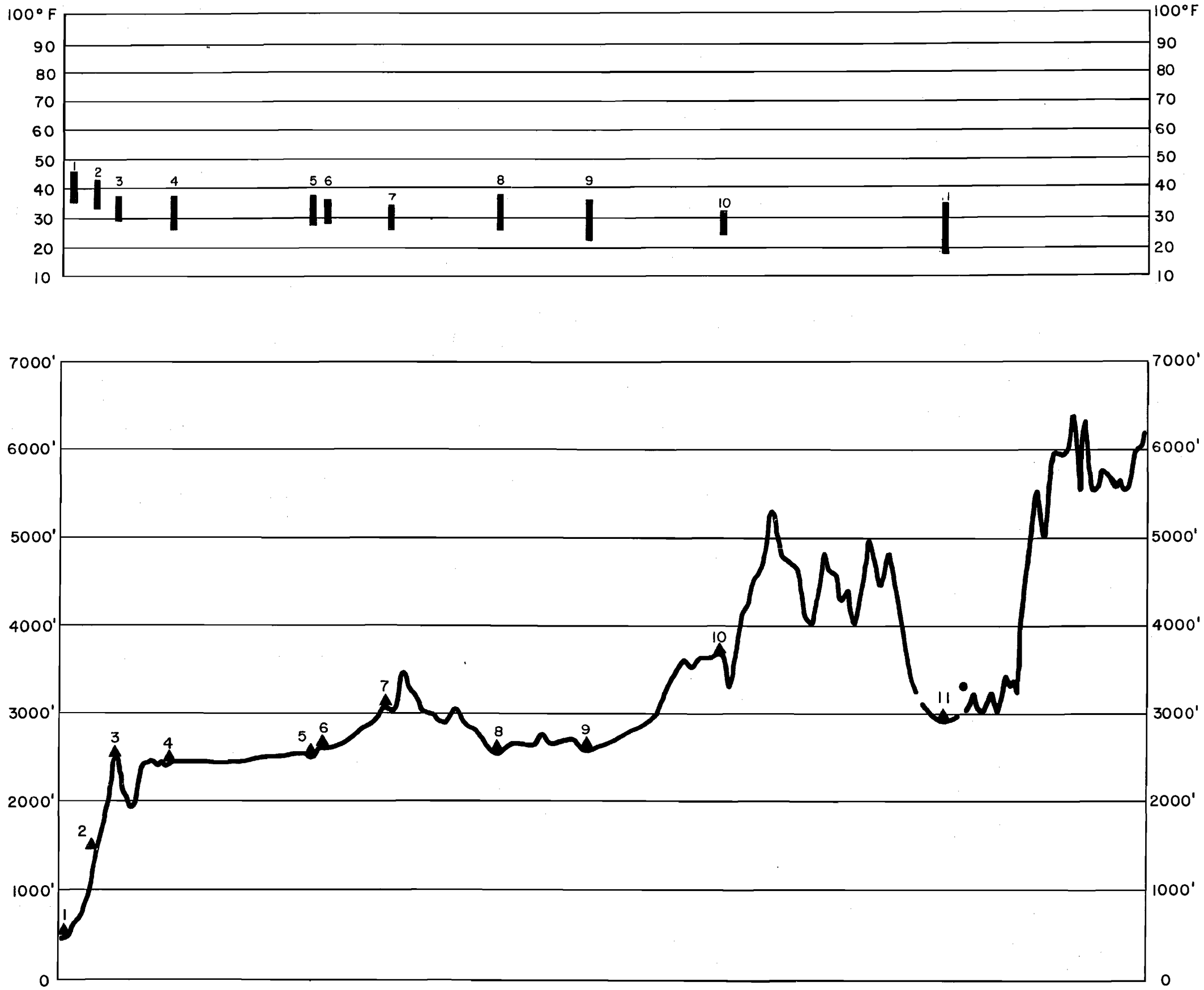
Another outstanding attribute of temperatures in the bottomlands is the very large diurnal range during the summer and early fall. This is, of course, primarily a consequence of the anomalously low night minima at these sites. In August 1967, mean diurnal range peaked at $52\frac{1}{2}^{\circ}$ at Purdue Creek Flat (Figure 4) and 55° at the subalpine fir meadow, comparable to the most extreme desert conditions in Nevada. The more usual mean diurnal ranges during the summer months at these sites is between 40 to 45°. By contrast, the mean summer diurnal range on Viola Hill and Freezeout Mountain is generally between 18° and 22°.

Greatest diurnal temperature range recorded on any one day was 68° at the subalpine fir meadow on August 17, 1967, when the maximum was 102° and the minimum 34^{0}. This was only seven degrees less than the largest diurnal range known to have occurred at a desert station in western U.S.

Winter Temperatures - With a high incidence of cloudiness and prevailing west-southwest winds transporting mild, humid maritime polar air directly from the Pacific Ocean much of the time during the winter months, nocturnal inversions and diurnal ranges are greatly diminished as illustrated by the mean maximum and minimum temperatures along the profile in January 1966 (Figure 7). Mean temperature inversions were eliminated from much of the southwestern portion of the profile where, for example, the minimum temperature for the month averaged one degree lower on Viola Hill than on the South Palouse Flat. However, farther east where a deep snowcover was present throughout the month (in contrast to the mere trace that was present at Moscow much of the time), and radiational cooling was therefore greater

fig 7

MAXIMUM - MINIMUM TEMPERATURE PROFILE



SNAKE RIVER CANYON, WASH.–
CLEARWATER MTNS., IDAHO

AVERAGES FOR JANUARY 1966

1 Wawawai, Snake River Canyon 675'

2 Wawawai Canyon Slope 1500'

3 Rim above Wawawai 2500'

4 Union Creek Flat 2436'

5 South Palouse Flat 2540'

6 Moscow, University of Idaho 2610'

7 Viola Hill 3150'

8 Potlatch Valley Flat 2510'

9 Harvard Valley Flat 2590'

10 Emida Ridge 3700'

11 Purdue Creek Flat 2880'

● off direct line of profile

10 0 10 20 miles

wood/chirumbio

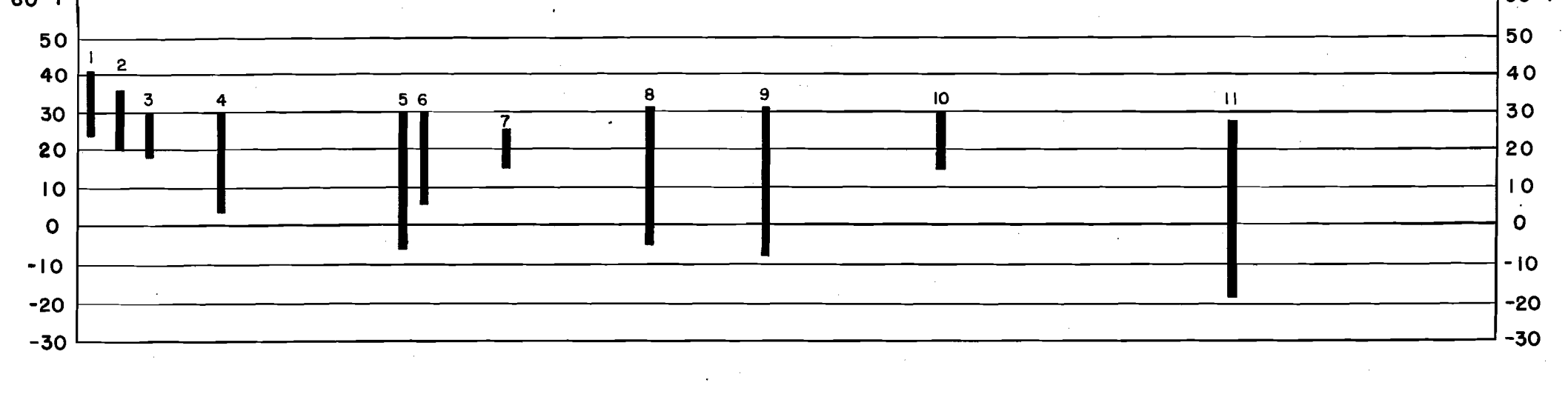
during the limited number of clear and partially clear nights, there is evidence of a mean inversion in the magnitude of about 5°F at Purdue Creek Flat. On a few nights it was more than 20° colder at this station than on Emida Ridge, some 800 feet higher. The mean diurnal temperature range of only 8° on hilltops and about 15° on low ground is about normal for December and January.

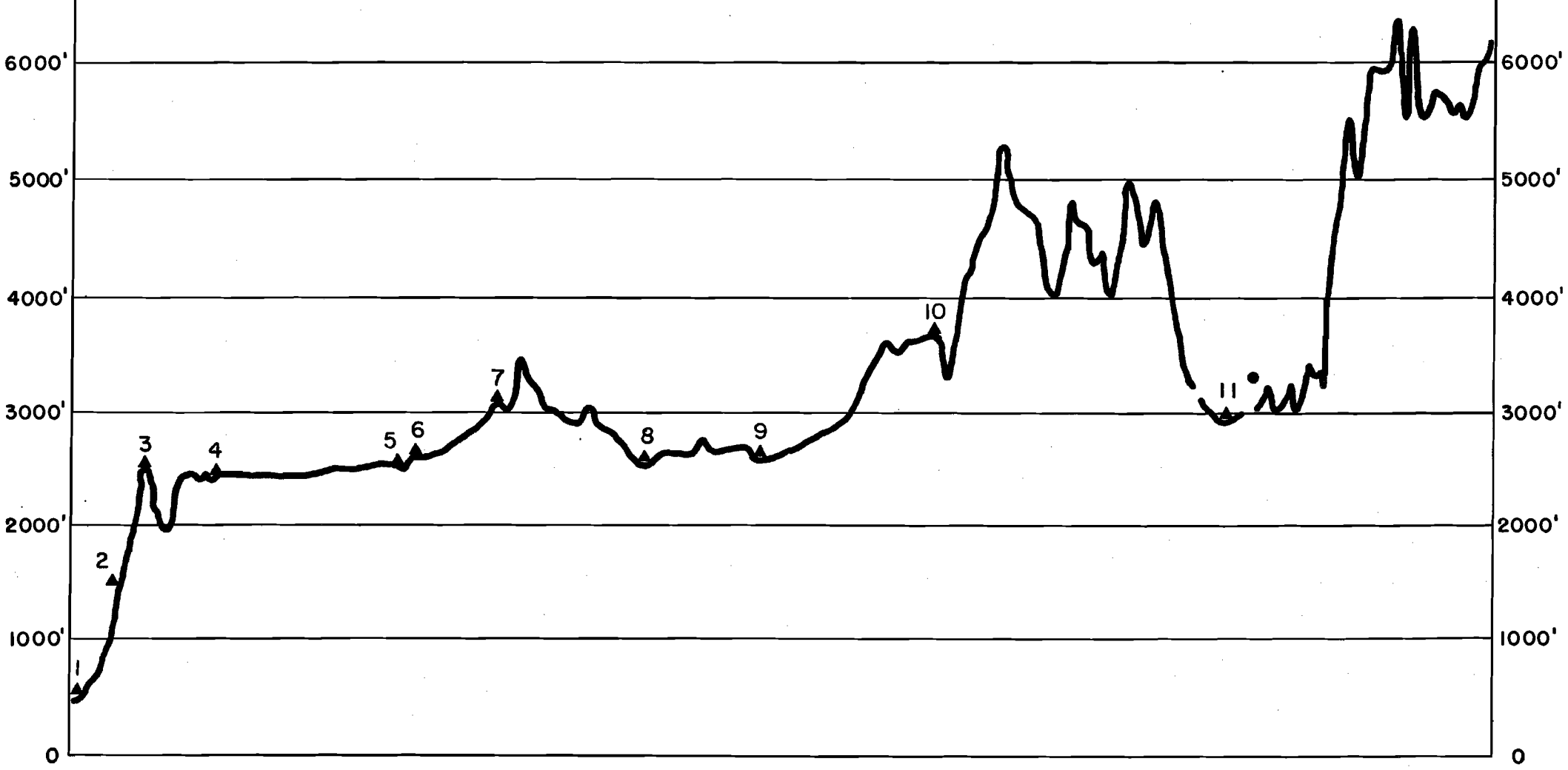
Occasionally, impressive inversions will develop when cold, dry continental arctic air accompanied by clearing skies briefly invades northern Idaho from western Canada. Such a situation developed on February 15, 1966 (Figure 8). The temperature descended to -18°F at Purdue Creek Flat, while never falling below 15° above zero on Emida Ridge. Even around Moscow, six inches of snow had fallen the day before, and with strong radiational cooling which followed during the night, a temperature inversion of 22° developed between South Palouse Flat where it was -6° and Viola Hill where the minimum was 16° above zero. The Snake River Canyon escaped the snow, and no temperature inversion developed there. The minimum at Wawawai was 24° above zero, while at the thermal belt station(Wawawai Canyon, 825 feet above) it was 20°. This was the coldest night of the winter at Moscow and Purdue Creek Flat, but most other stations had been a few degrees colder on another occasion earlier in the winter.

Special Conditions - Figures 9 and 10 depict temperature patterns along the profile under special circumstances. In September 1967 hygrothermographs were placed in two topographic lows in the high mountains near Crater Peak. One instrument was installed on the shores of Crater Lake, which is situated in a cirque just one-half mile northeast of, and 800 feet be-

fig 8

MAXIMUM - MINIMUM TEMPERATURE PROFILE





SNAKE RIVER CANYON, WASH.–
CLEARWATER MTNS., IDAHO

FEBRUARY 15, 1966

1 Wawawai, Snake River Canyon 675'

2 Wawawai Canyon Slope 1500'

3 Rim above Wawawai 2500'

4 Union Creek Flat 2436'

5 South Palouse Flat 2540'

6 Moscow, University of Idaho 2610'

7 Viola Hill 3150'

8 Potlatch Valley Flat 2510'

9 Harvard Valley Flat 2590'

10 Emida Ridge 3700'

11 Purdue Creek Flat 2880'

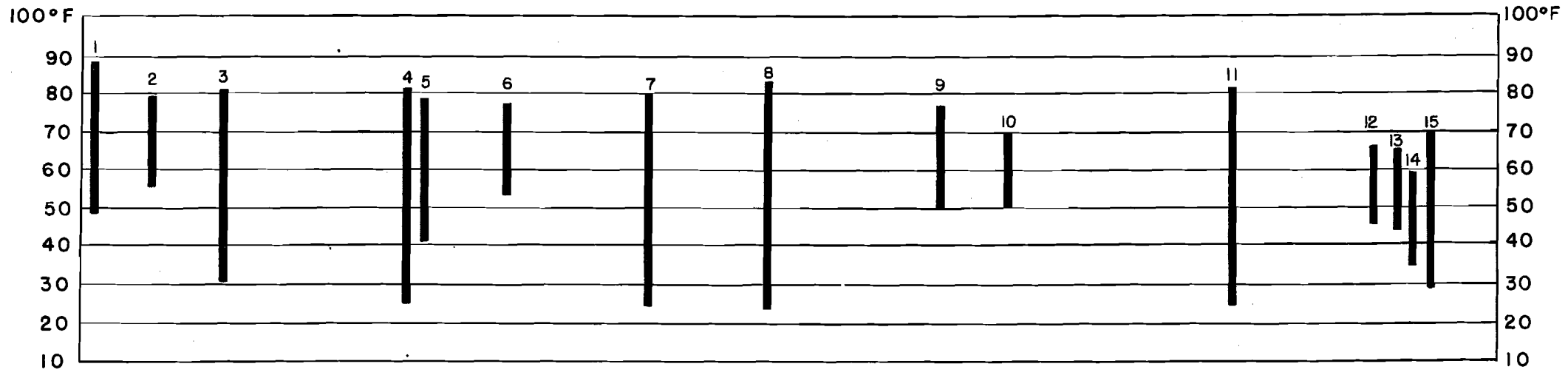
● Off direct line of profile

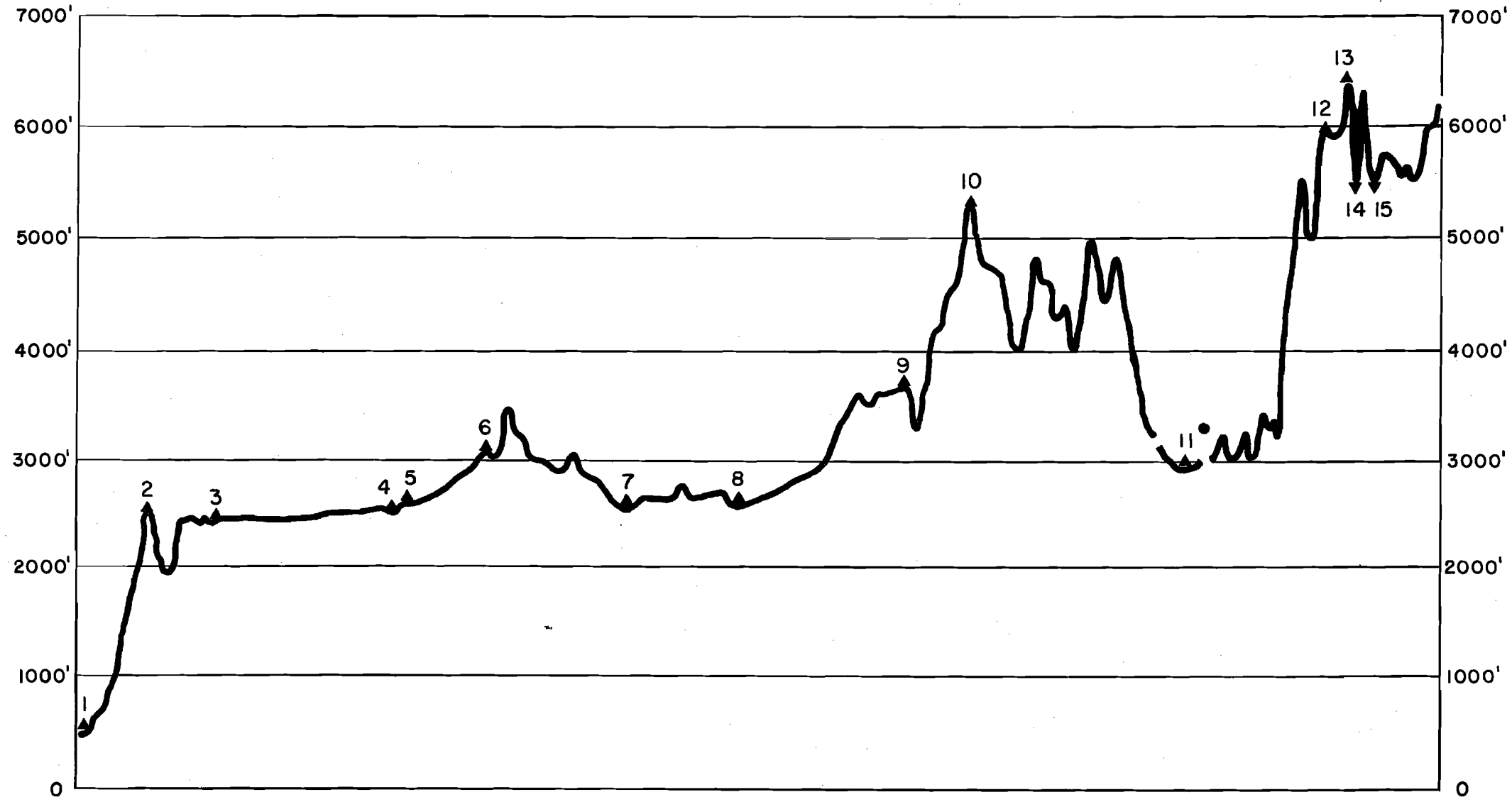
10 0 10 20 miles

c.h.wood

fig 9

MAXIMUM - MINIMUM TEMPERATURE PROFILE





SNAKE RIVER CANYON, WASH.– CLEARWATER MTNS., IDAHO

SEPTEMBER 23, 1967

1 Wawawai, Snake River Canyon 675'

2 Rim above Wawawai 2500'

3 Union Creek Flat 2436'

4 South Palouse Flat 2540'

5 Moscow, University of Idaho 2610'

6 Viola Hill 3150'

7 Potlatch Valley Flat 2510'

8 Harvard Valley Flat 2590'

9 Emida Ridge 3700'

10 Bald Mtn. Lookout 5330'

11 Purdue Creek Flat 2880'

12 Freezeout Mountain circa 5950'

13 Crater Peak circa 6400'

14 Crater Lake circa 5600'

15 Pinchot Marsh circa 5600'

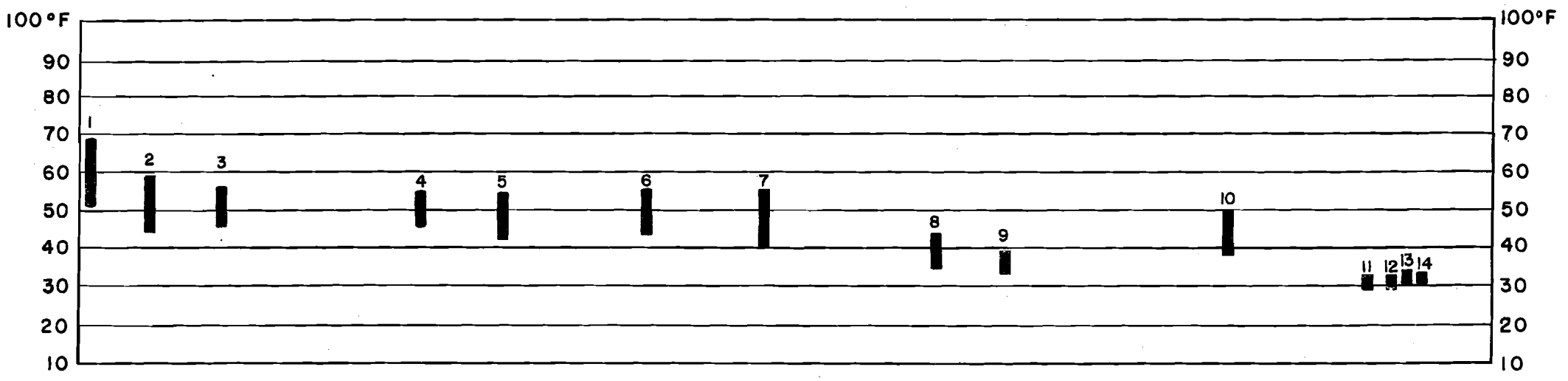
● Off direct line of profile

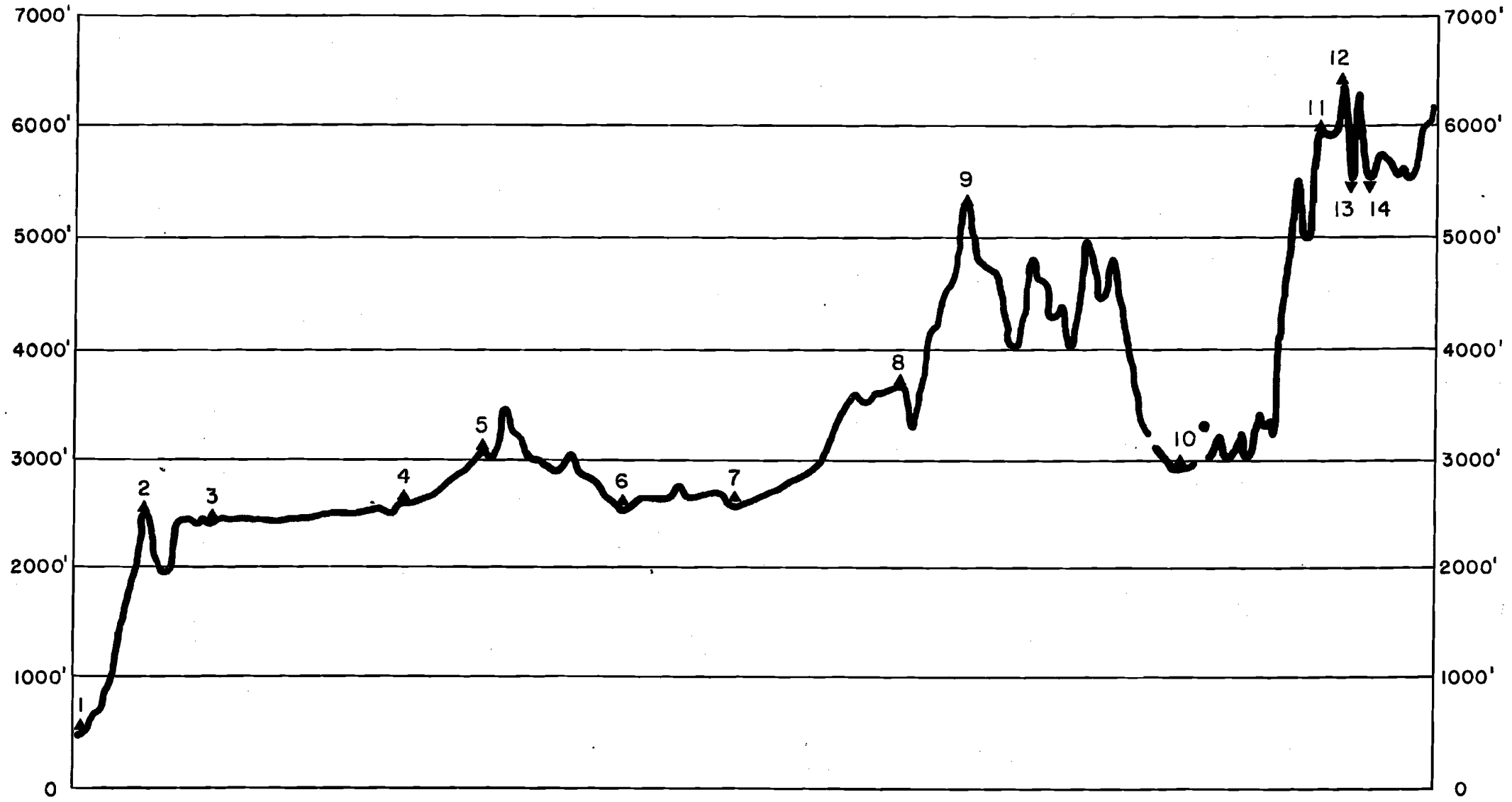
10 0 10 20 miles

c.h.wood

fig 10

MAXIMUM - MINIMUM TEMPERATURE PROFILE





SNAKE RIVER CANYON, WASH.–
CLEARWATER MTNS., IDAHO

OCTOBER 3, 1967

1 Wawawai, Snake River Canyon 675'

2 Rim above Wawawai 2500'

3 Union Creek Flat 2436'

4 Moscow, University of Idaho 2610'

5 Viola Hill 3150'

6 Potlatch Valley Flat 2510'

7 Harvard Valley Flat 2590'

8 Emida Ridge 3700'

9 Bald Mtn. Lookout 5330'

10 Purdue Creek Flat 2880'

11 Freezeout Mountain circa 5950'

12 Crater Peak circa 6400'

13 Crater Lake circa 5600'

14 Pinchot Marsh circa 5600'

● Off direct line of profile

10 0 10 20 miles

c.h.wood

low, Crater Peak. The other instrument was set up in a small, marshy depression designated as Pinchot Marsh three miles east of Crater Peak. On September 23, 1967, a hard freeze was experienced in the bottomlands throughout the agricultural portion of the Palouse Hills in Idaho, and inversions were unusually strongly developed. The ideal opportunity to compare the relative coldness of topographic lows high in the mountains with that of the bottomlands away from the mountains was thus provided. Figure 9 presents a somewhat surprising story. It was four degrees colder on the South Palouse Flat at elevation 2540 feet just south of Moscow than at Pinchot Marsh, which was at this time dry, at an altitude of 5600 feet in the mountains. The cold was even less severe at Crater Lake in the Bottom of the cirque, also at an altitude of about 5600 feet, where the 34° minimum was 9° warmer than that at the South Palouse Flat. In this case the lake may have modified the minimum temperature.

Other points of interest concerning the September 23rd cold snap were the following. First, the minimum temperature of 25° at South Palouse Flat and Potlatch Valley Flat was only one degree above that experienced at Purdue Creek Flat many miles to the east where minima generally average about six degrees lower than at the former sites. Second, the cold air was apparently more shallow than usual in the high pressure system which brought on this cold snap, for night temperatures on the mountain summits remained relatively high throughout the passage of the anticyclone. The Bald Mountain minimum on the previous day, when the mountains were coolest, was 48°, and even at Crater Peak it was no lower than 42°. (See hygrathermograph traces for the period September 21 through 23, 1967 as shown in Figure 15). Frequently freezing, or at

least near freezing, temperatures are recorded on the mountain summits the day preceding such a hard freeze on the bottomlands of the Palouse.

Figure 10 depicts temperature patterns on a day in which the mountains were enshrouded in heavy clouds down to an altitude of about 5000 feet, while Wawawai was experiencing considerable sunshine from about noon onward. The first strongly developed cyclone of the autumn season moved through the area early in the day. Rain, which was heavy in the mountains, began the previous afternoon, and turned to snow at about 1 a.m. on Freezeout Mountain and Crater Peak. A total of about 1.50 inches of precipitation accumulated on Crater Peak, and approximately one-half this amount on Bald Mountain. Only 0.36 inch fell at Moscow, and only about 0.20 inch at Wawawai. Gale force winds prevailed in the mountains and strong winds were experienced even in the lower country from about noon on the 2nd until near nightfall on the 3rd. Dust was blown in from the Columbia Basin more than 100 miles to the west by noon of the 3rd.

Maximum temperatures on the 3rd varied from only 32° on Crater Peak and Freezeout Mountain to 69° at Wawawai, indicating a mean lapse rate of 7° per thousand feet, which is as great as ever has been recorded along the profile. Hygrothermograph traces for the period from October 3rd through 5th are presented in Figure 16. It will be noted from this chart that the relative humidity was only 35% at Wawawai, while the mountains were experiencing 100%.

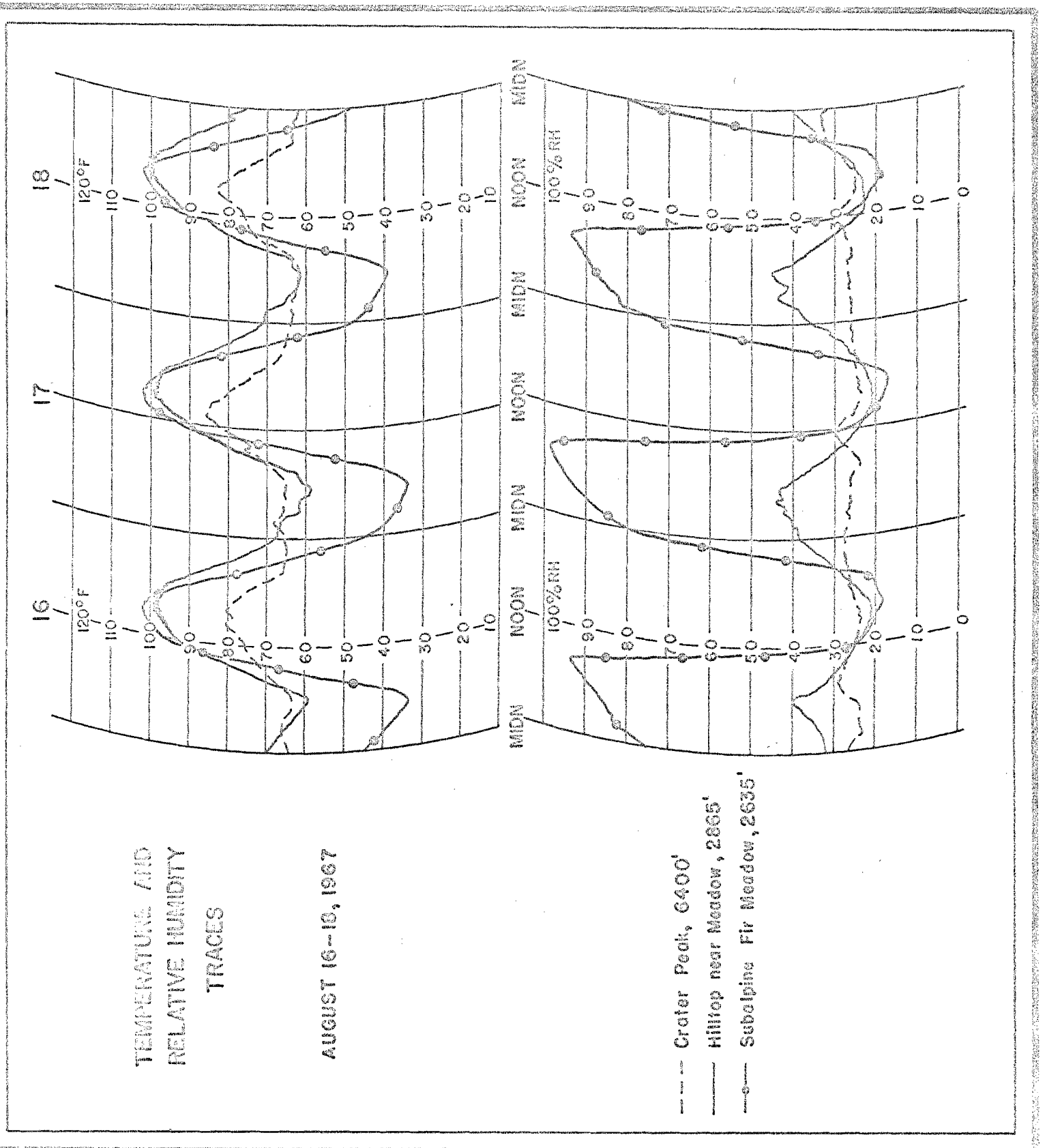
VI. Diurnal Patterns of Temperature and Relative Humidity

Bottomland-Hilltop-Mountain Summit Comparisons - The hygrothermegraph traces at each station tend to possess their own distinctive character, particularly during the clear, hot, dry days of summer. Figure 11 compares the simultaneous temperature and relative humidity traces made at one of the coldest bottomland sites, the subalpine fir meadow (elev. 2635 feet, 17 air line miles east of Moscow); a hilltop adjacent to the subalpine fir meadow (elev. 2865 feet); and on the summit of Crater Peak (6400 feet, 52 air line miles northeast of Moscow during three days, August 16-18, 1967.

At the subalpine fir meadow, both the temperature and relative humidity curves are smooth, showing a highly regular daily pattern during the clear days represented, and featuring a very large spread of temperature and relative humidity between night and day. On August 17th, there was a temperature range of 68° between a morning minimum of 34° and an afternoon maximum of 102°, greatest diurnal range ever recorded along the profile. Humidity was close to 100% in the early morning, but only about 15% in the afternoon (after allowance is made for probable instrumental error). The nearby hilltop temperature trace shows a few small irregularities, and a much reduced diurnal range of 39°, between the morning minimum of 60° and afternoon maximum of 99°. Relative humidity range is between 44% and 16% after estimated corrections are applied.

On Crater Peak, the diurnal temperature range is further reduced to only 19°, between 65° and 84°, and relative humidity shows very little variation from night to day. The temperature curve shows some

FIGURE 11


TEMPERATURE AND
RELATIVE HUMIDITY
TRACES
AUGUST 16–18, 1967
16
17
18
120°F
110
100
90
80
70
60
50
40
30
20
10
MIDN
NOON
MIDN
NOON
MIDN
100% RH
90
80
70
60
50
40
30
20
10
0
Crater Peak, 6400'
Hilltop near Meadow, 2665'
Subalpine Fir Meadow, 2635'

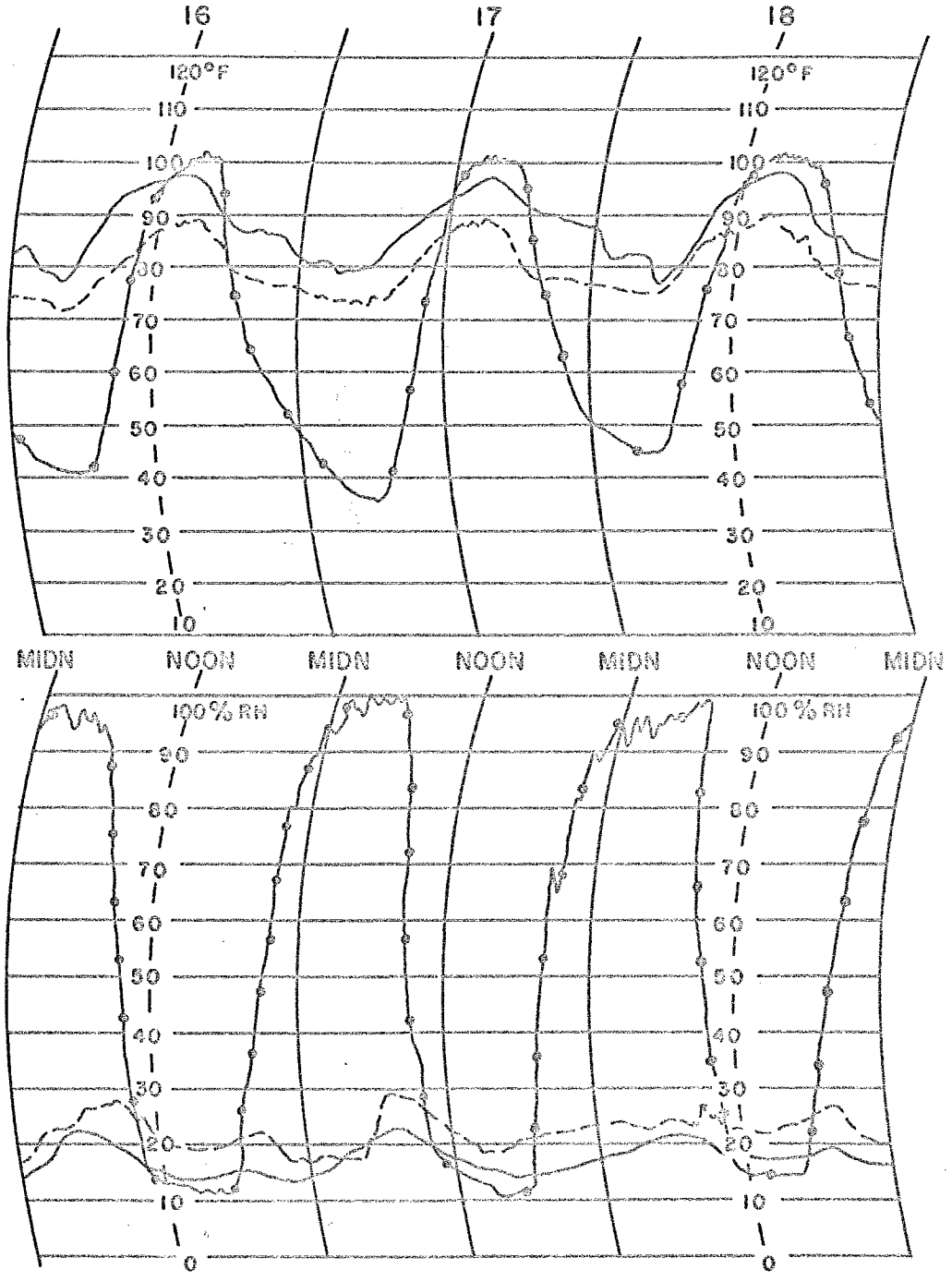
irregularities, with very little temperature drop after sunset, and on two of the nights an actual rise of 2° or 3° in the early morning hours. Relative humidity actually shows a tendency toward a noon maximum, but remains below 30% during most of the three-day period. The noon maximum is suspected to result from moisture being carried aloft from lower elevations by convection currents. Earlier studies by others have indicated that this is moisture accumulated during the night hours in the valleys, probably by transpiration from plants. By early afternoon the moisture source becomes depleted and the relative humidity drops back to its original level. These mountaintop relative humidities, as shown, may be a few per cent too high, particularly at the time of diurnal minimum, because of the tendency of the hygrothermogrph hairs to show inadequate response when the air is as dry as it was at the time of this record.

To investigate further the contrasting character of the hygrothermograph traces at bottomland, hilltop, and mountain summit sites, the records made at another similar combination of stations on the same dates as before are depicted in Figure 12. This second set of sites includes Harvard Valley Flat (elev. 2590 feet, 20 miles northeast of Moscow); Viola Hill (elev. 3150 feet, 4 miles north of Moscow); and Bald Mountain (elev. 5330 feet, 9 miles north of Harvard Valley Flat).

Ordinarily, the minimum temperatures at Harvard Valley Flat average about two degrees higher than at the subalpine fir meadow, while the daytime maximum is about the same. Altitudes are almost identical at the two stations, being 2590 and 2635 feet, respectively. Viola Hill is about 300 feet higher than the hilltop overlooking the subalpine fir meadow, and is actually the narrowest part of a ridge-like chain of hills which looms in an isolated manner above the surrounding landscape. Daytime maximum temperatures average 2° to 3° lower on Viola Hill than on the hilltop near the subalpine fir meadow, but minima average 2° to 3° higher in winter and

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

AUGUST 16-18, 1967



- - - Bald Mountain, 5330'
—— Viola Hill, 3150'
—o— Harvard Valley Flat, 2590'

FIGURE 12

as much as 6° to 8° higher in summer on Viola Hill. Bald Mountain, which is nearly 1100 feet lower in altitude than Crater Peak, averaged 6° to 7° warmer both day and night during August and September 1967, the only two months for which records are available at both places. With this background in mind as to the comparative characteristics of the two sets of stations, we may proceed with an evaluation of the traces.

The Harvard Valley Flat traces are of similar form to those made at the subalpine fir meadow, except that the minima are a few degrees higher. It is suspected that such differences as do exist in the humidity traces at the two places can be attributed mainly to differing responses of the hairs in the humidity element. There are, however, some significant differences in both the temperature and humidity traces made on Viola Hill, as contrasted to the hilltop near the subalpine fir meadow. The days were as usual 2° or 3° cooler on Viola Hill, but the minima averaged 13° warmer for the three nights, even after allowing for an instrumental correction of -2° that had to be applied to the Viola Hill record. On Viola Hill during clear, calm, hot weather there is a tendency for the temperature curve to level out after sunset. By contrast, there is nothing more than temporary slowing of the temperature drop on the lower hilltops such as that near the subalpine fir meadow or the hill near Genesee. The pronounced leveling off tendency on the higher, more isolated Viola Hill has been observed repeatedly, and occasionally the temperature actually rises one to three degrees in the late evening. This temporary nocturnal rise in temperature is similar to the phenomenon observed somewhat more frequently on the mountain summits. Usually an abrupt drop of 10° or even 15° follows towards dawn

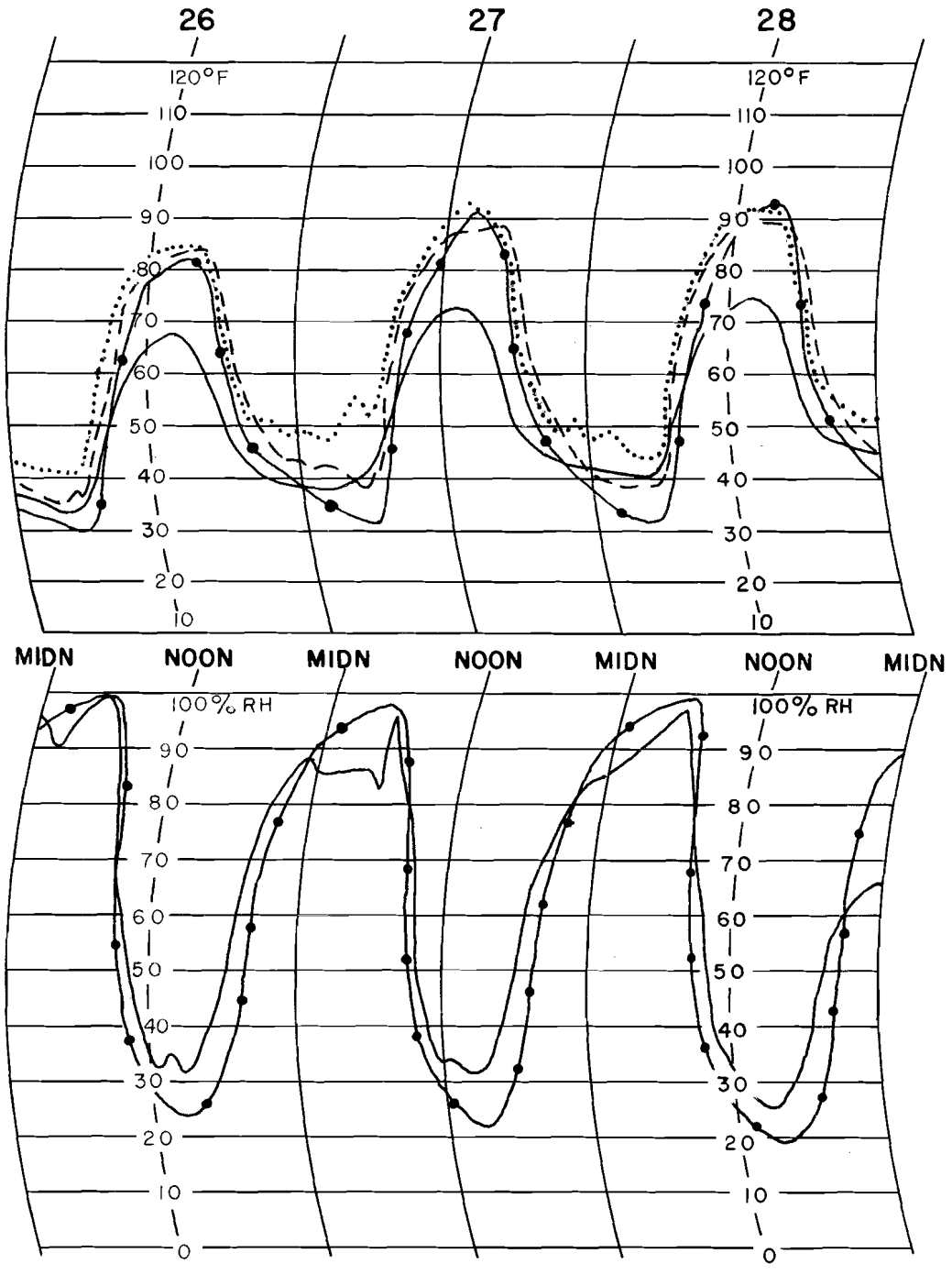
on Viola Hill, an event that seems to occur much less frequently on the mountaintops.

In accordance with the temperature characteristics described above, the relative humidity not only remains very low during the evening on Viola Hill, but actually may show a decline. Not uncommonly, as in the case of the August 16 and 18 portions of the trace shown in Figure 12, the late evening minimum in the humidity curve equals the afternoon minimum, even though the temperature is normally about 10° lower than at the time of afternoon maximum. Consequently, there is, in fact, a substantial decline in the absolute humidity during the evening hours on such occasions. This event is apparently associated with strong subsidense which brings in extremely dry air from aloft. Toward dawn, as the temperature suddenly drops, the relative humidity rises with equal abruptness, usually at least 15%, although less on the present record. Apparently the layer of radiationally cooled air, which begins to accumulate in the valleys shortly before sunset, deepens until it overtops Viola Hill at about dawn. The tendency for the temperature curve to show greater steadiness during the night on both Bald Mountain and Crater Peak is apparent on Figures 12 and 11, respectively.

Bottomland Exposures - Figure 13 reveals how the nights in bottomland sites characteristically become colder farther east along the profile during clear weather. During the three days represented, September 26 - 28, 1967, minimum temperatures in the subalpine fir meadow were 10° to 15° lower than on Union Creek Flat 30 miles to the west. On the other hand, afternoon maxima were about the same at the two places. As a matter of

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

SEPT. 26-28, 1967



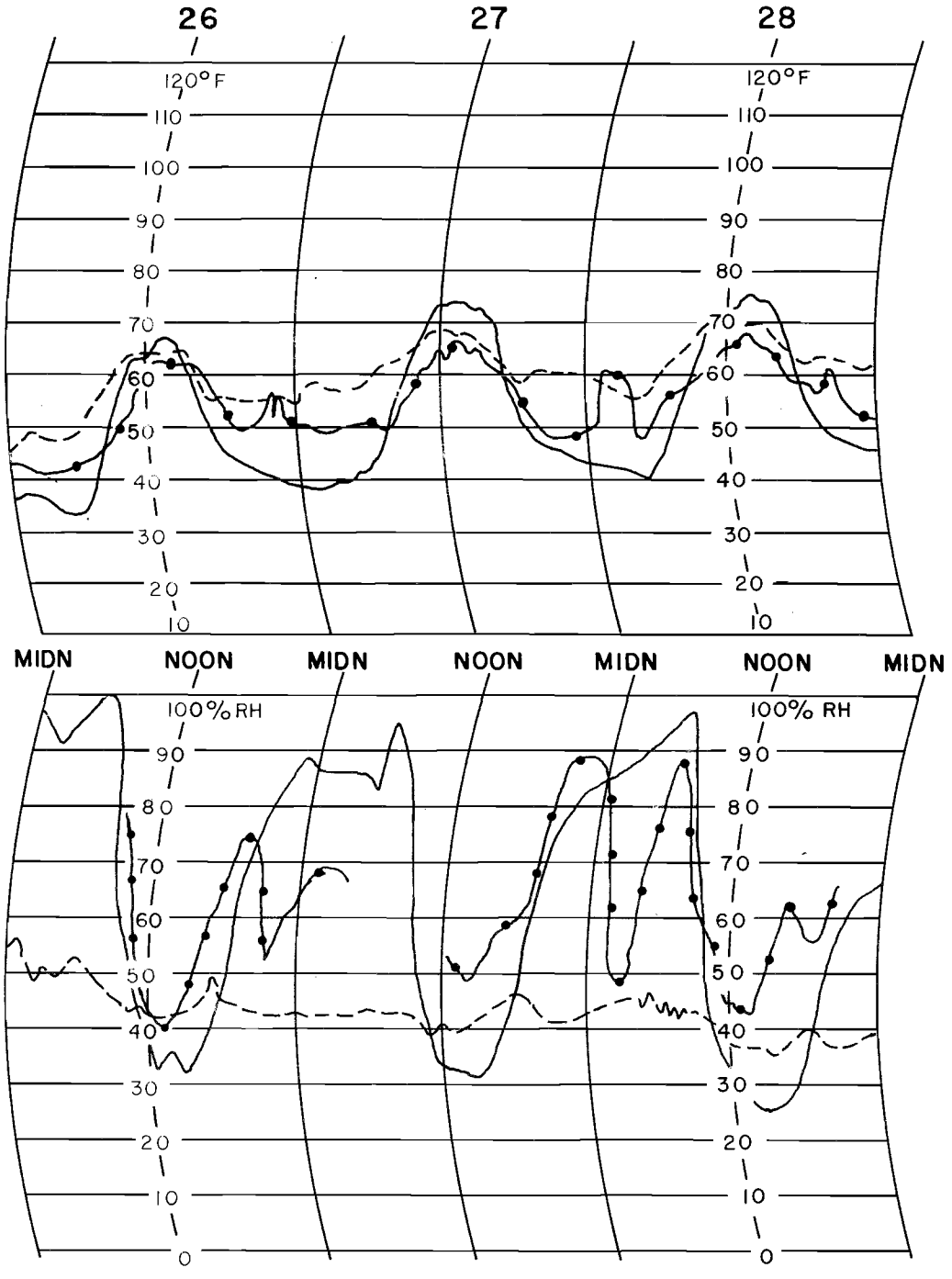
····· Union Creek Flat, 2436'
– – – Potlatch Flat, 2510'
—●— Subalpine Fir Meadow, 2635'
—— Pinchot Marsh, 5600'

fact, average maximum temperatures for the month of September were identical at the two sites, 80.8°. On the other hand, there was an average difference of 10.2° in the minima during the month. The average were 45.6° for Union Creek Flat and only 35.4° for the subalpine fir meadow. Potlatch Flat's minima, both on this chart, and for the month as a whole, averaged halfway between the two. Also included on Figure 13 is Pinchot Marsh in the high mountains about 40 miles northeast of the subalpine fir meadow, and 3000 feet higher in altitude. Minimum temperatures averaged seven degrees higher at Pinchot Marsh during the three day period, although maximum temperatures averaged 17° lower, reflecting the impact of the dry adiabatic lapse rate during the warm, very dry afternoons. Relative humidity patterns were similar at the subalpine fir meadow and Pinchot Marsh, although averaging about 10% higher at the latter place in the afternoon.

Three Contrasting High Altitude Exposures - Figure 14 depicts the diurnal temperature and relative humidity patterns at three high altitude stations during the same three clear days (September 26 through 28, 1967) as were dealt with in the preceding section. As noted earlier in this report, Crater Lake is only one-half mile northeast of Crater Peak in a direct line, but it is 800 feet lower and at the bottom of a cirque. By late September, the lake is in the shadow of the cirque walls most of the day. Probably both because of this and the presence of the water surface, maximum temperatures at the lake averaged four degrees lower than on Crater Peak during the three-day period. Considering solely the difference in altitude, one would have expected the maxima at the lake should average about four degrees higher, rather than lower. Pinchot Marsh, which is at the same altitude as the lake, but receives sunlight much of the day and was completely

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

SEPTEMBER 26-28, 1967



– – – Crater Peak, 6400'
—●— Crater Lake, 5600'
——— Pinchot Marsh, 5600''

Part of Crater Lake RH record is missing

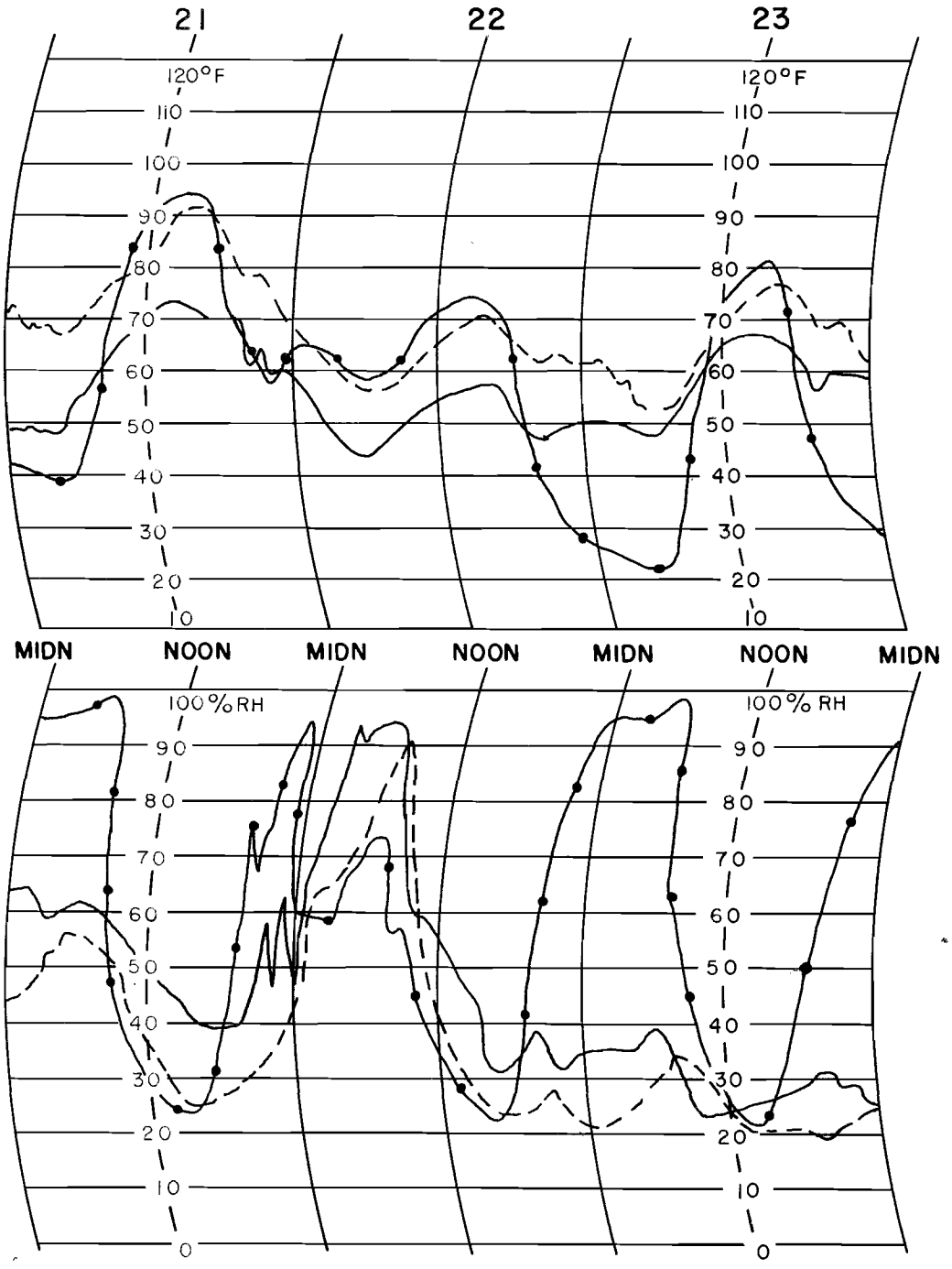
14

dry at the time of the record, did, in fact, average 4° warmer than Crater Peak at the time of the afternoon maximum. At night, temperatures at Crater Lake averaged about half way between those on the peak, which were warmest, and those at Pinchot Marsh which were coldest. Pinchot Marsh minima averaged 14° lower than those on the Peak, which is 800 feet higher. Temperatures at the lake apparently were modified by the water surface and possibly by air drainage northeastward out of the cirque as well. Nocturnal traces at Crater Lake exhibit abrupt temperature rises and relative humidity drops of an hour or two duration. It is surmised that either there was a sudden wind flow downward from the peak to the southwest, or possibly an intensified air drainage flow northeastward out of the cirque. There were similar abrupt temperature rises on several other nights during the three-week period of records made here. Further investigations are planned during the summer of 1968 concerning these possible air drainage winds that seem characteristic of certain mountain sites during the night. Less spectacular indications of such winds have been noted at several experimental stations not reported on here because of the lack of sufficient definitive data at this time.

Profile of a Cold Front and Anticyclone - Figure 15 depicts the changing relations between temperature and relative humidity at different altitudes and exposures during passage of a cold front and the anticyclone which follows. The cold front passed through near midnight of September 21-22, 1967. Until the wind began to pick up shortly before frontal passage, the temperature was dropping quite rapidly and the relative humidity was rising sharply in the cool air which was draining into the

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

SEPT. 21-23, 1967



--- Viola Hill, 3150'
—●— Subalpine Fir Meadow, 2635'
—— Freezeout Mountain, 6000'

subalpine fir meadow. Then the front, with its cloudiness and associated wind, moved in. The temperature rose and relative humidity dropped in the subalpine fir meadow. By contrast, on the summit of Freezeout Mountain, the temperature dropped steadily and the relative humidity rose abruptly as low clouds and cool air moved in. At sunrise on the 22nd, the temperature on Freezeout Mountain was 45°, lowest during the three-day period, while the minimum in the subalpine fir meadow was 56°, one of the warmest nights of the entire summer there.

Next night, as the center of the high pressure system lay directly over the area, a reverse pattern was in effect. In other words, on Freezeout Mountain the minimum temperature was a degree higher than on the previous night, following a drop of only 12° from the afternoon maximum of 58°, and there actually was a small rise in temperature during the middle of the night. By contrast, in the subalpine fir meadow, the temperature dropped precipitiously from 75° the previous afternoon to only 22° at sunrise, the coldest morning since April 23. Relative humfdity rose with equal abruptness from 22% the previous afternoon to 98% by sunrise in the subalpine fir meadow, but on the mountain the relative humidity held close to the previous afternoon's minimum throughout most of the night as dry air subsided from aloft, a typical situation near the center of an anticyclone. Also typical is the occurrance of the minimum temperature on the mountain one day earlier than in the adjacent lowland, during the passage of an anticyclone.

On Viola Hill, the temperature and relative humidity pattern was much the same as on Freezeout Mountain, except that being at a lower

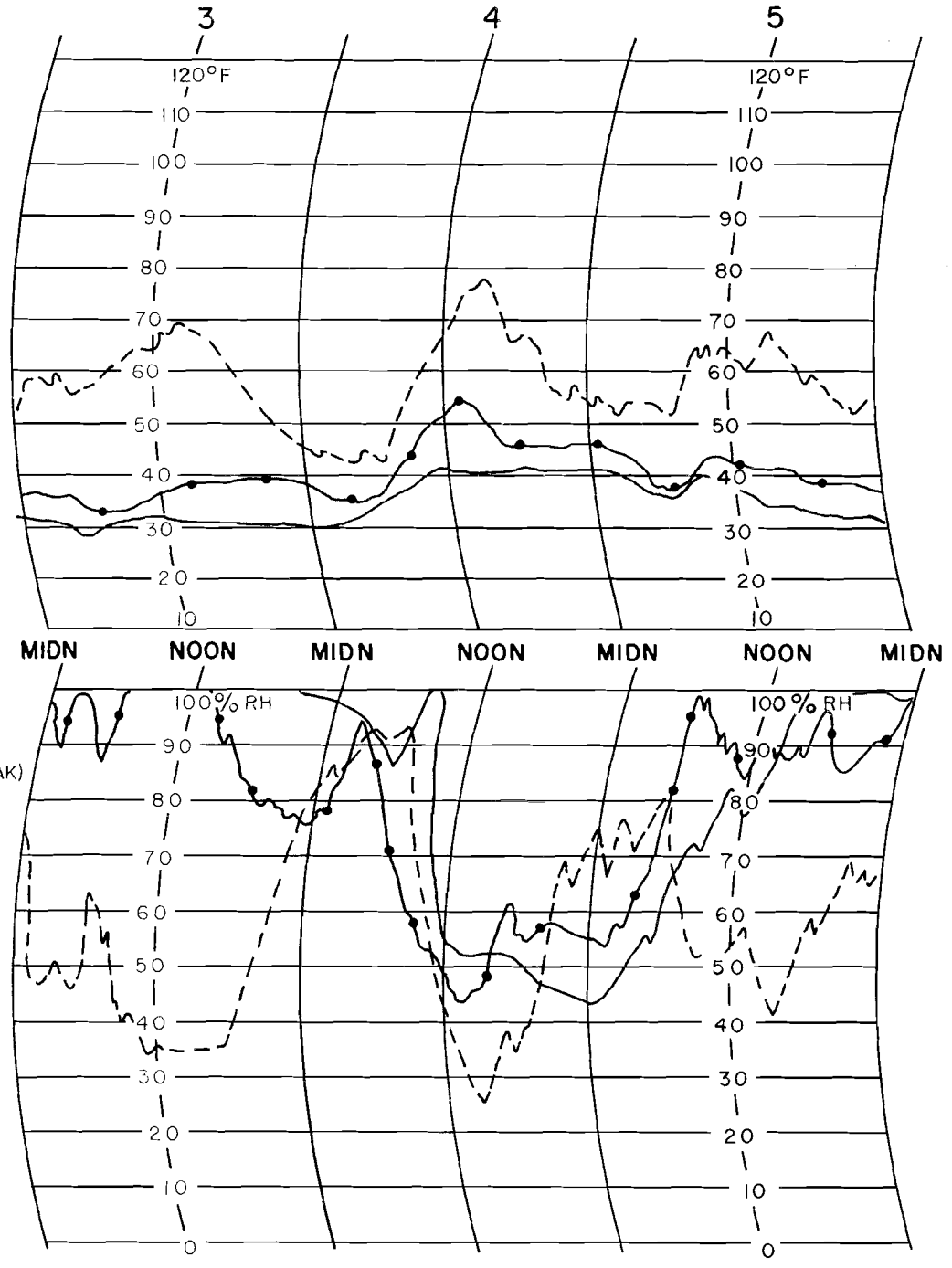
altitude, the general level of temperature was about 12° higher and, with the higher temperatures, the relative humidity was lower until the morning of the 23rd. At the latter time, cool air pooling in the lowlands apparently overtopped the hill causing a sudden temperature drop of nearly 10° and associated rise in relative humidity at dawn. Noteworthy was the exceptionally low relative humidity of about 20% at midnight on the 22nd-23rd on Viola Hill, at the same time the subalpine fir meadow was recording 96%.

Effect of Cloudiness on Mountain Records - Figure 16 provides an example of the impact of changing air masses and associated cloudiness patterns upon the temperature and humidity traces at mountain versus canyon sites. On October 3, 1967 strong to gale force west-southwest winds accompanied passage of the first major cyclone of the autumn. Rain had fallen the length of the profile during the preceding afternoon and night, with considerable snow above 5500 feet in the mountains at the northeastern end of the profile. However, precipitation had ceased by 8 a.m. on the 3rd at Wawawai on the southwestern end of the profile, and there was some sunshine by midday, although much dust was blowing in from central Washington. By contrast, Bald Mountain remained in the clouds until noon, and Crater Peak all day. As the canyon warmed to 69° under the influence of sunshine, the relative humidity dropped to only 35%. In contrast, the temperature never rose above 31½° on Crater Peak and the relative humidity remained at 100%. Thus there was the astonishing average lapse rate of 7° per 1000 feet between the opposite ends of the profile.

By the next day, October 4th, winds had shifted to the southeast

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

OCTOBER 3-5, 1967



--- Wawawai 675'

—●— Bald Mountain, 5330'

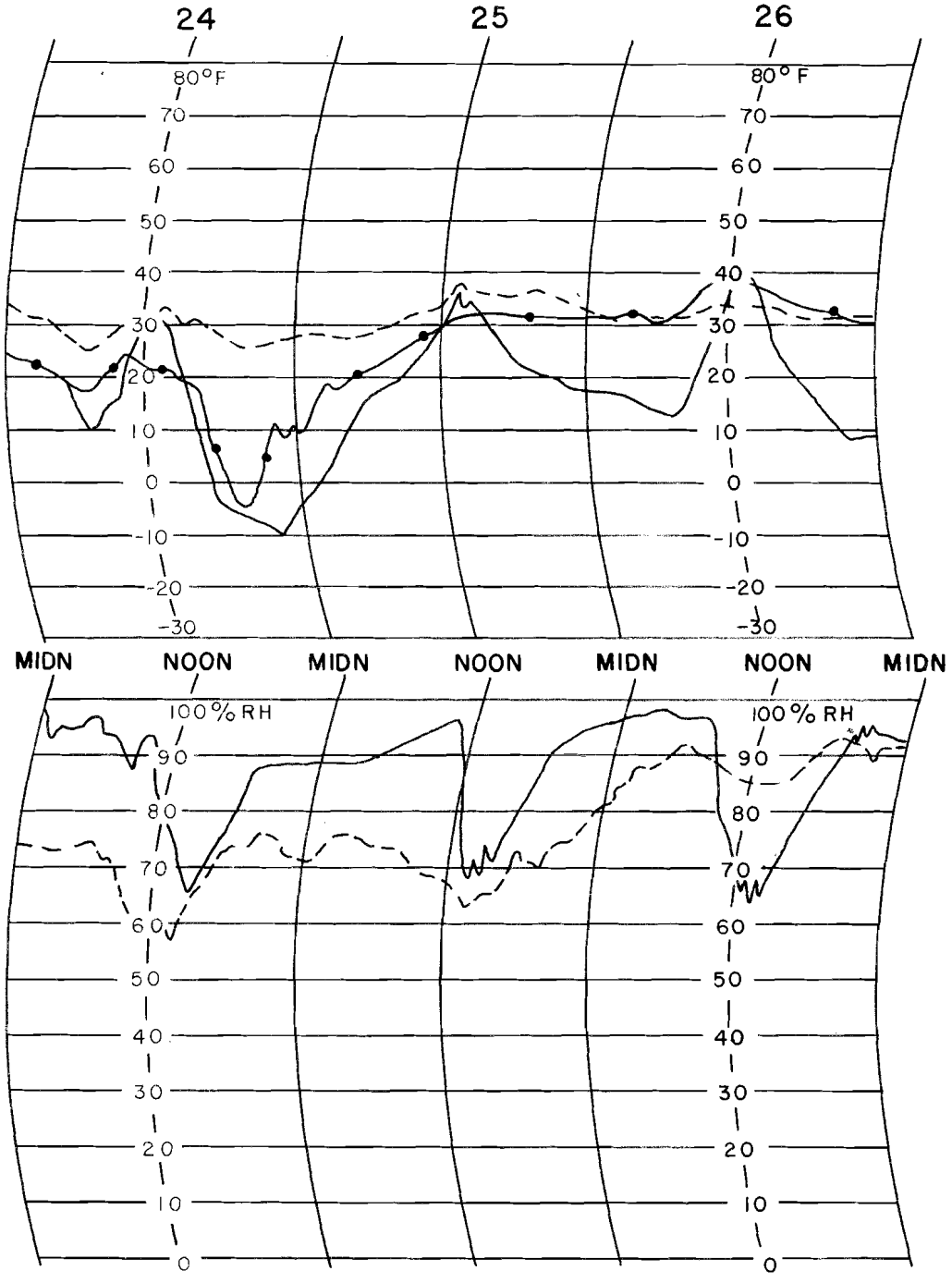
—— Crater Peak, 6400'

and skies had cleared except over the high mountains at the northeastern end of the profile as warmer, drier air moved in. Temperature rose to 78°, and relative humidity dropped to only 27% at Wawawai in the Snake River Canyon. Crater Peak slowly warmed to 42°, while Bald Mountain, with more sunshine, reached 55°. Thus lapse rates remained extremely steep at the northeastern end of the profile. However, even Crater Peak was enveloped in drier air by the afternoon of the 4th, and during the following night the Peak was experiencing the lowest relative humidities anywhere along the profile. Midnight relative humidity on Crater Peak was only 45%, compared with 75% at Wawawai in the Snake River Canyon. By the morning of October 5th, winds were again from the west, and the flow of moist air from the Pacific Ocean had resumed. Relative Humidity again rose to 100% as clouds returned to the mountains, while Wawawai reassumed the role of being the driest site along the profile with relative humidity falling to only 41%. The temperature dropped back to the freezing point on Crater Peak by late afternoon, after clouds had again enveloped the Peak, while Wawawai warmed to 68° in the sunshine. Lapse rate was again a very steep 6° per 1000 feet along the profile.

A Winter Cold Snap - Figure 17 depicts conditions at three bottomland sites along the profile at the time of one of the few winter cold snaps to occur during the period of the present study. There was no snow on the ground at Wawawai in the bottom of the Snake River Canyon at the time of these traces, but a 7-inch snowfall had occurred in the Palouse, including Potlatch Valley Flat, on the preceding day, January 23rd. At Purdue Creek Flat the snow was 32 inches deep from this and previous

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

JAN. 24-26, 1966



– – – Wawawai, Snake River Canyon 675'
—•— Potlatch Valley Flat, 2510'
—— Purdue Creek Flat, 2880'

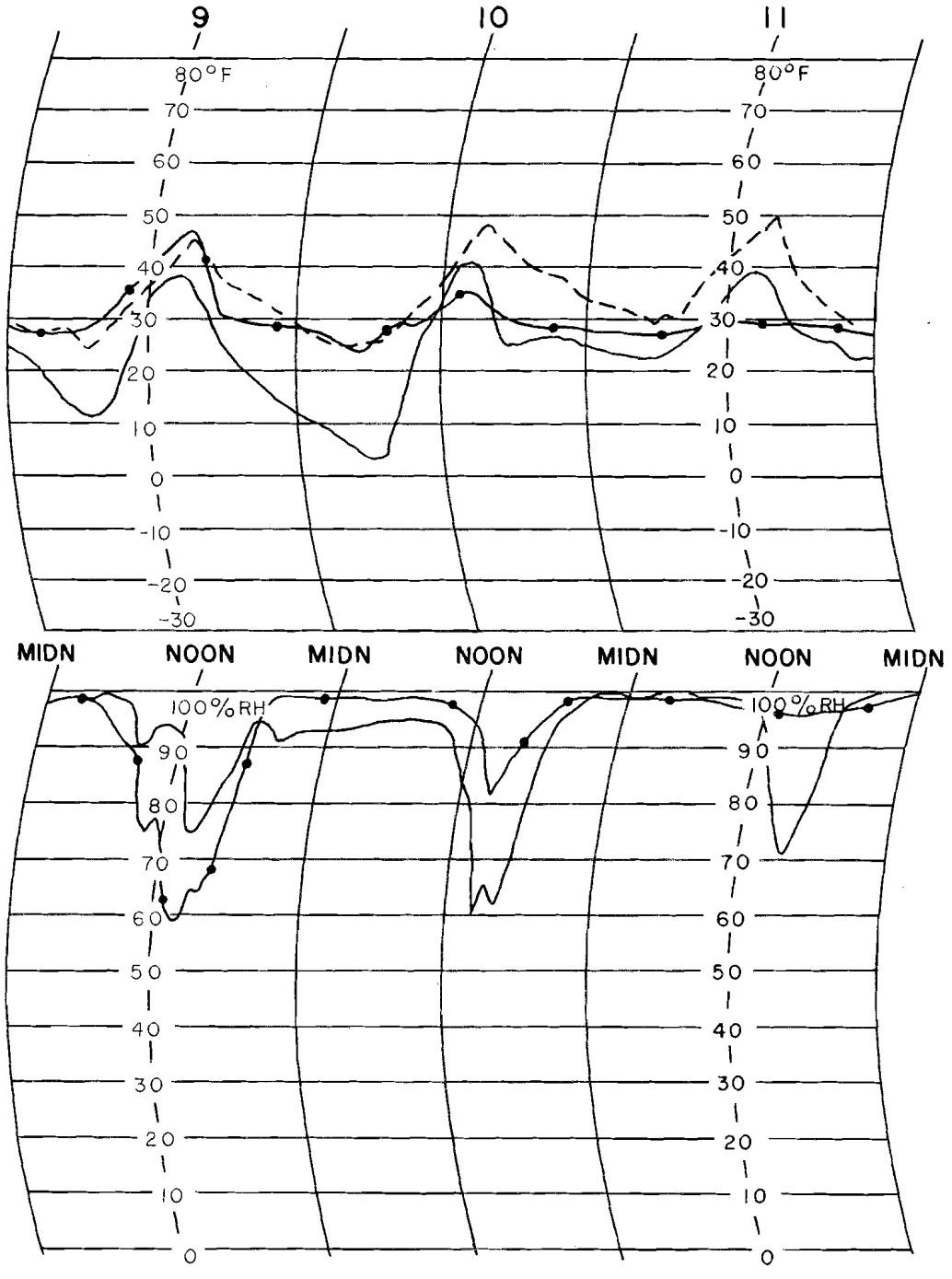
snowfalls.

During the afternoon and evening of January 23, 1966 the skies temporarily cleared as a surge of continental arctic air briefly invaded the Palouse from the north. However, it seemed to barely enter the Snake River Canyon at Wawawai where the temperature never dropped below 25°. By midnight the skies had once again clouded over and outgoing radiation had eased to such an extent that the temperature had risen 16 degrees from an early evening minimum of -6° at Potlatch Valley Flat. By the morning of the 25th, milder maritime polar air was moving in from the west, and by noon on the 26th the temperature had risen to 40° in the Palouse. Even as far back into the mountains as Purdue Creek Flat it was 38°. It will be noted, however, that the nights remained much colder at Purdue Creek Flat. In fact, the minimum of 6° which occurred there on the morning of January 27th was 24° below the minimum at Potlatch Valley Flat. It also will be noted that by noon of the 26th a temperature inversion had developed in the Snake River Canyon as somewhat cooler air remained there throughout the day. The highest temperature at Wawawai was only 34° on the 26th. Sometimes these daytime winter inversions become very pronouced, as will be seen in the next section (Figure 18).

Daytime Temperature Inversions of Winter - Figure 18 depicts a condition that develops a number of times each winter, most often in November, December, and January, but occasionally, as in this case, in February as well. Referred to is the daytime temperature inversion, usually accompanied by dense radiation fog below the inversion. Often the top of the inversion is at the level of the rim overlooking the Snake River

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

FEB. 9-11, 1968



--- Emida Ridge, 3700'

—●— South Fork Palouse Valley Flat, 2540'

—— Purdue Creek Valley Flat, 2880'

81

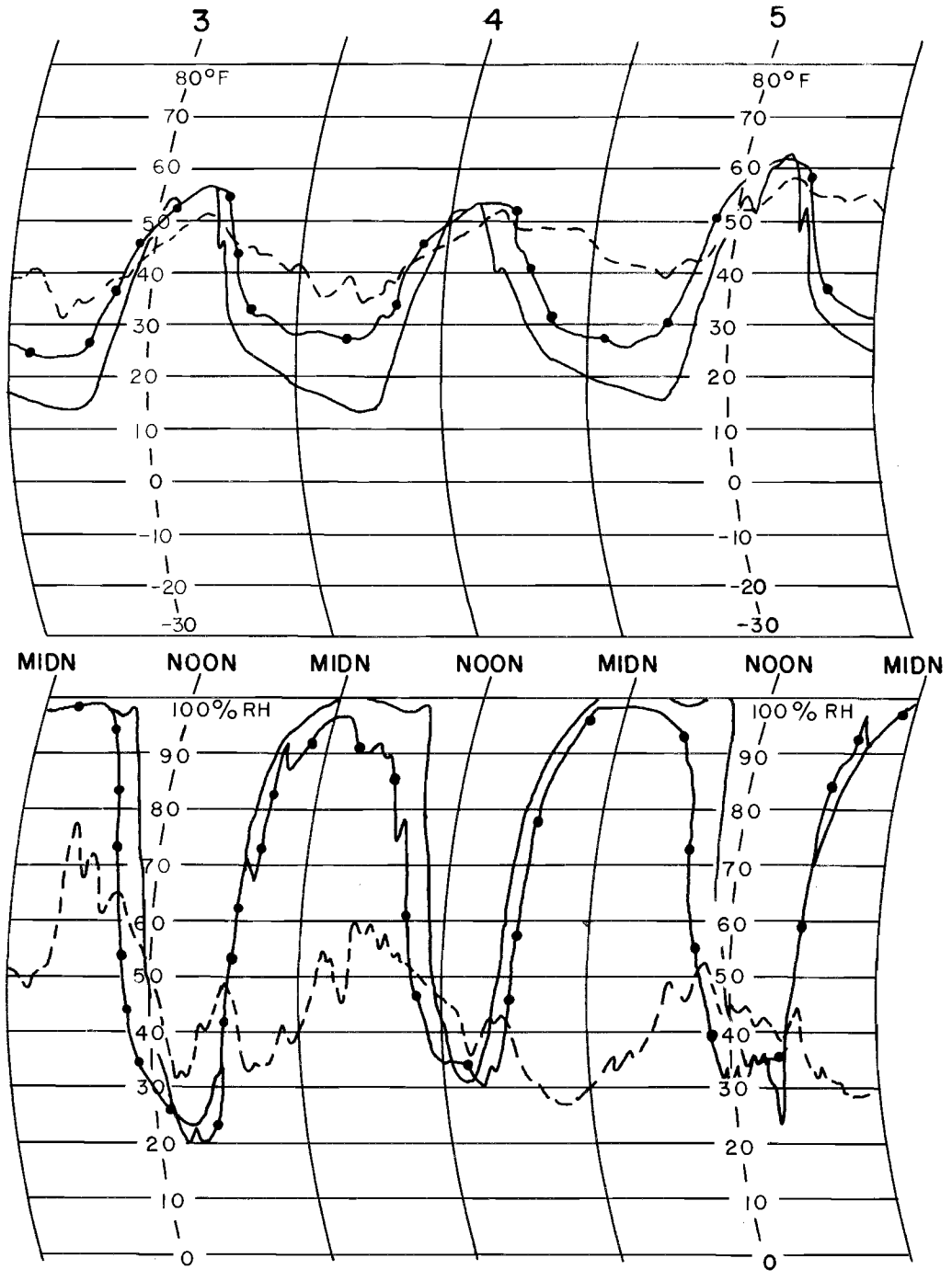
Canyon, about 2500 feet altitude. Under these circumstances, the Palouse is in sunshine with mild daytime temperatures, while the canyon is filled with fog and midday temperatures are about ten degrees colder than on the Palouse.

During the period February 7 through 11, 1968 a condition of the type described above developed, except that much of the time the top of the inversion was at about the 3500-foot level, thus placing most of the Palouse in the cold fog. Occasionally, as on the afternoon of February 9th, the fog would break here and there on the Palouse and the bright sunshine would then induce a rather rapid temperature rise of about 15°, as shown for the South Fork Palouse Valley Flat near Moscow in Figure 18. Also conspicuous is the drop in relative humidity to just below 60% at this time. In the late afternoon, however, the fog moved back in, the temperature dropped abruptly from 47° to 30°, and the relative humidity returned to 100%. On February 11 the fog did not break at all in the vicinity of Moscow, and the temperature never rose above 30° at the South Fork Palouse Valley Flat. However, Emida Ridge, at elevation 3700 feet, was in the warm sunshine above the inversion throughout the day and the temperature rose to 50° by afternoon. Relative humidity is known to have been very low, although unfortunately a hygrograph was not in service on the ridge at the time. Next day, when the inversion was broken by a freshening northeast wind, relative humidities dropped to between 25% and 35% at the lower stations which had been in the fog previously.

Late Winter Warm Period - Figure 19 portrays conditions during a late winter warm period of the kind that quite often occurs in February or March.

TEMPERATURE AND
RELATIVE HUMIDITY
TRACES

MAR. 3-5, 1965



--- Viola Hill, 3150'

—●— Potlatch Valley Flat, 2510'

—— 1 mile S. of Giant White Pine Valley Flat, 2760'

In this case the dates are March 3 to 5, 1965. Viola Hill on this chart represents conditions above the strong nocturnal temperature inversion which inevitably develops during these periods of clear, dry weather. Potlatch Valley Flat is representative of a bottomland station without snowcover, and the valley flat one mile south of the Giant White Pine represents conditions on a bottomland site where several inches of snow remain. Normally, minimum temperatures on this valley flat near the Giant White Pine are only 3° or 4° colder than at Potlatch Valley Flat. However, in the case under study, minimum temperatures were as much as 14° lower on the snowcovered flat or bottomland near the Giant White Pine than on the snowfree Potlatch Valley Flat. Another interesting aspect of the temperature traces at these two loctions was the delayed morning warmup and earlier afternoon cooling at the snowcovered site as compared with the snowfree site. There was, however, virtually no difference in the maximum temperature at mid-afternoon at the two sites. Nighttime relative humidities reached 100% at the snowcovered site and a little less than 100% at the snowfree site. Afternoon minimum relative humidities were about the same at the two sites.

The Viola Hill temperature pattern was quite similar to that previously shown for the summer heat waves. However, on the evenings of both March 4th and 5th, there was particularly pronounced drop in the relative humidity, to levels as much as 10% below the afternoon minimum. Associated with this was the exceptionally small evening drop in temperature, amounting to only 4° on these dates. In the meantime there was a very abrupt decline in temperature on the bottomlands. As a result,

the evening temperature inversion between Viola Hill and the Giant White Pine valley flat approached 30° on these evenings.

Records at 5½ Feet Vs. 6 Inches Above Ground Level - Figure 20 show simultaneous temperature and relative humidity traces made at normal head level (5½ feet) and at 6 inches above the ground. In the latter case, only about one-half inch of air space was left between the floor of the shelter and the ground surface, but the temperature and humidity elements of the hygrothermograph inside the shelter were of necessity about six inches above the ground surface.

In this record, the shelters were situated at the regular Emida Ridge station site, which is about 4 feet below and 20 feet northwest of the narrow crest of the ridge, so placed in order to be well clear of the trees which grow to a height of at least 50 feet on the south slope of the ridge. This site was selected for the ground temperature and humidity observations because it had been noticed that during the evening hours there was a perceptible flow of cool air adjacent to the ground down this northwest slope. The instrument 6 inches above the ground was, therefore, directly in the path of this air flow. It will be observed that the temperatures at the 6-inch level were as much as 10° lower than those at the 5½-foot level at certain times during the evening hours. Usual difference between the minima at the two levels was, however, closer to 5°.

No other site tested showed nearly as much spread in evening and nighttime temperatures between the 6-inch and 5½-foot levels as that on Emida Ridge. As a matter of fact, when a shelter was placed on the

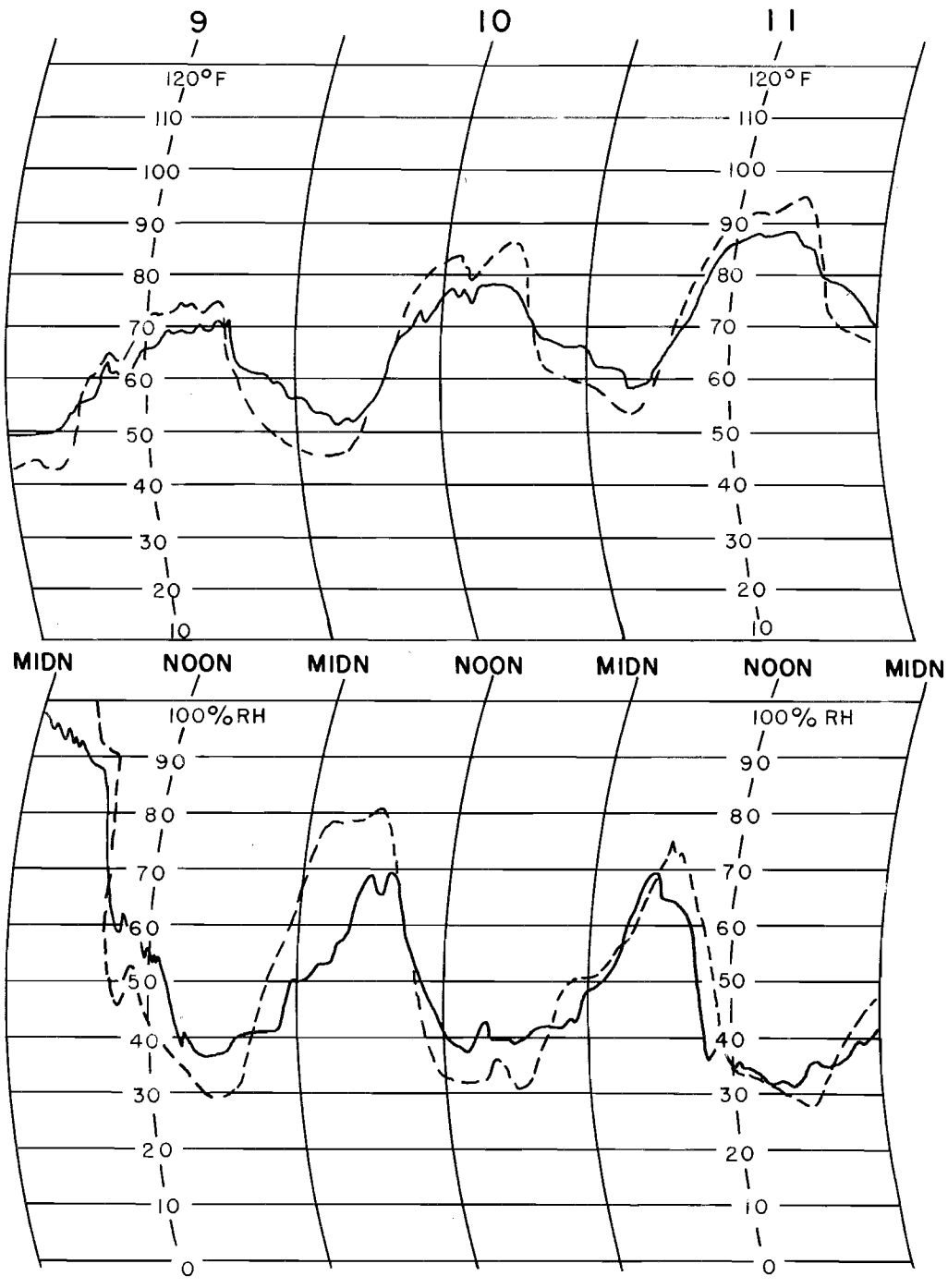
TEMPERATURE AND RELATIVE HUMIDITY TRACES

JULY 9-11, 1967

EMIDA RIDGE
ELEV. 3700'

--- 6 inches above the ground on NW slope just below the ridge crest

—— 5 1/2 feet above the ground in the same place



ground in the subalpine fir meadow, nocturnal temperatures were found to be virtually identical to those recorded in the adjacent shelter at the normal 5½-foot level. Temperatures seldom deviated more than a degree either way. The same was found to be true in a similar test on the hilltop near the subalpine fir meadow - there was no significant difference in the nighttime temperatures at the two levels. On the other hand, temperatures on sunny days were characteristically found to be 4 to 6 degrees higher at the 6-inch levels at all sites.

On Figure 20, relative humidities show the expected, although somewhat varying, deviation at the 6-inch level, frequently being about 6% to 8% lower during the heat of the afternoon and appreciably higher at night than at the 5½-foot level. It will be noticed that on the night of July 9th to 10th, there was a difference as great as 25% between the two levels shortly after midnight, with the cooler 6-inch level of course having the higher relative humidity.

VII. Relative Humidity Patterns

Seasonal Variations - A pronounced seasonal variation, generally paralleling that in cloudiness and precipitation, occurs in the mean monthly relative humidity along the profile. The period of records, which does not exceed three years at the majority of the stations, is insufficient to provide accurate means, but some indications can be given. Relative humidity is generally at its peak in December and January, when the mean varies from between 75% and 80% in the Snake River Canyon to probably close to 95% on the mountain summits, which are enveloped in cloud much

of the time during those months. July and August are the driest months, and the short period of summer records shows greater variations from year to year in average relative humidities than do the winter records. However, it appears that the normal means may vary from somewhere in the vicinity of 40% in the canyons to around 60% on the higher mountains.

Winter Conditions - More significant, in many respects, are the mean daily maximum and minimum relative humidities. In December and January the night maxima vary from about 90% in the canyons to between 95% and 100% over most of the Palouse and mountain areas, while afternoon minima appear to average near 60% in the canyons, and about 70% to 75% in the Palouse Hills, and over 90% on the mountains. As pointed out in the preceding section on diurnal temperature and humidity patterns of this report, there are occasions in the late fall and winter months when the normal altitudinal increase in relative humidities is absent. This is true when dense radiation fogs occupy the canyons, and sometimes the Palouse as well, throughout the day. Above these fogs skies are clear and the mountains are bathed in bright sunshine. Relative humidities above the fog may be well below 50% at midday, and temperatures 10° to even 20° higher than in the fog. This condition may persist for several days.

Summer Conditions - In summer there are wide variations in the nighttime relative humidities, depending upon a particular site's location with respect to the strongly developed temperature inversions which are so prevalent at that season. On the valley flats among the Palouse Hills average maximum relative humidities of the early morning vary from

between 90% and 95% in the heart of the agricultural Palouse to near 100% from the eastern edge of agriculture on into the mountain valleys, even during the driest months of July and August. Patches of radiation fog are not uncommon in the mountain valleys during the summer. These fog banks may become quite extensive after the occurrence of showers, particularly toward the end of the summer. By September, morning fogs become increasingly extensive in northern Idaho valleys and may linger until mid-morning in some places. By the last of October it is likely to be noon before radiation fog completely vanishes, and from November on through the winter it frequently persists all day. This fog also becomes deeper as the autumn advances.

On hilltops and even in the canyons, nocturnal relative humidities of summer are much lower than in the bottomlands of the Palouse and mountain valleys to the east. Average early morning maximum in the Snake River Canyon at Wawawai is about 75% in the driest months, dropping to about 55% in the thermal belt (but varying from below 50% to above 60% in individual years). On hilltops in the Palouse, the average maximum is about 10% higher than in the canyon thermal belt, and on the mountaintops there is a gain of perhaps another 10%, or back to the 75% of the canyon bottom.

Occasionally on summer nights, usually during the hottest weather, the relative humidity remains below 30% on the hilltops in the Palouse. From time to time in the late evening a relative humidity of only 20% has been recorded on Viola Hill at the same time 100% was being registered on the colder valley flats to the east.

Afternoon minimum relative humidities are undoubtedly of greatest

significance in their impacts upon plants and human activities, and these minima are low throughout the length of the profile during July, August, and sometimes September. The normal afternoon minimum during the summer season appears to vary from near 20% in the canyons to about 30% in the Palouse Hills (both on hilltops and valley flats), about 40% at 5,000 feet altitude in the mountains, and perhaps 45% above 6,000 feet. At certain times, considerably lower readings occur. August 1967 brought the lowest relative humidities in a number of years and averaged close to the all-time minimum. At Lewiston Airport (U.S. Weather Bureau office, elevation 1416 feet), the average daily minimum relative humidity during the month was only 12%, and a low of 7% occurred. On only two days during the month was the minimum above 20%. The hair elements in the hygrothermographs used along the profile lost much of their reliability during this exceptionally dry month, but it is estimated that the mean daily minimum relative humidity in the Palouse Hills was about 22%, on Bald Mountain (5330 feet) a little under 30%, and on Crater Peak (6400 feet) a little over 30%. Nighttime relative humidities remained very low during most of the month on the hilltops, ridges, and mountains, with average nighttime maxima varying from about 40% on Viola Hill to around 50% on the mountains.

Foehn Effects - East-southeast winds are associated with many of the lowest relative humidities throughout the profile except on the higher mountains where northwest winds are believed to prevail at such times. These winds are most persistent in the summer months but usually accompany warm, dry weather in spring and fall as well. However, in winter,

east-southeast winds, although still frequent, only occasionally bring low relative humidities. If the east-southeast wind becomes much stronger than usual as a deep low pressure system approaches the North Pacific Coast, then the relative humidity may be expected to drop far below its usual winter afternoon level of around 70%, descending to perhaps 35% on the Palouse and 25% in the Snake River Canyon, even if the skies are overcast. The temperature often rises to unusually high levels for the season at such times, perhaps 50° on the Palouse and 60° to 65° in the canyon bottoms. This warm, dry air is usually abruptly replaced within a few hours by a chilly, moist maritime polar air mass from the Pacific Ocean as the cold front passes through bringing rain, which may change to snow after a time, and strong to gale force west-southwest winds.

If the weather is clear at the time of these foehn-like winds, as is frequently the case in late winter and spring (from February onward), or until about the end of October in the fall, the warm weather may last two or three days. However, in these cases, the warm wind ceases abruptly in the late afternoon on the valley flats, but may continue through most of the night on the hilltops. Under such circumstances, very strong temperature inversions develop, which may persist during the daylight hours in the mountain valleys when the ground is snowcovered. On occasion, stagnant banks of ground fog only a few feet deep have been observed in the meadows near the Giant White Pine in mid-afternoon with the temperature still below freezing and the previous night's hoarfrost deposit remaining on exposed objects. In the meantime, a fresh east-southeast wind, with temperatures well above 40° and relative humidities below 50%, can be sweeping across the nearby hilltops and throughout the

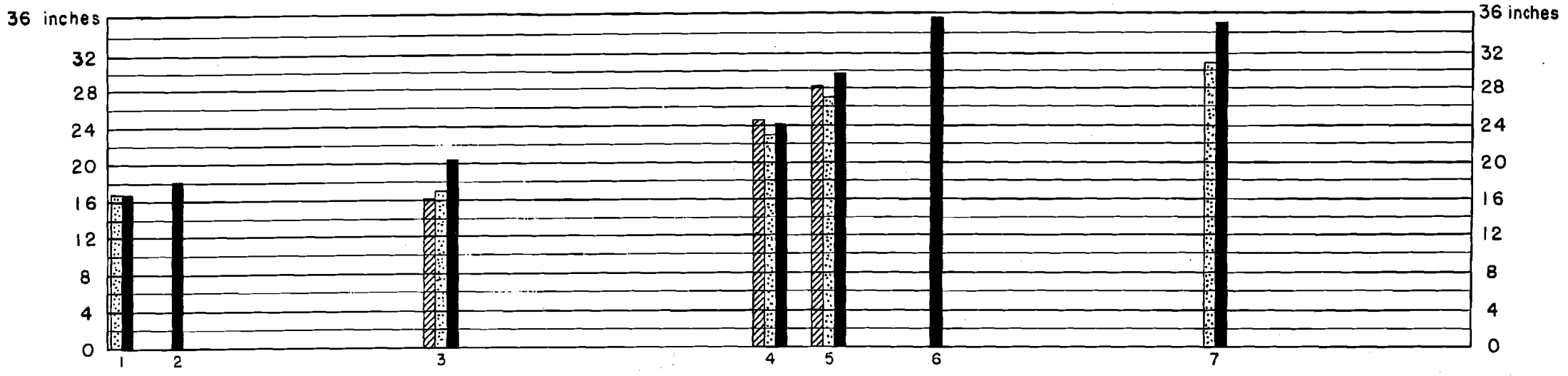
open country a few miles to the west. When these east-southeast foehn winds reach their fullest development in the late winter, the valley flats are swept clear of their cold air during the daytime, temperatures rise to the vicinity of 60°, and relative humidities fall to around 25%. During these foehn wind breakthroughs, valley flats near the mountains such as those at Purdue Creek and Harvard, may experience relative humidities as much as 15% to 20% lower than at stations farther west along the profile, including even Wawawai in the bottom of the Snake River Canyon. Even when these foehn winds do occur during the day, night on the valley flat comes on cold with temperatures well below freezing and relative humidities soaring to 99% or 100%.

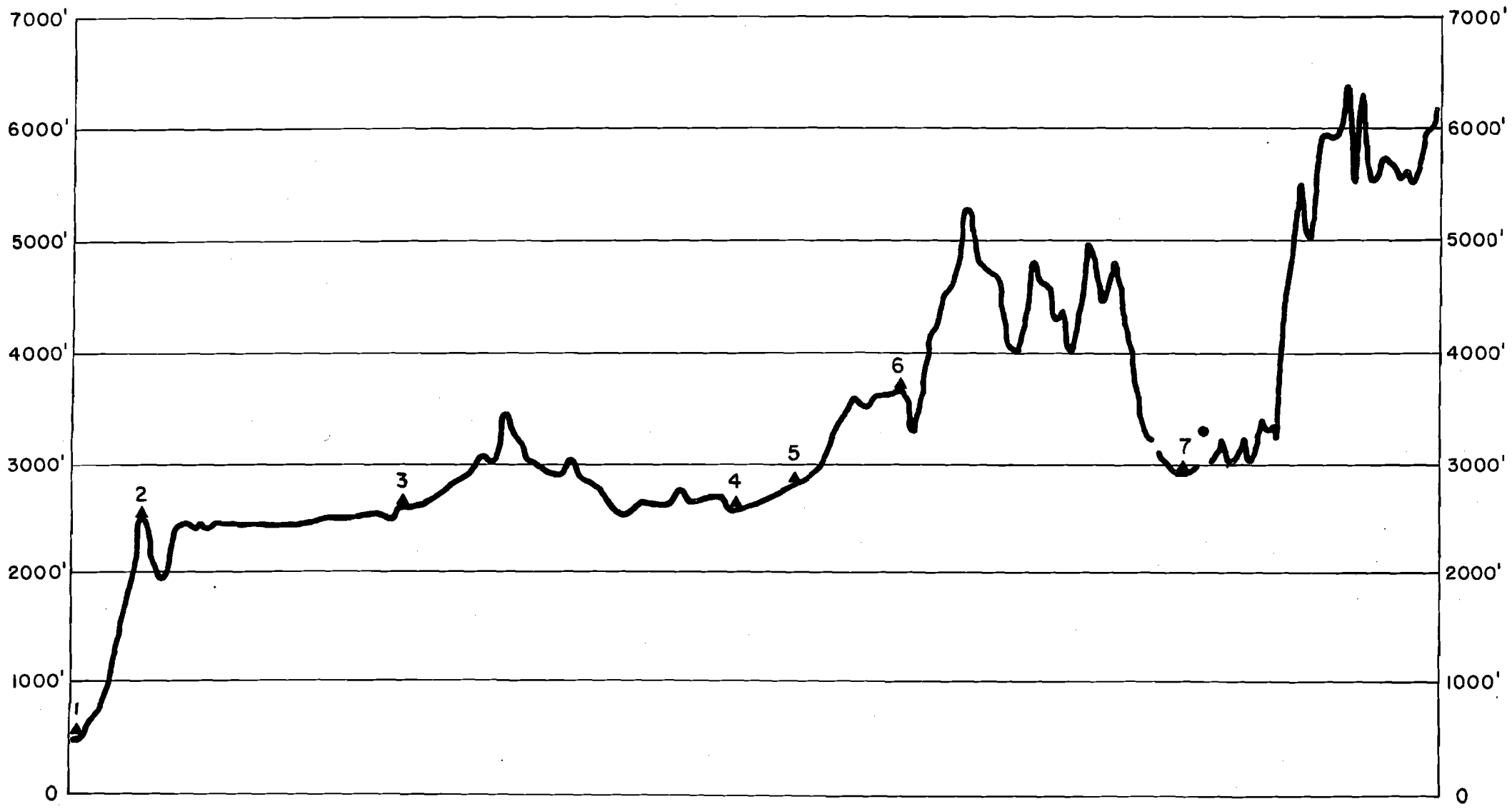
VIII. Precipitation Patterns

Annual Amounts - Record Availibility. - Figure 21 presents the available annual precipitation totals for stations along the profile during the years 1965, 1966, and 1967. Wind interference with the catch made it impossible to secure a complete record during 1966 for the Rim above Wawawai, while snow drifting at the gauge site on Emida Ridge prevented reliable records on numerous occasions during 1965 and 1966. Even where records for a full year are indicated, many estimates of precipitation were necessary for Wawawai and the Rim above Wawawai because of tampering with the gauge at the former location, and wind interference at the latter. Totals for 1965 are not available for Wawawai, Wawawai Rim, or Purdue Creek Flat because records were not started at those sites until April of that year. An effort was made to maintain records for

fig 21

TOTAL ANNUAL PRECIPITATION 1965, 1966, 1967





SNAKE RIVER CANYON, WASH.–
CLEARWATER MTNS., IDAHO

1 Wawawai, Snake River Canyon 675'

2 Rim above Wawawai 2500'

3 Moscow, University of Idaho 2610'

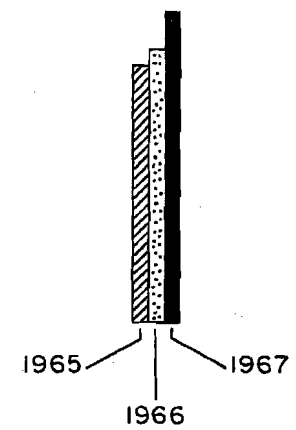
4 Harvard Valley Flat 2590'

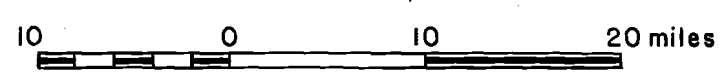
5 1 mile S. of Giant White Pine 2760'

6 Emida Ridge 3700'

7 Purdue Creek Flat 2880'

● Off direct line of profile





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a complete year on Bald Mountain, but problems with gauge operation during snowfalls made this impossible to accomplish, even though monthly visits were undertaken to the mountaintop throughout the 1966-67 season. No winter visits were possible on the higher mountains at the northeastern end of the profile.

Annual Amounts - Analysis - The available records in Figure 21 indicate a gradual but steady increase in annual precipitation between Wawawai and Harvard Valley Flat amounting to about one inch for each six miles during both 1966 and 1967. The air line distance between these two stations is 38 miles and the precipitation increased from 17 inches at Wawawai to 23 inches in 1966 and 24 inches in 1967 at Harvard Valley Flat. (The distance of 50 miles which is indicated between these two places in Figure 21 results from the curving character of the profile; reference to Figure 2, the relief map of the profile area, will clarify the matter).

In the next 10 air line miles between Harvard Valley Flat and Emida Ridge, precipitation increased at the rate of slightly more than one inch per mile, or from 24 to 36 inches, during 1967. Other studies suggest that if records were available for the summit of Bald Mountain, five miles farther along the profile, a further annual increase of about ten inches would occur, or two inches per mile.

East of Bald Mountain, there is a decline of altitude to just below 3,000 feet along most of the curving length of the valley which contains the head-waters of the St. Maries River to the north, and the Potlatch River to the south. For example, Purdue Creek Flat is at an elevation of 2880 feet. Here normal annual precipitation drops back

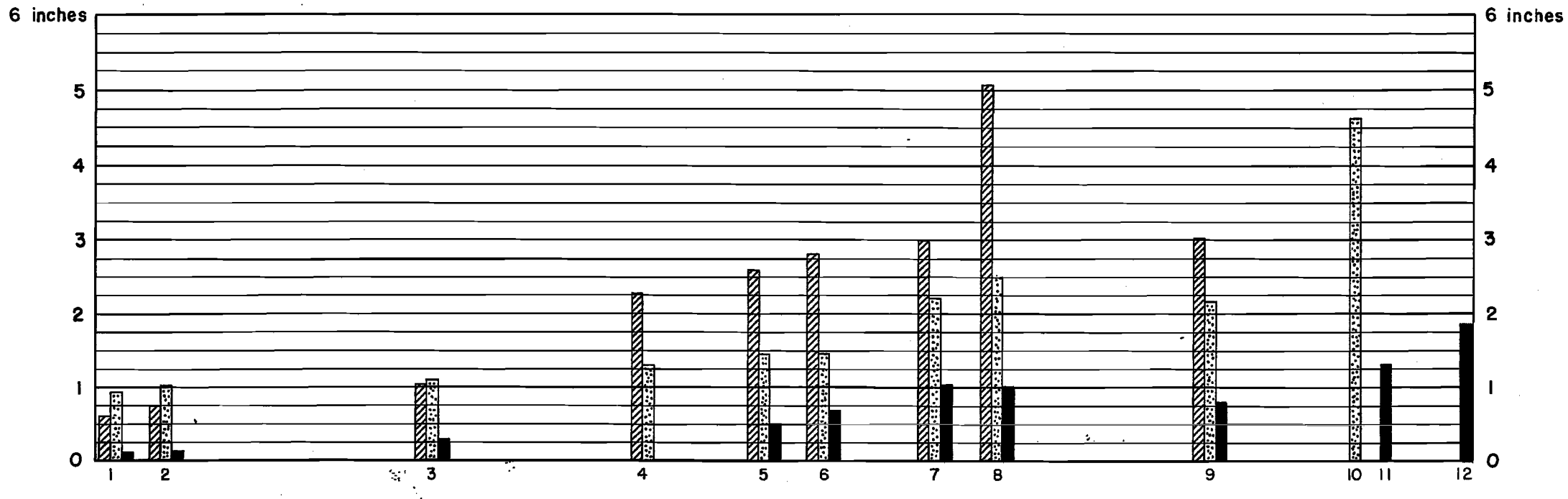
to approximately the amount received on Emida Ridge, or about 35 inches. East of this valley, there is a pronounced increase in precipitation in the direction of Freezeout Mountain and Crater Peak, as is suggested by the data appearing in Figure 22. It has been estimated in other surveys that mean annual precipitation increases from about 35 inches at Purdue Creek Flat and Clarkia to at least 60 inches on Freezeout Mountain and perhaps 65 inches on Crater Peak. A further increase to about 70 inches may occur a few miles east and northeast of Crater Peak, if snow survey data for Lost Lake provide a reasonable indication of the situation. The rate of precipitation increase between Clarkia and the mountain summits to the east is in the order of two inches per mile, or about the same as that between Emida Ridge and the summit of Bald Mountain.

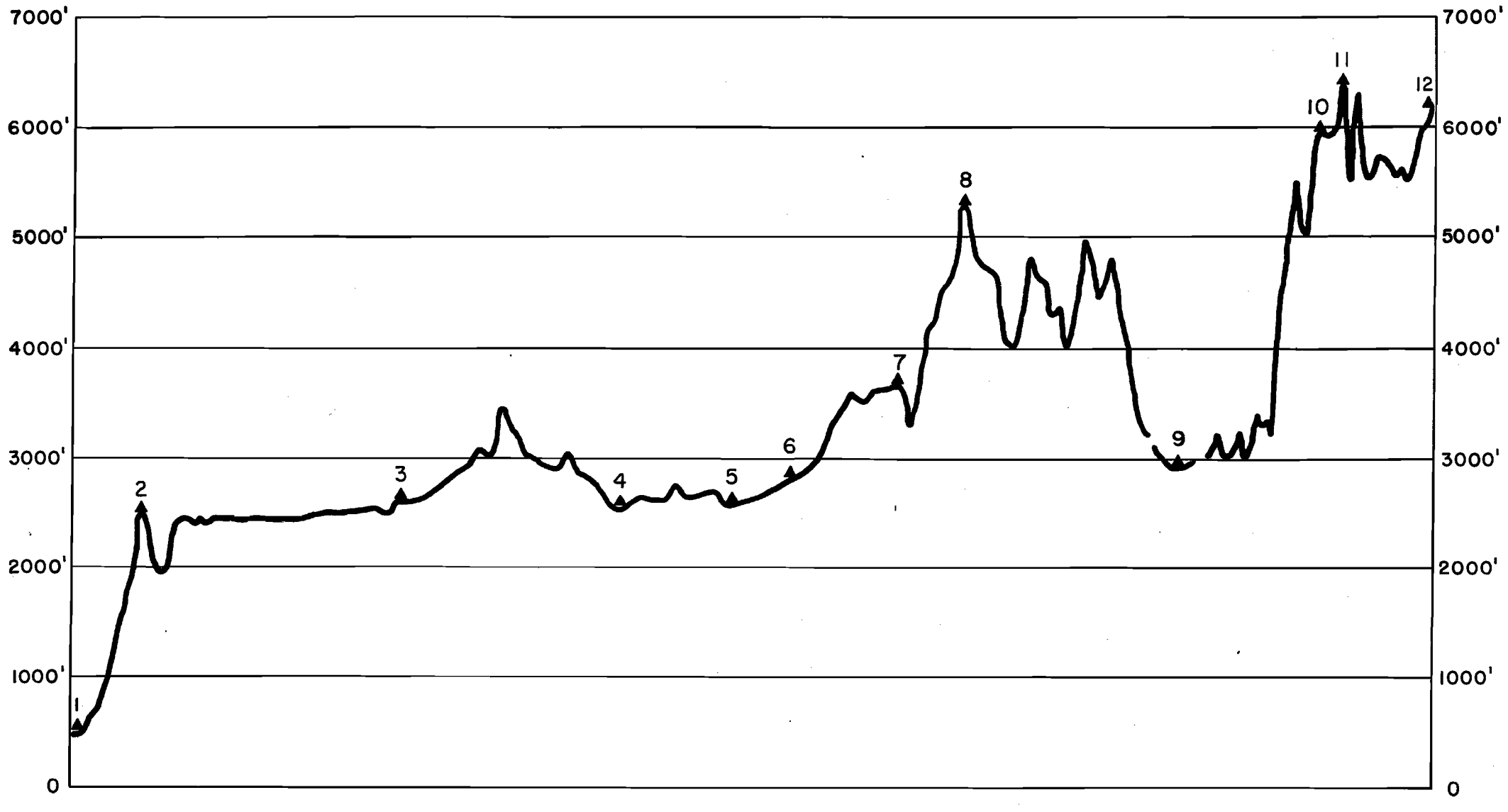
Amounts During Sample Months - Figure 22 reveals the distribution of precipitation along the profile during three different summer and fall months for which precipitation records are available at the mountain summit stations, in addition to the other stations at lower altitudes which are accessible throughout the year.

It will be seen that the relative accumulation of precipitation at different stations varies considerably during individual months. In August 1965, which was one of the wettest Augusts on record in the mountains of northern Idaho, eight times as much rain was measured on Bald Mountain, with 5.15 inches, as at Wawawai in the Snake River Canyon with only 0.66 inch. By contrast, in October 1966 a little less than three times as much precipitation was recorded on Bald Mountain, with 2.48 inches, as at Wawawai with 0.95 inch, although five times as much

Fig 22

TOTAL MONTHLY PRECIPITATION FOR THREE SAMPLE MONTHS





SNAKE RIVER CANYON, WASH.–
CLEARWATER MTNS., IDAHO

1 Wawawai, Snake River Canyon 675'

2 Rim above Wawawai 2500'

3 Moscow, University of Idaho 2610'

4 Potlatch Valley Flat 2510'

5 Harvard Valley Flat 2590'

6 1 mile S. of Giant White Pine 2760'

7 Emida Ridge 3700'

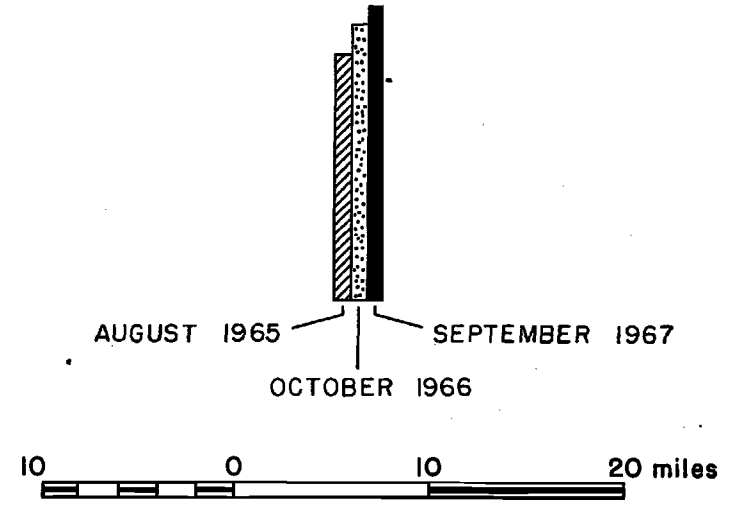
8 Bald Mtn. Lookout 5330'

9 Purdue Creek Flat 2880'

10 Freezeout Mountain circa 5950'

11 Crater Peak circa 6400'

12 Moses Butte circa 6150'



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(4.68 inches) did accumulate on the higher Freezeout Mountain farther east, where no record had been kept in August 1965.

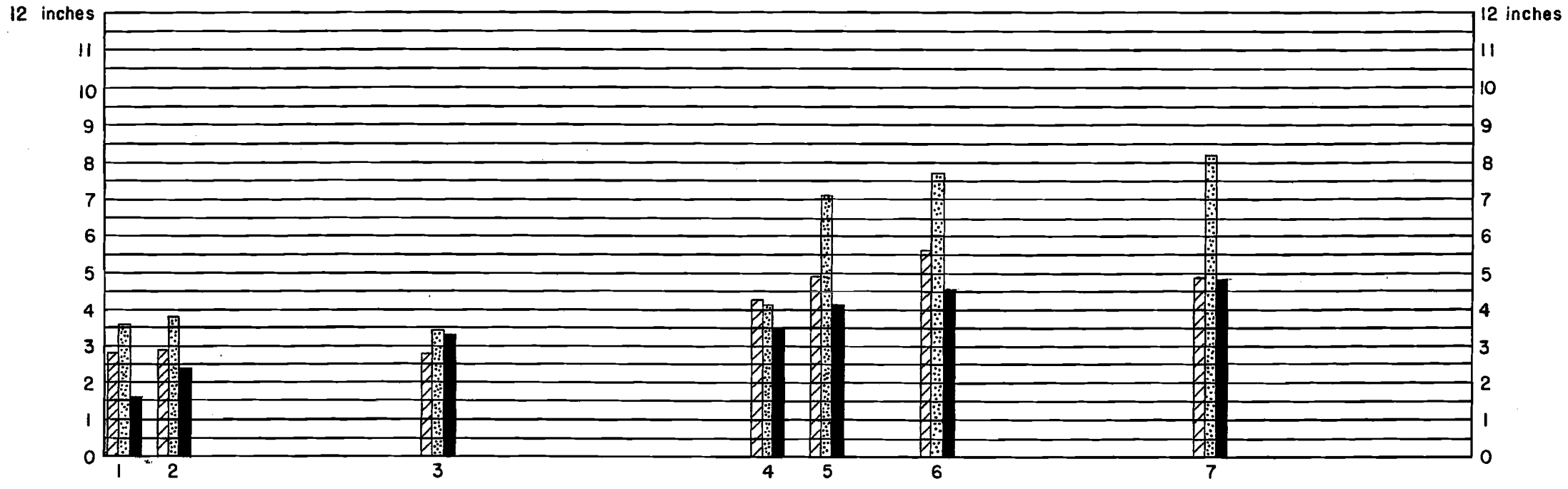
During August 1965, when Wawawai was driest relative to Bald Mountain, several of the heavier rains occurred when upper air winds were from a southeasterly direction, whereas in October 1966 the normal westerlies were present during most of the precipitetation occurrences. With a southeasterly flow, Wawawai, being west and northwest of the mountains, is in a rain shadow position, while during a westerly flow it is on the windward slope. Consequently, it seems reasonable that Wawawai should have relatively heavier precipitation, as compared with the mountain summits, during a westerly flow than during a southeasterly flow.

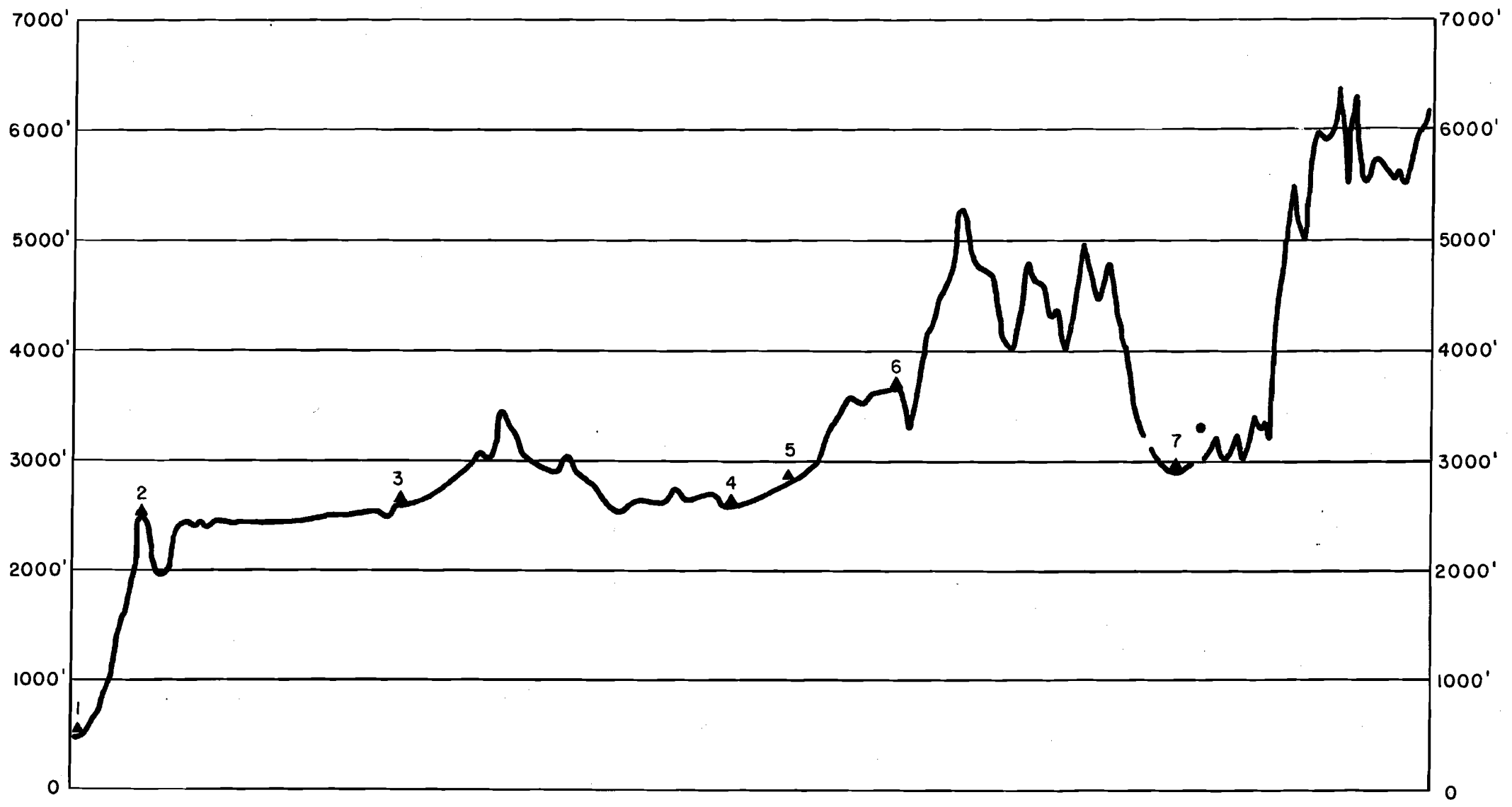
During September 1967, the third month charted in Figure 22, the increase in precipitation along the profile was from only 0.14 inch at Wawawai to 1.02 inches on Bald Mountain, 1.36 inches at Crater Peak, and 1.87 inches at Moses Butte on the extreme northeastern end of the profile. This is the only month for which a record is available at Moses Butte; consequently, it is impossible to speculate on whether it should be expected to normally receive more precipitation than Crater Peak.

Finally, in Figure 23 are charted the precipitation totals for three of the wetter winter months for which records are available at all key stations along the profile, except those on the mountain summits. During two of these months, December 1966 and January 1967, precipitation accumulations at Emida Ridge were a little over twice as great on Emida Ridge as at Wawawai, close to the relationship shown in

fig 23

TOTAL PRECIPITATION DURING THREE WINTER MONTHS





SNAKE RIVER CANYON, WASH.- CLEARWATER MTNS., IDAHO

1 Wawawai, Snake River Canyon 675'

2 Rim above Wawawai 2500'

3 Moscow, University of Idaho 2610'

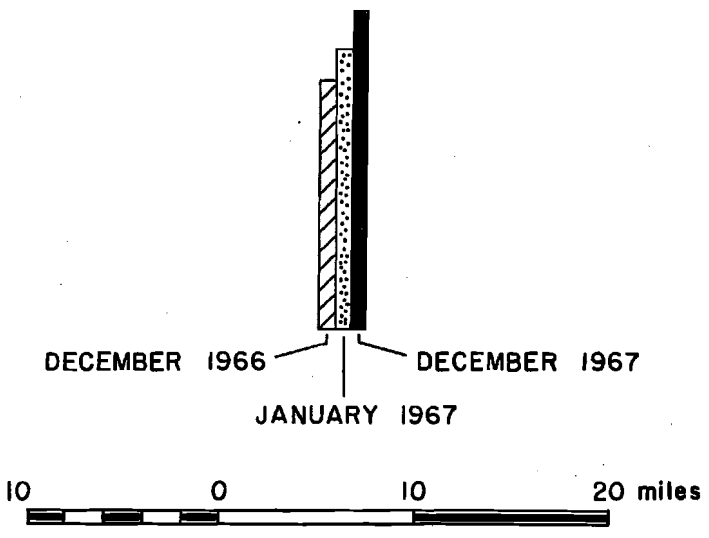
4 Harvard Valley Flat 2510'

5 One mile S. of Giant White Pine 2760'

6 Emida Ridge 3700'

7 Purdue Creek flat 2880'

● Off direct line of profile



wood/chirumblo

the annual totals in Figure 21. During the third month, December 1967, more than three times as much precipitation fell on Emida Ridge as at Wawawai. However, this difference may lack significance, for it will be noted that during December 1967 the Wawawai precipitation total was nearly an inch lower than that registered on the nearby Rim. Usually these two stations record very similar amounts of precipitation; consequently, the significantly lower figure for Wawawai is probably an anomaly.

Snow Accumulations - Snow depths were measured at stations along the profile each time they were visited during the winters of 1965-66, 1966-67, and 1967-68. However, only during the winter of 1966-67 were snow depths measured all the way to the summit of Bald Mountain (5330 feet). In the other years, Emida Ridge (3700 feet) and Purdue Creek Flat (2880 feet) represented the farthest penetrations into the mountains that could be arranged.

The winter of 1966-67 was of particular interest, because snow accumulations in the high country were greater than in either of the other two winters, while in the canyons it was the winter of least snow. Wawawai experienced only a trace of snow during the entire 1966-67 season. (The normal winter snowfall of only 6 inches at Wawawai is the least anywhere in the Pacific Northwest, except on immediate coast.) By contrast, the average snow depth on Bald Mountain reached 85 inches with a water content of 33 inches by April 1st, and was still within two or three inches of this depth as late as May 1st. At Lost Lake (elev. c. 6,000 feet) 5 miles northeast of Crater Peak, near the

northeastern end of the profile, is a snow course visited monthly between December 1st and June 1st by the Soil Conservation Service. Snow depth reached 169 inches, with a water content of 67.4 inches, at this place by April 1st, each figure about twice that for Bald Mountain. At other stations along the profile, greatest snow depths during the 1966-67 winter were as follows: Emida Ridge, 42 inches on March 18; Purdue Creek Flat, 18 inches on the same date; and one mile south of the Giant White Pine, 8 inches on March 11. Other maximum depths in the Palouse Hills were between 5 and 8 inches. Maximum snow depths on the mountains above the level of Emida Ridge were near or perhaps slightly above normal, while those below the altitude of Emida Ridge held considerably below normal throughout the 1966-67 winter because of the unusually mild temperatures which averaged more than 5½° above normal during the December - February period at Moscow.

During both the winters of 1965-66 and 1967-68, total accumulation of snow was not as great at Lost Lake as in the 1966-67 winter just described. Maximum water contents measured were 53.6 inches on April 1, 1966 and 51.8 inches on April 1, 1968. No figures are available for Bald Mountain during either winter, but the winter of 1965-66 was characterized by greater accumulations of snow than in 1966-67 at lower elevations along the profile while the winter of 1967-68 brought considerably less. Maximum depths at Emida Ridge, Purdue Creek Flat, and one mile south of the Giant White Pines were respectively as follows: 43, 25, and 19 inches in 1965-66; and 24, 18, and 6 inches in 1967-68.

Following is a summary of the approximate normal duration of the snow season at various stations along the profile, as nearly as can

be determined by several years of general observations:

Wawawai, Snake River Canyon: only two or three occasions on which snow accumulates on the ground during the winter, and even then melts within two or three days.

Moscow and Potlatch: snow covers the ground intermittently for two to four weeks at a time between late November and early March. Periodically during the winter, snow melts down to patches and then the ground may remain nearly bare for a week or two. Snow depth seldom exceeds ten inches. Snow somewhat more persistent and deeper at Genesee Flat.

Harvard Valley Flat: late November to mid-March (may melt off once in early December). Snow season slightly longer at subalpine fir meadow.

Giant White Pines: late November to late March in the open and to late April or even early May in the forest.

Emida Ridge: mid-November to mid-April

Purdue Creek Flat: late November to early April

Bald Mountain: early November to early June

Freezeout Mountain: late October to late June; drifts into July

Crater Mountain: mid-October to early July; drifts to mid-July

East of Crater Mountain: about October 10 to July 10; drifts to July 20

IX. How Much Do the Official Weather Bureau Records Tell Us?

There are six official U. S. Weather Bureau reporting stations in the vicinity of the profile. These are located at Lower Granite Dam, Washington, about two miles northwest of Wawawai; at the U.S. Agricultural Research Service's Conservation Farm two miles northwest of Pullman, Washington, and seven miles north of the Union Creek Flat station on the profile; at the University of Idaho's Experimental Farm two miles east of Moscow; at a private farm three miles north-northeast of Potlatch, Idaho; at the U.S. Forest Service Ranger Station, Clarkia, Idaho; and at the Terminal Building of the Lewiston, Idaho, Airport.

The Lower Granite Dam, Wash., station is in the bottom of the Snake River Canyon, at a site similar to that used at nearby Wawawai at the southwestern end of the profile. The Lower Granite Dam station is 620 feet above sea level, or 55 feet lower than the Wawawai site. The respective maximum and minimum temperatures average within a degree of each other at the two sites. Precipitation catches apparently will be very close, too. In fact, total precipitation at the two gauges differed by only 0.02 inch for the year 1966, Lower Granite Dam receiving 17.15 inches, and Wawawai 17.17 inches (Table 1). Individual months did vary up to nearly 0.80 inch. In 1967 there was a greater difference between the two stations, with 15.78 inches at Lower Granite Dam, and 17.17 inches at Wawawai. No doubt such deviations are to be expected, even at sites where long term precipitation accumulations will be very nearly the same. In summary, it seems safe to say that the Weather Bureau's official reporting station

TABLE 1 TEMPERATURE AND PRECIPITATION COMPARISONS - 1967

Official
LOWER GRANITE DAM, WASHINGTON
620'

	Temperatures					
	Means		Extremes			
	Max.	Min.	Month	Mx	Mn	Precip.
JAN	-	-	-	-	-	3.46
FEB	53.2	35.2	44.2	65	27	0.48
MAR	54.1	36.0	45.1	64	28	1.72
APR	59.5	38.0	48.8	68	32	1.08
MAY	71.8	45.9	58.9	90	33	1.38
JUN	85.3	54.2	69.8	98	45	2.22
JUL	96.3	60.8	78.6	112	50	0.11
AUG	101.0	62.3	81.7	110	51	0
SEP	91.5	57.6	74.6	111	47	0.28
OCT	69.6	45.4	57.5	85	35	1.35
NOV	53.2	34.8	44.0	72	18	1.44
DEC	44.4	29.6	37.0	58	14	2.20
YEAR	69.0e	44.6e	56.8e	112	14	15.72

Frost-free period: 214 days

WAWAWAI, WASHINGTON
675'

	Temperatures					
	Means		Extremes			
	Max.	Min.	Month	Mx	Mn	Precip.
JAN	47.5	36.6	42.0	65	28	3.51
FEB	53.2e	37.2e	45.2e	64	29	0.72e
MAR	52.7	36.6	44.6	65	29	2.14+
APR	57.1	38.6	47.8	65	33	2.13
MAY	71.9	46.3	59.1	88	33	1.85e
JUN	84.9	55.8	70.4	99	45	1.95e
JUL	96.9	62.4	79.6	114	53	0.02
AUG	101.6	61.9	81.8	111	51	T
SEP	89.8	57.5	73.6	103	44	0.14
OCT	68.6	46.0	57.3	86	34	1.67
NOV	50.2	35.3	42.8	61	19	1.50e
DEC	43.1	28.6	33.8	60	11	1.52
YEAR	68.1	45.2	56.6	114	11	17.17e

Frost-free period: 231 days

Official
PULLMAN, WASHINGTON
(2 mi. NW - 2545')

	Temperatures					
	Means		Extremes			
	Max.	Min.	Month	Mx	Mn	Precip.
JAN	40.5	29.9	35.2	54	22	3.52
FEB	44.6	30.4	37.5	56	23	0.64
MAR	44.2	30.2	37.2	55	19	1.85
APR	50.6	31.6	41.1	60	26	1.74
MAY	63.3	39.3	51.3	80	27	1.46
JUN	74.3	47.3	60.8	87	38	2.22
JUL	85.1	49.5	67.3	102	40	0.10
AUG	90.4	51.5	71.0	100	38	0.02
SEP	79.5	48.3	63.9	93	36	0.45
OCT	58.9	38.9	48.9	75	27	2.65
NOV	46.8	30.7	38.8	59	17	1.43
DEC	35.6	23.9	29.8	47	5	2.68
YEAR	59.5	37.6	48.6	102	5	18.76

Frost-free period: 160 days

UNION CREEK FLAT, WASH.
(6 mi. SSW - 2436')

	Temperatures					
	Means		Extremes			
	Max.	Min.	Month	Mx	Mn	Precip.
JAN	39.8	31.1	35.4	56	16	-
FEB	44.6	30.0	37.3	57	19	-
MAR	-	-	-	55	16	-
APR	51.1	32.1	41.6	61	25	-
MAY	63.0	39.5	51.2	78	25	-
JUN	74.5	46.1	60.3	87	35	-
JUL	86.3	47.8	67.0	105	38	-
AUG	93.0	48.0	70.5	103	38	-
SEP	81.3	45.6	63.4	96	31	-
OCT	61.3	37.7	49.5	80	27	-
NOV	47.2	29.9	38.6	62	12	-
DEC	35.5	23.9	29.7	50	5	-
YEAR	60.2e	36.7e	48.4e	105	5	-

Frost-free period: 104 days

e = estimated because of missing records.

at Lower Granite Dam will present a representative record of temperatures and precipitation for this particular stretch of the Snake River Canyon bottom.

Missing, of course, from Weather Bureau records are any indications of temperature conditions in the thermal belt 700 or 800 feet above the canyon bottom where summer minimum temperatures average a few degrees warmer than at the canyon bottom. However, it has been found that Wawawai's 200-plus day frost-free season apparently is not exceeded in the "thermal belt", because the temperature inversions not only are weakly developed, but frequently absent during the early spring and late fall cold snaps which effectively delimit the frost-free season. In some years, the frost-free season actually is longer at the bottom of the canyon than in the thermal belt. For example, in 1967 the frost-free season was 231 days in length in the canyon bottom but only 187 days in the thermal belt. The principal value of the "thermal belt" station at elevation 1500 feet in the Wawawai side canyon has been in the discovery, of meteorological interest, that here exist mean minimum temperatures as high as can be found anywhere in the Pacific Northwest during the mid-summer period. For example, in August 1967, the mean minimum was 68.5°, or 0.7° warmer than the runnerup, Huntington, Oregon. This mean minimum was 6.6° higher than in the canyon bottom, but it was offset by a mean maximum which was 6.5° lower than in the canyon bottom.

The official U.S. Weather Bureau station for Pullman, Washington, occupies a less well defined bottomland site than that at Union Creek Flat along the profile (Table 1). Consequently, summer minimum temper-

atures average 2° or 3° higher at the official station. Despite these small differences in average minimum temperatures at the two sites, there was a 56-day difference in frost-free season in 1967: 160 days at the official station compared with only 104 days at Union Creek Flat. In 1966 the difference had been only 12 days. There is little difference in average winter minima at the two sites, although clear nights tend to be slightly colder at Union Creek Flat. Daytime maximum temperatures are about the same at the two sites, except that on the warmest days Union Creek Flat shows a tendency to be about 2° warmer at all seasons. Possibly this is related to the fact that its altitude is 110 feet lower. In summary, the Weather Bureau's official reporting station is marginally representative for low ground locations in the Palouse Hills of eastern Washington. No precipitation records were kept at Union Creek Flat, but when comparing the total annual precipitation recorded at the official Pullman station, it is found to be about halfway between the quantities received at Moscow and Waverma.

The official Weather Bureau station for the Moscow, Idaho, area is situated on a bench about 20 feet above the bottomland of the South Fork of the Palouse River two miles east of Moscow, and about 150 feet below a hilltop which lies half a mile west of the station. Being on a bench, nighttime minima average about 1.5° higher for the year than on the South Palouse Flat bottomland station one mile south of Moscow (Table 2). The difference between the two stations disappears in winter, but may average as much as 4° to 6°, with the official station at the University farm reporting the higher readings during July, August and September.

TABLE 2 TEMPERATURE AND PRECIPITATION COMPARISONS - 1967

Official
MOSCOW, IDAHO (2 mi. E.)
U. of I. Exp. Farm - 2620'

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn	Precip.
JAN	40.0	29.3	34.7	52	19	3.46
FEB	44.1	30.5	37.3	55	23	0.35
MAR	45.1	29.5	37.3	53	20	1.57
APR	51.2	31.5	41.4	62	25	2.75
MAY	63.4	38.2	50.8	80	27	1.94
JUN	75.4	48.3	61.9	86	37	2.06
JUL	86.1	47.2	66.7	103	39	0.04
AUG	91.8	50.7	71.8	100	41	0
SEP	82.6	47.7	65.2	98	35	0.53
OCT	59.1	39.0	49.1	75	28	3.28
NOV	46.8	29.8	38.3	64	13	1.27
DEC	34.3	22.9	28.6	48	4	3.48
YEAR	60.0	37.0	48.6	103	4	20.73

Frost-free period: 146 days

MOSCOW, IDAHO
Univ. of Idaho - Campus - 2610'

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn	Precip.
JAN	38.8	31.2	35.5	52	22	3.45
FEB	43.5	31.3	37.4	56	24	0.84
MAR	43.9	30.9	37.4	56	22	1.604
APR	51.4	33.6	42.5	63	28	2.20
MAY	64.1	43.4	53.8	83	31	1.88
JUN	75.6	52.3	64.0	90	43	2.39
JUL	84.9	55.3	70.1	103	48	0.06
AUG	90.2	56.8	73.5	100	45	T
SEP	78.8	52.1	65.4	93	41	0.29
OCT	58.2	42.3	50.2	74	31	2.89
NOV	44.7	33.8	39.2	57	18	1.25
DEC	33.5	26.2	29.8	46	8	3.35
YEAR	59.0	40.8	49.9	103	8	20.20

178 days

MOSCOW, IDAHO (1 mi. S.)
South Palouse Flat - 2540'

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn	Precip.
JAN	-	-	-	-	-	-
FEB	45.3	30.9	38.1	59	23	-
MAR	45.0	30.6	37.8	58	20	-
APR	52.5	32.0	42.2	64	22	-
MAY	63.5	38.8	51.2	81	27	-
JUN	76.0	47.0	61.5	90	37	-
JUL	85.6	44.0	64.8	105	33	-
AUG	91.6	43.9	67.8	103	31	-
SEP	80.8	41.3	61.0	94	25	-
OCT	59.3	35.8	47.6	78	25	-
NOV	45.2e	29.2e	37.2e	59	10	-
DEC	33.5	22.5	28.0	48	-3	-
YEAR	59.9e	35.5e	47.7e	105	-3	-

Frost-free period: 90 days

MOSCOW. IDAHO (4 mi. N.)
Viola Hill - 3150'

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn	Precip.
JAN	35.7	29.8	32.8	49	22	-
FEB	40.6	30.7	35.6	53	24	-
MAR	41.6	30.2	35.9	54	18	-
APR	48.6	34.0	41.3	60	28	-
MAY	61.5	44.3	52.9	81	32	-
JUN	72.3	55.0	63.6	86	46	-
JUL	82.3	61.7	72.0	103	52	-
AUG	88.4	66.0	77.2	99	50	-
SEP	77.3	58.3	67.8	93	41	-
OCT	55.8	42.4	49.1	74	32	-
NOV	43.3	32.9	38.1	57	19	-
DEC	31.6	23.5	27.6	44	7	-
YEAR	56.6	42.4	49.5	103	7	-

165 days

e = estimated because of missing records.

This contrast between the bench and bottomland temperatures in 1966 made the difference between a 133-day frost-free season at the official station and a 20-day frost-free period at the South Palouse Flat station, where the temperature dropped below 32° every month of the summer. Thus, the official station at the University farm definitely does not reveal temperature conditions on bottomlands in the vicinity of Moscow.

On the other hand, minimum temperatures average much lower at the official station during the May - October period than at two other stations maintained in the Moscow area for this study: the University of Idaho campus station, and the Viola Hill station (Table 2). The campus station is on a hillside, but probably the most significant environmental influences are the numerous trees and buildings nearby, as well as the expanse of asphalt pavement and concrete surfaces around and beneath the shelter. This location for the campus instruments was required by University policy and hence was unavoidable. The net effect of such an environment is undoubtedly to raise minimum temperatures slightly. In any event, during the midsummer period, minima average about 5° higher at this campus station than at the official station on the University farm. Occasionally the difference exceeds 10°. In winter the average differential is reduced to 2°. In both 1966 and 1967, the frost-free season was just over a month longer at the campus station than at the University farm.

Summer minimum temperatures average about 12° warmer on Viola Hill than at the official station on the University farm, but in August 1967 there was a 15° average difference. On individual nights, minima are

occasionally 25° or more higher on Viola Hill than at the University farm. The record spread was on July 12, 1967 when the minimum was 78° on Viola Hill and only 50° at the official station. The hill station is 535 feet higher in elevation than the University farm.

Of particular meteorological interest is the fact that the highest minima experienced on individual summer nights on Viola Hill equal or exceed those reported from any official Weather Bureau station in the Pacific Northwest. For example, the highest minimum recorded during the summer of 1967 on Viola Hill was 78° on July 12. This was equal to the Pacific Northwest high of 78° registered at Huntington, Oregon, on August 13 and 14. It was also 16° above the highest official minimum reported at the University farm during the summer. Even the warmest nights in the thermal belt of the Snake River Canyon have not surpassed those on Viola Hill during the period of available records, although the summer minima average 2° to 4° higher at the thermal belt station in the canyon than on Viola Hill. *

* Comparison of minimum temperatures recorded at the campus station with those on the South Palouse Flat and Viola Hill stations is of interest. In summer, campus minima average about 10° higher than those at South Palouse Flat and about 7° lower than on Viola Hill. On some nights the campus minima are 15° or more warmer than at South Palouse Flat; on other occasions the campus station minimum may be 15° or more lower than that on Viola Hill. In winter the differences are greatly reduced, with the campus station averaging about 2° warmer than both the South Palouse Flat and Viola Hill stations. The temperature inversion between the campus and Viola Hill is absent much of the time in winter and only occasionally exceeds 2°. In fact, the hilltop is sometimes as much as 5° colder than the campus. As noted, an average inversion of about 2° does exist between the campus and South Palouse Flat in winter, and during the rare periods of clear, dry weather it may become as great as 10° or 12°.

Length of frost-free season appears to average about the same on Viola Hill as at the campus station, probably about 5½ months (166 days). This compares with the official 134 days, and a probable 60 days, or even less, at South Palouse Flat.

Daytime maximum temperatures average within about a degree of each other at all stations around Moscow, except that on Viola Hill the average is 2° to 4° lower than at the other stations. However, occasional individual days may be as warm on the hill as at the lower stations.

Precipitation apparently averages slightly higher at the official station on the University farm, possibly in the vicinity of one-half inch per year, but the period of comparative records at the two stations is too brief to make any positive statement.

In contrast to the official Moscow station, that on the farm 3 miles north-northeast of Potlatch, Idaho, does effectively reveal the low summer night temperatures experienced on the bottomlands in the heart of the agricultural Palouse of Idaho (Table 3). In fact, the average summer minimum is almost identical to that recorded at the profile station on the valley flat one mile east of Potlatch, and for the year as a whole the minimum averages about a degree lower at the official Weather Bureau station.

Minima at the official station 3 miles north-northeast of Potlatch average about 1½° colder than at the South Palouse Flat one mile south of Moscow. South Palouse Flat station at elevation 2540 feet above sea level is 60 feet lower than the Potlatch official station. In turn, the minimum temperatures at Genesee Flat, 13 air line miles south of Moscow, and 28 miles south of the official Potlatch station (but 60 feet higher

TABLE 3 TEMPERATURE AND PRECIPITATION COMPARISONS - 1967

Official
POTLATCH, IDAHO
(3 mi. NNE - 2600')

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn
JAN	39.5	28.1	33.8	52	12
FEB	43.3	28.2	35.8	57	19
MAR	44.7	27.1	35.9	57	7
APR	51.1	29.5	40.3	60	24
MAY	63.8	35.9	49.9	81	25
JUN	74.6	44.8	59.7	86	35
JUL	83.7	43.3	63.5	100	35
AUG	89.9	42.3	66.1	99	32
SEP	80.9	40.2	60.1	94	27
OCT	58.9	34.7	46.8	78	24
NOV	46.6	27.8	37.2	60	10
DEC	34.8	23.2	29.0	44	3
YEAR	59.2	33.8	46.5	100	3

Frost-free period: 86 days

POTLATCH, IDAHO
(Valley Flat - 1 mi. E. - 2510')

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn
JAN	39.3	30.4	35.4	55	19
FEB	44.9	29.8	37.4	59	19
MAR	44.6	28.5	36.6	57	6
APR	50.9	30.7	40.8	62	26
MAY	63.2	37.9	50.6	81	28
JUN	73.9	46.0	60.0	88	35
JUL	84.1	43.6	63.8	102	35
AUG	90.4	42.0	66.2	101	30
SEP	79.8	40.2	60.0	95	25
OCT	58.5	35.1	46.8	78	24
NOV	47.2	29.0	38.1	61	12
DEC	34.0	24.1	29.0	46	2
YEAR	59.2	34.8	47.0	102	2

85 days

Official
CLARKIA, IDAHO
(Ranger Station - 2810')

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn	Precip.
JAN	35.0	26.4	30.7	45	0	8.68
FEB	40.1	23.3	31.7	50	4	2.61
MAR	41.7	24.7	33.2	50	2	4.81
APR	49.3	28.1	38.7	58	22	3.00
MAY	65.9	36.2	51.1	83	28	2.94
JUN	75.3	43.3	59.3	89	36	3.03
JUL	84.9	41.5	63.2	98	34	0.54
AUG	90.4	39.3	64.9	98	30	0
SEP	82.0	36.4	59.2	97	25	0.88
OCT	57.1	34.4	45.8	71	24	5.24
NOV	42.2	26.9	34.6	53	-1	2.07
DEC	30.5	19.8	25.2	41	-11	4.32e
YEAR	57.9	31.7	44.8	98	-11	38.12e

Frost-free period: 91 days

PURDUE CREEK FLAT, IDAHO
(2½ mi. E. of Bovill - 2880')

	Temperatures Means Max.	Min.	Month	Extremes Mx	Mn	Precip.
JAN	36.5	22.7	29.6	47	-6	8.28
FEB	40.3	20.6	30.4	54	-1	1.70+
MAR	43.1	21.6	32.4	54	1	3.73+
APR	50.0	26.1	38.0	60	18	3.04
MAY	62.3	32.4	47.4	82	24	2.21
JUN	73.4	40.8	57.1	88	31	2.49
JUL	84.0	37.8	60.9	102	30	0.20
AUG	88.9	36.3	62.6	99	27	T
SEP	79.0	34.9	57.0	94	24	0.82
OCT	55.2	30.5	42.8	76	22	4.37
NOV	43.5	23.6	33.6	63	-2	1.95
DEC	30.9	18.3	24.6	44	-14	4.87
YEAR	57.3	28.8	43.0	102	-14	33.66+

21 days

in altitude), average identifcal to those on the South Palouse Flat during the period of available records, although on individual nights there are occasionally differences as great as 5° to 10° between the two stations.

Minima at the profile station maintained on a typical low Palouse Hill within the heart of the agricultural area, namely that 3 miles east of Genesee, average about 4° lower than those on the higher, more isolated Viola Hill north of Moscow during the summer months. Also, the lower hill does not experience the extreme high minima in excess of 70° which occasionally characterize Viola Hill. Nevertheless, minima do average about 10° warmer than on the nearby Genesee Flat, only 250 feet lower, during a typical summer month. In winter there is virtually no difference between the average minimum temperatures on the relatively low hilltops and nearby bottomlands.

In summary, it may be said that while the Weather Bureau does have a station effectively representing bottomland temperature conditions in the heart of the agricultural Palouse (in its station 3 miles northnortheast of Potlatch), it has no stations whatsoever which even suggest the much higher summer minima characteristic of hilltop sites. The frost-free season on these hill sites is at least one month longer than at the official station at the University of Idaho Experimental Farm near Moscow, and at least three months longer than at the Potlatch site. Minima average 6° to 10° warmer on the innumerable low hills than at the official station, and as much as 10° to 15° warmer at special sites such as Viola Hill during the July - September period.

Near and beyond the eastern limits of agriculture, minimum temperatures on both hilltops and bottomlands, but particularly on the bottomlands, become lower (Table 3). Clarkia, Idaho Ranger Station is the official U. S. Weather Bureau station which best reflects conditions at such sites. Actually, however, the station is located on a bench some 50 feet above the valley flat of the St. Maries River, where the community of Clarkia is situated. The profile stations at the subalpine fir meadow and Purdue Creek Flat 2½ miles north of Bovill, and 6½ miles southwest of Clarkia, do accurately reveal the low temperatures characteristic of these bottomlands. At Purdue Creek Flat minimum temperatures average 3° lower than at the Clarkia bench site throughout the year. In some years, this may make the difference between a marginal frost-free period, and no frost-free period of consequence. For example, in 1967, there was a 91-day frost-free period on the bench at Clarkia, in contrast to only 21 days at Purdue Creek Flat and 26 days at the subalpine fir meadow. As a matter of fact, for all practical purposes, there is no frost-free season at either Purdue Creek Flat or the subalpine fir meadow because temperatures of 32° or lower have been recorded in each summer month in each of the three years that records have been kept at these locations. This may seem somewhat surprising in the case of the subalpine fir meadow which is only 17 air line miles east of Moscow, and surrounded by hills which are about 50% cropland. The altitude of the meadow is only 2635 feet above sea level, or no more than 100 feet higher than downtown Moscow. The hilltop adjacent to, and only 250 feet above, the subalpine fir meadow does have an apparent frost-free season of at least the duration of that at the official Moscow

station on the University farm. In fact, summer minima average about 7° higher on this hilltop than at the University of Idaho Experimental Farm. Nevertheless, the nights are still 3° or 4° cooler than on the hills in the heart of the agricultural Palouse which attain equal elevations. Mean summer minimum temperature differential between this hilltop and the nearby subalpine fir meadow is between 12° and 15°, but in August 1967 it reached 20°.

In summary, it could be said that if the Weather Bureau is to have a station in a valley or low ground setting east of the agricultural area of the Palouse (or anywhere else, for that matter), it would be more meaningful to place the station directly on the bottomland rather than on a terrace where neither bottomland nor hilltop conditions are represented. Then one would at least know how cold the bottomlands can become in the area being represented by the station. Locating the station on the actual bottomland would be of particular significance to the people of Clarkia and vicinity, because most of the habitations are situated on the bottomland. In an area of considerable relief where agriculture is of major significance, as is the case in the Palouse, it would seem desirable to have two stations, one on bottomland, and one on a nearby hilltop, in order to show the true range of growing conditions in the area.

The only Weather Bureau station manned by full-time, paid personnel in the vicinity of the profile is that at Lewiston Airport. This station is situated on a tableland nearly 700 feet above the junction of the Snake and Clearwater Rivers. Daytime maximum temperatures average about 3½° lower than at Wawawai, while minimum temperatures average about 2½° lower. The most distinctive climatic characteristic

of the Lewiston area is, however, the precipitation minimum that exists there. Mean annual precipitation increases in all directions, even down the Snake River towards Wawawai, where normal annual precipitation is at least five inches more than the 13.24 inches at Lewiston Airport. Lewiston actually is located in a basin well below the average level of the surrounding plateau, and in the lee of the Blue Mountains to the west-southwest. Consequently, the west-southwest winds commonly associated with cyclonic storms blow downslope into this basin, where the Snake River is oriented in a general southeast-northwest direction. In contrast, just below Wawawai, the Snake River turns west, and ultimately west-southwestward, to become oriented approximately in line with the winds usually accompanying and following a frontal passage from the Pacific Ocean. At the bend near Wawawai, these winds tend to be lifted upward over the plateau to the east. In other words, at Wawawai, there is a tendency toward orographic lifting, while at Lewiston local subsidence occurs within the air mass during the strong west-southwest winds usually associated with cyclonic storms and frontal passages.

In summary, the Weather Bureau station at Lewiston Airport is not completely representative of canyon bottom conditions, since it is located about 700 feet above the Snake River. However, the station is strategically situated in an area characterized by a pronounced local precipitation minimum.

There is a complete lack of Weather Bureau stations which would provide an indication of high mountain weather in the profile area. However, a station does exist on the isolated summit of Mt. Spokane, elevation 5870 feet, 85 miles due north of Pullman, Washington. Particularly needed in the profile area is an official station in a hilltop location.

X. Summary

Mean annual temperatures for the two-year period 1966-67, during which the most complete records are available along the profile, varied from 56.8°F at Wawawai to 45.4° at Emida Ridge, a distance of 45 air line miles. These mean annual temperatures are practically identical to those, respectively, for Washington, D.C., and Portland, Maine, separated by a distance ten times as great. Of course, a difference of 3,000 feet in altitude is the principal cause of the temperature spread between Wawawai and Emida Ridge, whereas a difference in latitude of about 5° accounts for the similar temperature contrast between Washington and Portland. Thus 600 feet of altitude appears to correspond to about 1° of latitude insofar as its impact upon temperature is concerned. Unfortunately, further testing of this relationship is not possible because year-round records could not be maintained on any of the mountain summits along the profile.

The most distinctive characteristic of temperature along the 75-mile profile between Wawawai and Crater Peak is found in the remarkable summer and early fall nocturnal temperature inversions. These temperature inversions are not only of much interest per se, but they also have a major impact upon relative humidity patterns, length of frost-free seasons, the overall mean temperatures, and even the natural vegetation and land use at various places along the profile. Mean magnitude of this inversion between adjacent hilltops and bottomlands in the Palouse Hills is generally between 10° and 15° during the summer and early fall months. During the near record hot, dry month of August 1967, the mean inversions were about 5° greater than usual, or 15° to 20°. On some nights they reached 30° between adjacent hilltops and valley flats.

Mean difference in minimum temperatures between non-contiguous hilltops and bottomlands is at least 20° during the peak of the "inversion season". In August 1967, the mean minimum temperature on Viola Hill, elevation 3150 feet near Moscow, was 66°, while at Purdue Creek Flat, elevation 2880 feet near Bovill, it was only 36°. Greatest minimum temperature spread on a particular night was 42°, from 76° on Viola Hill to only 34° at both Purdue Creek Flat and the subalpine fir meadow on August 17, 1967. The subalpine fir meadow is 515 feet lower in elevation than Viola Hill, and lies 17 air line miles to the east, while Purdue Creek Flat is 270 feet lower and is located 30 miles east.

These remarkable temperature inversions result in frost-free seasons varying from nil at the subalpine fir meadow and Purdue Creek Flat to about 5½ months on the warmer hilltops. The subalpine firs and Englemann spruce found at such sites as the subalpine fir meadow are isolated islands of a vegetation type ordinarily found between elevations of about 5,000 to 7,500 feet on mountains of northern Idaho. No attempt is made to use these frosty bottomlands for any form of agriculture other than pasture or hay.

A point of interest is that mean monthly temperatures at such bottomland sites as the subalpine fir meadow and Purdue Creek Flat are about the same as at elevations of 6,000 to 6,500 feet in the mountains during the summer season. Of course, the daytimes are much warmer, with maxima averaging 15 to 17° higher at the subalpine fir meadow (elev. 2635 feet) than on Crater Peak (elev. 6400 feet), but summer nights often average 15 to 17° lower at the subalpine fir meadow than on Crater Peak, thus producing a similar overall mean. As fall comes on, the mean temperatures on Crater Peak decline substantially below those at the subalpine fir meadow. The similar character of the climax forest vegetation at

these two sites reflects the similarity in mean summer temperatures.

Other particularly interesting aspects of the temperature patterns along the profile include the following: (1) the great diurnal ranges in temperature during the July - September period, equivalent in magnitude to those experienced in many desert areas; (2) the significantly warmer summer nights experienced on the highest mountains than on the bottomlands of even the agricultural portion of the Palouse Hills, and the somewhat less severely cold nights at "frost pocket" sites at altitudes of 5600 feet in the mountains than at the subalpine fir meadow 3,000 feet lower; (3) the virtual elimination of inversions much of the time in winter, except during the brief invasions of cold, dry arctic air from Canada; (4) the great contrast in daytime temperatures between the lower altitudes and mountain summits when the former areas are receiving sunshine, but the latter heights are enshrouded in cloud. Under these circumstances, lapse rates as great as 7°/1000 feet have been recorded.

The contrasting diurnal temperature and relative humidity traces recorded by hygrothermographs at various sites along the profile are analyzed. Especially conspicuous are the following features: (1) diurnal temperature ranges on isolated hilltops and mountain summits which are usually less than half as great as on the bottomlands during the warmer half of the year; (2) the tendency for the temperature to cease dropping after sunset, and then to remain steady or perhaps actually rise slightly during the late evening hours on these isolated hilltops and mountain summits; (3) the accompanying tendency toward a secondary, and sometimes even a primary, relative humidity minimum during the night at these sites; (4) relative humidities approaching 100% almost nightly

on the bottomlands throughout the driest part of the summer. (5) the increasing coldness of the bottomlands eastward along the profile, with the decline in mean minimum temperatures being 8° to 10° in summer and slightly less in winter between Union Creek Flat, Washington, at an elevation of 2436 feet, and the subalpine fir meadow 30 air line miles to the east, but only 200 feet higher in altitude.

Among other temperature-humidity phenomena examined are the following: (1) the changing temperature relationship between mountaintop and valley flat during the passage of an anticyclone, whereby there is a tendency for lowest temperatures to occur on the first night of anticyclonic influence on the mountaintop, but not until subsequent nights on the bottomlands, by which time winds have subsided and cold air drainage is chilling the bottomlands, while mountaintops may be undergoing some warming by air mass subsidence aloft; (2) the daytime temperature inversions which may be as great as 20° during winter radiation fogs that tend to persist for several days at a time; (3) the depressing effect of snowcover upon winter temperature minima during clear weather, sometimes as much as 10° to 14°; and (4) the differences in temperature and humidity traces between the normal 5½-foot shelter level and the 6-inch level. At a certain sloping site, namely Battle Ridge, temperatures at the 6-inch level were occasionally as much as 10° to 12° lower than at the 5½-foot level during the night hours. Associated relative humidities were 20% to 25% higher at the 6-inch level than at the 5½-foot level. Temperatures were generally 3° to 6° higher at the 6-inch level on sunny days.

Contrasts between winter and summer relative humidity patterns are discussed in detail. In winter, mean nocturnal relative humidities are between 90% and 100% throughout the area of the profile, but in summer mean night maxima vary from about 65% on hilltops in the Palouse to nearly 100% on the colder bottomlands. Average winter afternoon relative humidities increase from near 60% in the canyons to over 90% in the mountains, while the corresponding averages on summer afternoons vary from near 20% in the canyons to about 45% above 6,000 altitude on the mountains.

Foehn effects are noticeable during summer heat waves when winds are often from the east-southeast and relative humidities drop to near 15% on the Palouse and 10% or lower in the canyons. Similar foehn effects are noticeable during warm periods at other seasons, but are rare from November through January. East-southeast winds during the latter period are usually cold and quite moist. Occasionally, however, as a deep cyclone approaches from the Pacific Ocean a strong to gale force southeast wind develops, the temperature rises to about 50° on the Palouse and above 60° in the canyons, and the relative humidity may drop as low as 35% on the Palouse and 25% in the canyons.

Annual precipitation is about twice as great on Emida Ridge (elevation 3700 feet) as at Wawawai (elevation 675 feet), 45 miles to the southwest. The rate of precipitation increase northeastward from Wawawai is about one inch in each six miles between Wawawai and Harvard Valley Flat, then accelerates to a little over an inch per mile in the last ten miles between Harvard and Emida Ridge. From Emida Ridge to the summit of Bald Mountain, an air line distance of five miles, a

further annual increase of ten inches is estimated from other studies, or two inches per mile. Precipitation drops back to near 36 inches at Clarkia (2880 feet), farther east, but then increases rapidly once again, at the rate of about two inches per mile, to the summit of Freezeout Mountain (c. 6000 feet) and Grater Peak (6400 feet).

During individual months, relative quantities of precipitation at various points along the profile may vary, particularly during the summer. For example, although the estimated normal annual precipitation on Bald Mountain is about 2½ times that at Yawawai, during August 1965, precipitation totalled eight times as much on Bald Mountain (5.15 inches compared with only 0.66 inch at Yawawai). Variations in relative amounts are believed related to differing orientation of upper air wind flow during precipitation periods.

Contrasts in winter snowfall and snowcover are enormous from one end of the profile to the other. At Yawawai, in the Snake River Canyon, normal annual snowfall is only six inches and there are only a few days each winter with any snow whatsoever on the ground. During the entire 1966-67 winter season, only a trace fell. By contrast, hundreds of inches of snow fall each winter on the mountains at the northeastern end of the profile, where water content of the snow pack at Lost Lake, 3 miles northeast of Grater Peak, varied between 52 and 67 inches on April 1st during the three years, 1965 through 1968. Snow, at the U. S. Soil Conservation Service's snow course, the snow depth was 169 inches on April 1, 1967. Snow frequently blocks the road beyond Grater Peak to ordinary automobile travel by about October 10, and opening date the next summer is around July 10 to 15.

An analysis of the official U. S. Weather Bureau sponsored weather stations in the vicinity of the profile reveals two main points. First, a hilltop station is needed somewhere in the agricultural portion of the Palouse Hills. The existing stations are all on relatively low sites, and give no indication of the much warmer summer nights and substantially longer frost-free season which exists on the Palouse Hills. Second, two of the relatively low-lying official stations, specifically those at Moscow and Clarkia, Idaho, are actually on benches about 20 and 50 feet, respectively, above nearby bottomlands. As a result, the temperatures recorded at these stations do not accurately indicate bottomland conditions. Summer minima at the Moscow station average about 5° higher than on the true bottomland sites, while minima at Clarkia average about 3° higher. Fortunately, the official station 3 miles north-northeast of Potlatch is located so that it does accurately portray bottomland temperatures.

More care needs to be taken in locating weather stations, particularly in hilly terrain. Average minimum temperatures differ by as much as 10° to 15° between hilltops and valley flats in the immediate vicinity of Moscow during the summer and early fall months. Here the average relief is only about 250 feet. Associated frost-free seasons vary from perhaps 60 days on the bottomlands to 5½ months on the hilltops. At the very least, some indication should be provided in the Weather Bureau's monthly climatological Data as to the character of the weather station sites, particularly in hilly agricultural areas.

APPENDIX I

Annual Climatological Summaries

For Each Station 1963 Through 1967

WAWAWAI, SNAKE RIVER CANYON, WASHINGTON
Elevation 675 feet
Lat. 46°38'N., Long. 117°23'W.

Month	Temperature Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	47.5	36.6	42.0	65	28	34	47	3.51
FEB	53.2e	37.2e	45.2e	64	29	45	48	0.72e
MAR	52.7	36.6	44.6	65	29	47	42	2.14+
APR	57.1	38.6	47.8	65	33	43	46e	2.13
MAY	71.9	46.3	59.1	88	33	49	58	(1.85e*)
JUN	84.9	55.8	70.4	99	45	66	69	(1.95e+)
JUL	96.9	62.4	79.6	114	53	85	76	0.02
AUG	101.6	61.9	81.8	111	51	87	71	Te
SEP	89.8	57.5	73.6	103	44	63	69	0.14
OCT	68.6	46.0	57.3	86	34	53	60	1.67
NOV	50.2	35.3	42.8	61	19	38	47	(1.50e*)
DEC	43.1	28.6	33.8	60	11	26	43	1.52
YEAR	68.1	45.2	56.6	114	11	26	76	17.17e

WAWAWAI CANYON, WASHINGTON
(3 miles SE of Wawawai)
Elev. 1500 feet
Lat. 46°37'N., Long. 117°20'W.

Month	Temperature Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	44.0	35.6	39.8	62	27	32	45
FEB	47.4	34.6	41.0	59	25	39	44
MAR	47.5	34.1	40.8	59	45	36	45
APR	52.8	37.4	45.1	63	31	38	44
MAY	66.3	47.6	57.0	83	34	41	61
JUN	78.3	57.2	67.8	93	48	61	68
JUL	90.4	65.6	78.0	108	58	80	73
AUG	95.1	68.5	81.8	106	57	79	76
SEP	-	-	-	-	-	-	-
OCT	-	-	-	-	-	-	-
NOV	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-
YEAR	-	-	-	108	-	-	76

RIDGE ABOVE WAWAWAI, WASHINGTON
(4 miles SE of Wawawai)
Elev. 2500'
Lat. 46°36'N., Long. 117°19'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	39.6	32.4	36.0	55	23	27	42	3.72
FEB	45.3	34.1	39.7	53	25	37	44	0.66
MAR	44.6	32.5	38.6	56	22	34	42	(2.60e*)
APR	49.4	35.1	42.2	60	28	34	42	1.90
MAY	62.6	44.9	53.8	79	34e	40	58	(1.98e*)
JUN	74.6	52.4	63.5	89	45	57	65	(2.05e*)
JUL	86.2	62.9	74.6	107	50	75	71	T+
AUG	91.5	64.3	77.9	102	52	75	72	Te
SEP.	79.5	56.6	68.0	95	41	51	70	0.15
OCT.	58.3	41.9	50.1	75	32	47	52	1.55
NOV.	45.2	33.6	39.4	57	20	30	45	1.06e
DEC.	34.5	26.4	30.4	50	8	16	43	2.47
YEAR	59.3	43.1	51.2	107	8	16	72	18.14e

UNION CREEK FLAT, WASHINGTON
(6 miles SSW of Pullman)
Elev. 2436'
Lat. 46°41'N., Long. 117°15'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	39.8	31.1	35.4	56	16	30	42
FEB	44.6	30.0	37.3	57	19	34	38
MAR	-	-	-	57e	18e	34e	42e
APR	51.1	32.1	41.6	61	25	38	42
MAY	63.0	39.5	51.2	78	25	40	50
JUN	74.5	46.1	60.3	87	35	55	59
JUL	86.3	47.8	67.0	105	38	76	66
AUG	93.0	48.0	70.5	103	38	77	62
SEP	81.3	45.6	63.4	96	31	54	61
OCT	61.3	37.7	49.5	80	27	48	56
NOV	47.2	29.9	38.6	62	12	32	45
DEC	35.5	23.9	29.7	50	5	19	45
YEAR	60.2	36.7	48.4	105	5	19	66

e = estimated
* = estimate of low reliability; no records obtained because of malfunctioning rain gages during extended periods.
+ = slightly more than indicated amount of rain probably fell.

MOSCOW - UNIVERSITY OF IDAHO
Elev. 2610 feet
Lat. 46°44'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	38.8	31.2	35.5	52	22	28	42	3.45
FEB	43.5	31.3	37.4	56	24	34	42	0.84
MAR	43.9	30.9	37.4	56	22	34	41	1.60+
APR	51.4	33.6	42.5	63	28	39	41	2.20
MAY	64.1	43.4	53.8	83	31	40	57	1.88
JUN	75.6	52.3	64.0	90	43	57	61	2.39
JUL	84.9	55.3	70.1	103	48	74	62	0.06
AUG	90.2	56.8	73.5	100	45	73	66	T
SEP	78.8	52.1	65.4	93	41	54	62	0.29
OCT	58.2	42.3	50.2	74	31	47	55	2.89
NOV	44.7	33.8	39.2	57	18	31	51	1.25
DEC	33.5	26.2	29.8	46	8	19	41	3.35
YEAR	59.0	40.8	49.9	103	8	19	66	20.20

VIOLA HILL, IDAHO
(4 miles N. of Moscow)
Elev. 3150 feet
Lat. 46°47'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	35.7	29.8	32.8	49	22	25	40
FEB	40.6	30.7	35.6	53	24	32	44
MAR	41.6	30.2	35.9	54	18	30	40
APR	48.6	34.0	41.3	60	28	35	40
MAY	61.5	44.3	52.9	81	32	37	61
JUN	72.3	55.0	63.6	86	46	54	70
JUL	82.3	61.7	72.0	103	52	71	78
AUG	88.4	66.0	77.2	99	50	71	77
SEP	77.3	58.3	67.8	93	41	50	73
OCT	55.8	42.4	49.1	74	32	43	54
NOV	43.3	32.9	38.1	57	19	30	50
DEC	31.6	23.5	27.6	44	7	16	40
YEAR	56.6	42.4	49.5	103	7	16	78

SOUTH FORK PALOUSE RIVER
VALLEY FLAT
(1 mile S. of Moscow)
Elev. 2540 feet
Lat. 46°43'N., Long. 117°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN.	-	-	-	-	-	-	-
FEB	45.3	30.9	38.1	59	23	35	45
MAR	45.0	30.6	37.8	58		35	42
APR	52.5	32.0	42.2	64	22	39	41
MAY	63.5	38.8	51.2	81	27	40	54
JUN	76.0	47.0	61.5	90	37	57	60
JUL	85.6	44.0	64.8	105	33	74	60
AUG	91.6	43.9	67.8	103	31	75	61
SEP	80.8	41.3	61.0	94	25	51	59
OCT	59.3	35.8	47.6	78	25	48	50
NOV	45.2e	29.2e	37.2e	59	10	30	49
DEC	33.5	22.5	28.0	48	-3	18	41
YEAR	59.9	35.5	47.7	105	-3	18	61

POTLATCH VALLEY FLAT, IDAHO
(1 mile E. of Potlatch)
Elev. 2510 feet
Lat. 46°54'N., Long. 116°53'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN.	39.5	30.4	35.4	55	19	30	41	-
FEB	44.9	29.8	37.4	59	19	34	41	-
MAR	44.6	28.5	36.6	57	6	33	42	-
APR	50.9	30.7	40.8	62	26	40	40	2.70
MAY	63.2	37.9	50.6	81	28	40	48	2.52
JUN	73.9	46.0	60.0	88	35	54	59	4.10+
JUL	84.1	43.6	63.8	102	35	73	60	0.04e
AUG	90.4	42.0	66.2	101	30	74	62	Te
SEP	79.8	40.2	60.0	95	25	55	60	-
OCT	58.5	35.1	46.8	78	24	47	49	-
NOV	47.2	29.0	38.1	61	12	33	47	1.17
DEC	34.0	24.1	29.0	46	2	18	39	-
YEAR	59.2	34.8	47.0	102	2	18	62	-

e = estimated

\+ = actual precipitation believed to be perhaps 0.25 inch greater at Moscow in February and at Potlatch in June than actually shown by gage measurement (problem of inasufficient snow catch in first case, and evaporation in the second.

HARVARD VALLEY FLAT, IDAHO
(1¼ miles NE of Harvard)
Elev. 2590 feet
Lat. 46°55'N., Long. 116°42'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	39.5	27.1	33.3	53	10	30	35	4.14
FEB	44.1	25.0	34.6	60	12	34	37	1.20
MAR	44.5	24.5	34.5	57	4	34	40	2.97
APR	51.5	26.9	39.2	62	19	36	37	2.46
MAY	64.2	34.1	49.2	83	23	40	45	2.23
JUN	74.7	42.8	58.8	88	34	54	59	2.87
JUL	85.5	40.4	63.0	101	34	74	58	0.05
AUG	92.0	39.5	65.8	102	30	73	54	Te
SEP	81.1	37.2	59.2	96	24	53	60	0.55
OCT	59.6	31.2	45.4	78	20	48	45	2.67
NOV	47.4	23.9	35.6	64	3	30	40	1.43
DEC.	35.5	21.3	28.4	47	-2	20	39	3.49+
YEAR	60.0	31.2	45.6	102	-2	20	60	24.06

EMIDA RIDGE, IDAHO
(11 miles NNE of Harvard
(Near N-S Ski Bowl)
Elev. 3700 feet
Lat. 47°4'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	31.1	24.1	27.6	42	14	20	33	7.70
FEB	36.7	24.8	30.8	56	17	26	37	2.43
MAR	37.3	23.9	30.6	49	12	25	34	4.46
APR	44.5	28.5	36.5	56	21	30	35	3.23
MAY	58.4	37.8	48.1	79	28	34	53	2.38
JUN	69.6	49.6	59.6	84	41	48	59	2.20
JUL	81.8	58.0	69.9	100	46	69	66	0.08
AUG	87.8	61.7	74.8	100	47	71	70	Te
SEP	76.5	53.0	64.8	94	34	45	67	1.09
OCT	52.5	37.2	44.8	74	26	40	49	4.43
NOV	40.3	28.2	34.2	57	10	25	42	3.04
DEC	28.0	20.3	24.2	40	2	13	35	4.55+
YEAR	53.7	37.3	45.5	100	2	13	70	35.59+

BALD MOUNTAIN, IDAHO
(11 miles NE of Harvard)
Elev. 5330 feet
Lat. 47°2'N., Long. 116°34'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	36	12	-	-	5.31
FEB	-	-	-	48	11e	-	-	3.10
MAR	-	-	-	42	4	-	-	4.80
APR	-	-	-	46	19	-	-	3.01
MAY	-	-	-	-	-	-	-	-
JUN	-	-	-	78e	-	-	59	2.51
JUL	74.4	55.5	65.0	92	41	63	68	0.11
AUG	80.8e	61.9e	71.4e	91	43	64	74	T
SEP	70.3	52.1	61.2	84	33	41	67	1.02
OCT	46.4	33.8	40.1	65	22	31e	46	4.36
NOV	-	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-	-
YEAR	-	-	-	92	-	-	74	-

2½ MILES N. OF BOVILL, IDAHO
(at Purdue Creek)
Elev. 2880 feet
Lat. 46°3'N., Long. 116°23'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	36.5	22.7	29.6	47	-6	28	32	8.28
FEB	40.3	20.6	30.4	54	-1	31	34	1.70+
MAR	43.1	21.6	32.4	54	1	33	37	3.73+
APR	50.0	26.1	38.0	60	18	35	33	3.04
MAY	62.3	32.4	47.4	82	24	41	43	2.21
JUN	73.4	40.8	57.1	88	31	53	58	2.49
JUL	84.0	37.8	60.9	102	30	72	56	0.20
AUG	88.9	36.3	62.6	99	27	72	50	T
SEP	79.0	34.9	57.0	94	24	49	54	0.82
OCT	55.2	30.5	42.8	76	22	42	45	4.37
NOV	43.5	23.6	33.6	63	-2	28	37	1.95
DEC	30.9	18.3	24.6	44	-14	16	34	4.87
YEAR	57.3	28.8	43.0	102	-14	16	58	33.66 (35.16)

e = estimated

+ = precipitation catch believed too low in February and March at Bovill because it is suspected that there was a problem with the gage during a major snowstorm in each month. Total precip. for the two months may be about 1.50 inches higher than shown. Emida Ridge precipitation may be about 0.15 inch greater than shown here.

GENESEE FLAT, IDAHO
(½ mile NE. of Genesee)
Elev. 2690 feet
Lat. 46°32'N., Long. 116°54'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	38.6	30.0	34.3	54	15	28	41
FEB	44.3	30.5	37.4	56	23	34	41
MAR	44.1	29.5	36.8	55	13	32	41
APR	50.3	30.4	40.4	61	23	38	38
MAY	62.5	38.4	50.4	80	26	40	49
JUN	73.3	45.8	59.6	88	34	61	59
JUL	84.4	43.9	64.2	102	34	74	63
AUG	91.9	45.6	68.8	102	34	77	66
SEP	80.2	43.3	61.8	95	27	54	60
OCT	57.8	36.5	47.2	74	27	46	50
NOV	45.8	29.7	37.8	60	7	30	47
DEC	34.3	22.6	28.4	48	-4	17	44
YEAR	59.0	35.5	47.2	102	-4	17	66

GENESEE HILL, IDAHO
(3 miles ENE of Genesee)
Elev. 2900 feet
Lat. 46°32'N., Long. 116°52'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	36.7	29.4	33.0	52	19	26	40
FEB	41.9	30.3	36.1	54	22	33	41
MAR	42.1	29.8	36.0	55	19	32	41
APR	48.7	32.8	40.8	60	27	36	38
MAY	61.4	42.4	51.9	81	30	42	55
JUN	72.8	51.6	62.2	88	43	60	61
JUL	84.4	57.6	71.0	104	49	73	64
AUG	89.6	60.7	75.2	99	69	75	69
SEP	-	-	-	-	-	-	-
OCT	-	-	-	-	-	-	-
NOV	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-
YEAR	-	-	-	104	-	-	69

SUBALPINE FIR MEADOW, IDAHO
(Halfway between Troy and Deary)
Elev. 2635 feet
Lat. 46°46'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	38.7	24.8	31.8	51	5	31	34
FEB	44.2	23.6	33.9	58	9	34	37
MAR	44.7	24.2	34.4	58	2	33	36
APR	52.9	26.9	39.9	62	17	38	38
MAY	64.7	33.6	49.2	83	21	40	44
JUN	74.8	40.6	57.7	89	32	55	58
JUL	85.4	38.4	61.9	103	31	73	58
AUG	92.6	37.3	65.0	102	27	73	57
SEP	80.8	35.4	58.1	95	22	51	56
OCT	58.5	29.5	44.3	79	17	44	46
NOV	45.7	23.1	34.4	63	3	29	37
DEC	32.9	18.3	25.6	45	-5	16	37
YEAR	59.7	29.6	44.6	103	-5	16	58

HILLTOP NEAR SUBALPINE FIR MEADOW
(Halfway between Troy and Deary)
Elev. 2865 feet
Lat. 46°46'N., Long. 116°39'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	37.3	28.9	33.1	50	17	28	39
FEB	41.8	29.0	35.4	55	18	30	38
MAR	43.2	29.2	36.2	52	17	31	41
APR	49.4e	32.4e	40.9e	59	25e	36	36
MAY	61.6	40.0	50.8	80	28	38	51
JUN	72.9	50.4	61.6	87	42	56	60
JUL	85.3	54.4	69.9	100	46	73	66
AUG	90.5	57.9	74.2	100	46	74	68
SEP	-	-	-	93	-	51	61
OCT	-	-	-	-	-	-	-
NOV	-	-	-	-	-	-	-
DEC	-	-	-	-	1	-	-
YEAR	-	-	-	100	1	-	-

ONE MILE SOUTH OF GIANT WHITE PINES = = = = = PRECIPITATION ONLY
(6 MILES NNE OF HARVARD, IDAHO)
Elev. 2880 feet
Lat. 46°59'N., Long. 116°40'W.

January	7.15	May	2.13	September	0.70
February	1.90	June	1.98	October	4.02
March	3.40	July	0.07	November	2.20
April	2.19	August	Te	December	4.18+

+December precipitation may be about 0.15 inch greater than shown on this record (near Giant White Pines).

YEAR 29.92

LEWISTON, IDAHO - AIRPORT
(U. S. Weather Bureau Office)
Elev. 1415 feet
Lat. 46°23'N., Long. 117°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.	Precip. Month Total
JAN	45.5	34.3	39.9	58	23	32	44	1.28
FEB	50.4	33.2	41.8	63	25	42	45	0.29
MAR	51.4	33.5	42.4	64	22	41	46	1.15
APR	56.9	36.8	46.8	68	29	45	44	1.66
MAY	68.5	44.7	56.6	88	32	50	57	1.17
JUN	81.3	55.3	68.3	95	46	67	65	1.93
JUL	92.4	59.7	76.0	110	52	82	69	0.03
AUG	96.3	62.1	79.7	106	50	82	72	T
SEP	84.4	55.3	69.9	101	42	61	67	0.59
OCT	64.2	43.8	54.0	77	33	52	54	1.67
NOV	48.4	34.2	41.3	60	19	34	50	0.39
DEC	40.7	27.6	34.2	52	6	24	43	1.46
YEAR	65.0	43.4	54.2	110	6	24	72	11.62

LEWISTON, IDAHO - DOWNTOWN
(Lewiston Morning Tribune Office)
Elev. 760 feet
Lat. 46°26'N., Long. 117°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.
JAN	47.1	35.6	41.4	58	24	35	45
FEB	52.4	33.9	43.2	64	26	44	44
MAR	54.5	35.8	45.2	69	25	44	47
APR	60.5	38.5	49.4	70	31	48	46
MAY	71.7	44.6	58.2	93	33	53	54
JUN	85.0	54.1	69.6	100	45	70	64
JUL	96.0	60.7	78.4	114	50	86	78
AUG	98.2	60.0	79.1	108	50	84	70
SEP	87.2	53.6	70.4	103	40	73	71
OCT	66.5	44.2	55.4	81	35	56	51
NOV	51.0	35.1	43.0	63	19	38	53
DEC	41.4	29.0	35.2	54	9	27	41
YEAR	67.6	43.7	55.6	114	9	27	78

CRATER PEAK, IDAHO
Elev. 6400 feet
Lat. 47°3'N., Long. 115°59'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-	-
MAY	-	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-	-
JUL	-	-	-	-	-	-	-	-
AUG	73.6	54.9	64.2	86	36	50	66	0.03
SEP	63.1	46.3	54.7	81	30	35	63	1.36e
OCT	-	-	-	-	-	-	-	-
NOV	-	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-	-
YEAR	-	-	-	-	-	-	-	-

FREEZEOUT MOUNTAIN, IDAHO
Elev. 6000 feet
Lat. 47°1'N., Long. 116°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.
JAN	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-
MAY	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-
JUL	-	-	-	-	-	-	-
AUG	-	-	-	-	-	-	-
SEP	64.7e	48.7e	56.7e	-	30	36	-
OCT	-	-	-	-	-	-	-
NOV	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-
YEAR	-	-	-	-	-	-	-

e = estimated

Notes relating to relative humidity records on the following page (page 6):

*Instrument used at Bovill from August through December believed to register at least 5% too high at the time of the daily minimum. The same is true of several other instruments during the driest summer months of July, August, and September. South Palouse Flat instrument probably averaged more than 5% too high at daily minimum from August onward.

AVERAGE RELATIVE HUMIDITIES - PER CENT

	Ave. Daily	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Wawawai	Max.	93	88e	95	93	92	94	75	79	81	88e	90	94	88
Snake R.	Min.	59	48e	47	42	39	34	25	24	29	41e	60	65	43
Canyon	Mean	76	68e	71	68	66	64	50	52	55	64e	75	80	66
Wawawai	Max.	89	82	85	86	78	80	57	47	-	-	-	-	-
Canyon	Min.	60	53	51	49	44	36	25	20	-	-	-	-	-
(3 mi.SE)	Mean	74	68	68	68	61	58	41	34	-	-	-	-	-
Ridge above	Max.	93	88	88	92	86	84	55	41	61	81	92	94	80
Wawawai	Min.	70	59	54	54	49	40	27	23	28	43	62	73	48
(4 mi. SE)	Mean	82	74	71	73	68	62	41	32	45	62	77	84	64
S.Palouse	Max.	-	-	95	98	96	97	97	88	-	-	96e	96	-
Flat (1 mi.	Min.	-	-	57	49	46	44	31	30	-	-	62e	80	-
S. of Moscow)	Mean	-	-	76	74	71	70	64	59	-	-	79e	88	-
Viola	Max.	95	86	91	90	78	82	58	39	58	84	89	95	79
Hill	Min.	75	61	58	50	46	44	30	22	31	49	62	80	51
	Mean	85	74	74	70	62	63	44	30	44	67	76	88	65
Harvard	Max.	99	99	98	99	99	99	99	98	98	99	99	98	99
Valley	Min.	72	60	56	49	46	48	31	25	31	48	57	71	50
Flat	Mean	86	79	77	74	72	74	65	62	65	74	78	84	74
Emida Ridge	Max.	99	93	96	95	94	89	68	58	72	93	95	97	87
(N-S Ski	Min.	83	64	60	50	51	44	33	29	33	54	65	78	54
Bowl)	Mean	91	78	78	72	72	66	50	44	52	74	80	88	70
Bald Mtn.	Max.	-	-	-	-	-	-	-	48e	68	94	-	-	-
Lookout	Min.	-	-	-	-	-	-	-	27e	38	66	-	-	-
	Mean	-	-	-	-	-	-	-	38e	53	80	-	-	-
Bovill	Max.	95	99	97	99	99	100	99	99	100	100	100	100	99
(2½ mi. N.)	Min.	77	62	57	48	41	42	29	28*	37*	60*	75*	88*	54*
	Mean	86	80	77	74	65	71	64	64	68	80	88	94	76
Subalpine	Max.	99	99	99	100	99	99	100	99	98	99	99	97	99
Fir Meadow	Min.	72	56	53	43	39	42	29	23	29	47	62	76	48
	Mean	86	78	76	72	69	70	64	61	64	73	80	86	74
Hilltop near	Max.	97	93	95	92e	91	93	76	60	-	-	-	-	-
Subalpine	Min.	74	62	55	44e	43	45	32	26	-	-	-	-	-
Fir Meadow	Mean	86	78	75	68e	67	69	54	43	-	-	-	-	-
Genesee	Max.	96	93	-	91	-	-	71	48	-	-	-	-	-
Hill	Min.	74	62	-	51	-	-	33	26	-	-	-	-	-
	Mean	85	78	-	71	-	-	52	37	-	-	-	-	-
Lewiston	Max.	89	86	88	90	80	81	54	46	68	83	93	90	79
Airport	Min.	63	50	46	45	34	32	16	12	24	41	62	68	41
(Wea.Bur.)	Mean	76	68	67	68	57	56	35	29	46	62	78	79	60
Crater	Max.	-	-	-	-	-	-	-	52	74	-	-	-	-
Peak	Min.	-	-	-	-	-	-	-	36	44	-	-	-	-
	Mean	-	-	-	-	-	-	-	44	59	-	-	-	-

*See note at bottom of preceding page (page 5)

1967

Station	Last 32°	First 32°	Growing Season
Wawawai, Washington (Snake River Canyon)	March 14 (33 May 1)	Nov. 2	231 (almost 183)
Wawawai Canyon (3 mi. SE of Wawawai)	April 28	Nov. 2 (e)	187 (e)
Wawawai Ridge	May 1	Oct. 26 (33 Oct. 24)	178 (almost 176)
Union Creek Flat	May 31	Sept. 13	104
South Palouse Flat (1 mi. S. of Moscow)	May 26	Aug. 25 (33 July 22)	90 (almost 56)
Moscow, Univ. of Idaho	May 1	Oct. 26 (33 Oct. 19)	178 (almost 171)
Viola Hill	May 12	Oct. 26	165
Potlatch Valley Flat	May 31	Aug. 25	85
Harvard Valley Flat	May 31	Aug. 25 (34 July 10)	85 (almost 39)
Emida Ridge	May 25	Oct. 15 (34 Sept. 12)	141 (almost 103)
Bald Mountain Lookout	May 31 (e)	Oct. 14 (33 Sept. 12)	135 (almost 103e)
Bovill ($2\frac{1}{2}$ mi. N.)	June 14	July 7	21
Subalpine Fir Meadow	June 3 (33 several times in June)	July 1	26 (almost 15)
Hilltop near above	May 25	-	-
Genesee Flat	May 26	Sept. 13 (34 July 15 & Aug. 25)	92 (almost 48)
Genesee Hill	May 12	-	-
Lewiston Airport	May 1	Nov. 2	192
Lewiston Downtown	April 22	Nov. 2	192
Crater Mountain	May 31 (e)	Sept. 11	102 (e)

1966 CLIMATOLOGICAL SUMMARY

WAWAWAI, SNAKE RIVER CANYON, WASHINGTON
Elevation 675 feet
Lat. 46°38'N., Long. 117°23'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	45.3	35.3	40.3	63	25	34	47	4.15
FEB	50.0	35.8	42.9	62	24	41	45	1.39
MAR	58.2	38.8	48.5	75	25	45	50	1.88
APR	66.5	42.9	54.7	78	27	52	54	0.49
MAY	76.6	49.1	62.8	101	39	56	61	0.61
JUN	80.2	55.0	67.6	98	43	59	67	0.75
JUL	90.0	59.1	74.6	100	50	65	72	0.78
AUG	90.5	60.0	75.2	110	50	69	69	0.50
SEP	84.4	57.5	71.0	102	46	65	71	0.46e
OCT	66.2	46.1	56.2	84	37	51	62	0.95
NOV	53.3	39.6	46.8	63	30	40	47	2.36
DEC	47.7	37.3	42.5	54	28	37	47	2.85
YEAR	67.4	46.4	56.9	110	24	34	72	17.17

WAWAWAI CANYON, WASHINGTON
(3 miles SE of Wawawai)
Elev. 1500 feet
Lat. 46°37'N., Long. 117°20'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	41.7	32.8	37.2	61	17	26	46
FEB	45.4	34.5	40.0	56	20	37	44
MAR	53.7	38.4	46.0	74	22	40	49
APR	61.8e	45.4e	53.6e	74	27	50	56
MAY	72.8	52.1	62.4	97	42	52	67
JUN	73.8	54.1	64.0	90	42	55	63
JUL	84.1	60.5	72.3	94	50	59	68
AUG	85.0	61.9	73.4	105	51	63	77
SEP	78.9	58.1	68.5	100	50	63	71
OCT	62.3	46.3	54.3	80	36	49	58
NOV	50.0	39.7	44.8	61	28	38	51
DEC	44.7	37.2	41.0	53	29	33	46
YEAR	62.8	46.8	54.8	105	17	26	77

RIDGE ABOVE WAWAWAI, WASHINGTON
(4 miles SE of Wawawai)
Elev. 2500'
Lat. 46°36'N., Long. 117°19'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	37.8	28.9	33.4	54	17	25	40	2.03
FEB	41.4	31.2	36.3	54	18	30	40	-
MAR	49.4e	33.4e	41.4e	69	20	35	46	-
APR	57.4	39.3	48.4	71	23	43	48	0.42e
MAY	68.6	47.7	58.2	92	34	46	64	0.51e
JUN	69.3	51.6	60.4	87	38	51	62	0.73
JUL	81.3	58.7	70.0	93	46	54	70	0.73
AUG	82.5	60.4	71.4	101	50	59e	72	0.80
SEP	76.5	55.2	65.8	96	44	58	67	-
OCT	58.4	42.2	50.3	78	33	45	54	1.01e
NOV	44.2	34.7	39.4	54	24	32	43	2.46+
DEC	39.8	32.5	36.2	49	25	30	41	2.96-
YEAR	58.9	43.0	51.0	101	17	25	72	-

UNION CREEK FLAT, WASHINGTON
(6 miles SSW of Pullman)
Elev. 2436'
Lat. 46°41'N., Long. 117°15'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	38.3	26.5	32.4	53	0	24	40
FEB	40.6	27.1	33.8	51	3	30	35
MAR	49.6	30.1	39.8	72	14	28	42
APR	56.8	31.7	44.2	70	10	43	42
MAY	68.1	39.3	53.7	92	29	48	58
JUN	69.4	42.7	56.0	85	30	50	57
JUL	80.9	45.2	63.0	91	34	58	60
AUG	82.1	45.9	64.0	99	36	60	60
SEP	77.2	45.1	61.2	96	32	59	58
OCT	59.5	35.6	47.6	78	24	44	53
NOV	46.9	32.3	39.6	60	23	37	42
DEC	40.0	31.1	35.6	48	19	29	42
YEAR	59.1	36.0	47.6	99	0	24	60

e = estimated

MOSCOW - UNIVERSITY OF IDAHO
Elev. 2610 feet
Lat. 46°44'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	36.6	28.4	32.5	50	9	21	39	4.00
FEB	39.6	28.0	33.8	49	6	30	38	1.25
MAR	48.8	32.2	40.5	72	18	33	44	1.87
APR	57.5	35.0	46.2	73	17	43	46	0.34e
MAY	69.1	43.4	56.2	93	33	48	60	0.61
JUN	69.3	47.5	58.4	88	38	50	59	1.13
JUL	79.8	50.7	65.2	92	43	56	61	0.53
AUG	81.0	52.5	66.8	101	40	60	68	0.39
SEP	76.7	50.6	63.6	93	42	59	63	0.08
OCT	56.9	39.2	48.0	76	29	40	52	1.13
NOV	45.2	34.6	39.9	55	23	34	44	3.12
DEC	38.8	32.3	35.6	46	23	30	43	2.81
YEAR	58.3	39.5	48.9	101	6	21	68	17.26

VIOLA HILL, IDAHO
(4 miles N. of Moscow)
Elev. 3150 feet
Lat. 46°47'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	33.8	26.5	30.2	50	11	18	36
FEB	36.6	28.8	32.7	48	16	26	38
MAR	46.0e	32.7e	39.4e	68	19	31	48
APR	54.8	36.3	45.6	68	18	41e	50
MAY	66.3	46.9	56.6	90	32	45	66
JUN	66.5	49.1	57.8	84	34	49	62
JUL	78.9	57.1	68.0	91	42	52	68
AUG	80.2	58.9	69.6	97	47	55	74
SEP	75.0	55.1	65.0	92	44	56	66
OCT	54.1	40.1	47.1	76	28	38	55
NOV	42.9	34.3	38.6	55	21	30	44
DEC	37.5	31.0	34.2	47	22	29	42
YEAR	56.0	41.4	48.7	97	11	18	74

SOUTH FORK PALOUSE RIVER
VALLEY FLAT
(1 mile S. of Moscow)
Elev. 2540 feet
Lat. 46°43'N., Long. 117°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	37.6	27.4	32.5	51	-4	23	39	3.32
FEB	41.0	26.4	33.7	52	-6	30	38	-
MAR	49.9	30.5	40.2	73	13	36	43	-
APR	57.9	31.4	44.6	72	10	45	46	0.47e
MAY	68.9	37.8	53.4	92	25	49	59	0.67
JUN	70.2	42.5	56.3	88	31	49	54	1.01
JUL	81.1	42.7	61.9	92	31	58	58	0.61
AUG	82.5	43.6	63.0	99	30	60	57	0.43
SEP	76.9	41.7	59.3	96	31	58	52	0.20e
OCT	56.6	30.7	43.6	76	13	40	45	1.32
NOV	44.3	29.3	36.8	56	14	28	42	2.87
DEC	39.8	31.8	35.8	49	16	31	44	-
YEAR	58.9	34.6	46.8	99	-6	23	59	-

POTLATCH VALLEY FLAT, IDAHO
(1 mile E. of Potlatch)
Elev. 2510 feet
Lat. 46°54'N., Long. 116°53'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	38.0	26.2	32.1	55	-6	25	38	3.32
FEB	41.4	27.1	34.2	55	-5	31	35	-
MAR	49.5	28.4	39.0	71	9	34	41	-
APR	56.7	30.5	43.6	72	12	44	45	0.47e
MAY	68.3	36.9	52.6	93	25	50	49	0.67
JUN	69.0	40.6	54.8	86	30	46	51	1.01
JUL	80.5	42.1	61.3	92	30	56	56	0.61
AUG	82.2	41.0	61.6	102	31	59	59	0.43
SEP	78.1	41.3	59.7	96	32	59	53	0.20e
OCT	58.9	33.9	46.4	78	19	40	51	1.32
NOV	47.0	32.0	39.5	62	21	34	48	2.87
DEC	40.0	32.1	36.0	49	22	30	44	-
YEAR	59.1	34.3	46.7	102	-6	25	59	-

e = estimated

HARVARD VALLEY FLAT, IDAHO
(1¼ miles NE of Harvard)
Elev. 2590 feet
Lat. 46°55'N., Long. 116°42'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	36.9	22.3	29.6	51	-7	24	35	5.67
FEB	40.3	19.3	29.8	56	-8	-	33	1.24
MAR	49.6e	23.5e	36.6e	72	2	-	38	2.28e
APR	57.0	27.8e	42.4	73	12	44	46	0.61
MAY	68.0	34.2	51.1	91	22	48	48	0.79
JUN	68.5	38.0	53.2	88	30	45e	48	1.65
JUL	80.8	40.1	60.4	91	30	55	53	0.60
AUG	82.1	38.6	60.3	101	29	59	58	0.59
SEP	77.8	38.3	58.0	95	30	60	47	0.49
OCT	57.7	26.7	42.2	78	14	34	43	1.48
NOV	45.8	26.0	35.9	60	12	31	45	3.62
DEC	40.2	26.7	33.4	49	12	30e	38	4.22
YEAR	58.7	30.1	44.4	101	-8	24	58	23.24

EMIDA RIDGE, IDAHO
(11 miles NNE of Harvard)
(Near N-S Ski Bowl)
Elev. 3700 feet
Lat. 47°4'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	31.6e	23.5e	27.6e	43	7	20	33	-
FEB	36.9	25.4	31.2	56	14	26	40	-
MAR	45.0e	28.4e	36.7e	-	9	28	-	-
APR	52.3e	33.7e	43.0e	68	18	39	45	-
MAY	65.1	42.5	53.8	91	28	42	59	1.31
JUN	63.7	44.2	54.0	84	32	39	55	1.85
JUL	76.2e	50.4e	63.3e	88	39	52	65	1.35
AUG	76.8	54.2	65.5	96	41	55	70	0.83
SEP	72.8	50.6	61.7	92	42	53	63	0.52
OCT	53.6	36.7	45.2	74	26	34	49	2.24
NOV	40.1	29.4	34.8	58	17	26	40	4.92
DEC	32.6	25.6	29.1	42	16	21	36	5.65e
YEAR	53.9	37.0	45.4	96	7	20	70	-

BALD MOUNTAIN, IDAHO
(11 miles NE of Harvard)
Elev. 5330 feet
Lat. 47°2'N., Long. 116°34'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-	-
MAY	-	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-	-
JUL	-	-	-	81	-	-	62	0.65
AUG	70.0	49.5	59.8	88	35	46	68	1.23
SEP	65.6	47.0	56.3	85	35	47	64	0.53
OCT	45.8	32.9	39.4	68	20	25	50	2.48
NOV	-	-	-	55	14e	23	37	-
DEC	-	-	-	38	12	-	-	-
YEAR	-	-	-	88	-	-	68	-

2½ MILES N. OF BOVILL, IDAHO
(at Purdue Creek)
Elev. 2880 feet
Lat. 46°3'N., Long. 116°23'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	34.6	17.9	26.2	44	-16	22	32	7.55
FEB	38.9	15.6	27.2	54	-18	28	31	2.18
MAR	46.1	18.0	32.0	67	-9	30	33	3.7
APR	54.6	24.3	39.4	70	10	39	36	0.5
MAY	68.2	31.7	50.0	92	20	48	45	1.0
JUN	67.0	37.3	52.2	85	29	43	50	1.9
JUL	80.4	38.3	59.4	91	28	53	48	0.1
AUG	81.1	36.3	58.7	100	27	57	56	0.6
SEP	76.8	36.4	56.6	94	23	57	50	0.4
OCT	55.7	26.5	41.1	76	14	33	45	2.1
NOV	42.8	26.1	34.4	58	10	30	39	5.4
DEC	34.9	25.5	30.2	43	6	27	35	4.9
YEAR	56.8	27.8	42.3	100	-18	22	56	30.8

ONE MILE SOUTH OF GIANT WHITE PINES
(6 MILES NNE OF HARVARD, IDAHO)
Elev. 2880 feet
Lat. 46°59'N., Long. 116°40'W.

e = estimated

PRECIPITATION ONLY

January	6.22	August	0.8
February	2.05	September	0.5
March	2.50	October	1.4
April	0.59e	November	4.5
May	1.05	December	4.9
June	1.82		

GENESEE FLAT, IDAHO
(½ mile NE. of Genesee)
Elev. 2690 feet
Lat. 46°32'N., Long. 116°54'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-
APR	56.5	31.5	44.0	71	13	42	46
MAY	67.7	37.4	52.6	91	23	47	58
JUN	68.2	42.4	55.3	84	31	46	55
JUL	80.6	43.5	62.0	92	31	58	61
AUG	81.7	43.9	62.8	102	30	55	59
SEP	76.9	42.2	59.6	93	32	59	57
OCT	57.4	33.0	45.2	77	18	37	51
NOV	45.6	31.9	38.8	58	22	34	44
DEC	38.9	30.2	34.6	46	17	29	41
YEAR	-	-	-	102	-	-	61

GENESEE HILL, IDAHO
(3 miles ENE. of Genesee)
Elev. 2900 feet
Lat. 46°32'N., Long. 116°52'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-
APR	56.8	37.2	47.0	72	21	42	49
MAY	-	-	-	-	-	-	-
JUN	67.6	47.0	57.3	84	34	45	56
JUL	79.3	53.4	66.4	91	42	54	61
AUG	80.5	54.6	67.6	99	42	55	67
SEP	74.7	51.6	63.2	91	43	57	64
OCT	55.0	38.2	46.6	74	50	38	50
NOV	44.2	33.3	38.8	56	24	33	42
DEC	37.1	29.8	33.4	44	19	27	39
YEAR	-	-	-	99	-	-	67

SUBALPINE FIR MEADOW, IDAHO
(Halfway between Troy and Deary)
Elev. 2635 feet
Lat. 46°46'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	38.5	19.3	28.9	49	-10	24	34
FEB	43.3	16.1	29.7	57	-5	35	32
MAR	49.8	22.2	36.0	72	1	35	38
APR	-	-	-	75	9	42	-
MAY	70.0	31.4	50.7	94	18	49	45
JUN	-	-	-	86	28	-	-
JUL	-	-	-	93	29	-	-
AUG	83.5	37.1	60.3	102	28	58	59
SEP	80.0	38.0	59.0	97	24	63	51
OCT	58.8	26.2	42.5	79	14	35	46
NOV	-	-	-	60	12	-	44
DEC	39.4	25.7	34.6	47	7	29	35e
YEAR	-	-	-	102	-10	24	59

HILLTOP NEAR SUBALPINE FIR MEADOW
(Halfway between Troy and Deary)
Elev. 2865 feet
Lat. 46°46'N., Long. 116°39'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	37.6e	23.3e	30.4e	46	2	24e	32e
FEB	38.2	25.0	31.6	52	8	28	33
MAR	45.9	28.2	37.0	70	13	31	42
APR	54.7	33.6	44.2	70	21	40	44
MAY	67.7	41.8	54.8	92	32	47	54
JUN	-	-	-	-	-	-	-
JUL	-	-	-	93	40	52	61
AUG	81.8	52.3	67.0	99	39	56	70
SEP	77.1	50.6	63.8	95	41	60	62
OCT	56.4	36.7	46.6	77	51	34	51
NOV	44.3	32.1	38.2	58	23	32	44
DEC	37.7	29.6	33.6	46	18	28	40
YEAR	-	-	-	99	2	24e	70

MOSCOW MOUNTAIN
Elev. 4700 feet
Lat. 46°48'N., Long. 116°51'W.

Record provided by Alan Robertson, c/o Engineering Experiment Station, Univ. of Idaho.

e = estimated

PRECIPITATION ONLY

January	9.12e	August	0.81e
February	4.47e	September	0.16
March	5.00	October	2.61
April	1.14	November	5.75
May	1.39	December	7.32
June	2.15		
July	0.84	YEAR	40.71

LEWISTON, IDAHO - AIRPORT
(U. S. Weather Bureau Office)
Elev. 1415 feet
Lat. 46°23'N., Long. 117°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	42.2	30.1	36.2	52	16	28	41	1.43
FEB	45.6	30.3	38.0	57	18	34	40	0.71
MAR	54.5	33.5	44.0	73	19	43	48	0.97
APR	63.3	38.2	50.8	76	20	49	51	0.31
MAY	75.5	47.5	61.5	96	36	54	56	0.31
JUN	76.9	51.9	64.4	93	36	57	64	0.68
JUL	87.7	57.7	72.7	98	46	62	70	0.28
AUG	80.3	57.9	73.1	106	45	64	68	0.48
SEP	82.6	55.3	69.0	99	44	71	66	0.22
OCT	63.5	42.3	52.9	80	30	48	55	0.97
NOV	50.2	36.5	43.4	62	27	37	44	1.76
DEC	45.5	34.8	40.2	52	26	36	44	1.70
YEAR	64.0	43.0	53.5	106	16	28	70	9.82

LEWISTON, IDAHO - DOWNTOWN
(Lewiston Morning Tribune Office)
Elev. 760 feet
Lat. 46°26'N., Long. 117°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	44.5	30.9	37.7	55	17	30	42	1.43
FEB	48.9	31.3	40.1	61	23	36	44	0.71
MAR	57.3	34.5	45.9	77	20	43	48	0.97
APR	66.4	39.0	52.7	80	23	53	53	0.31
MAY	78.8	46.9	62.8	100	35	57	57	0.31
JUN	80.3	53.5	66.9	97	41	59	66	0.68
JUL	91.3	58.4	74.8	102	48	66e	71	0.28
AUG	91.5	57.7	74.6	109	48	68	69	0.48
SEP	86.1	55.5	70.8	104	43	71	66	0.22
OCT	65.8	41.7	53.8	83	32	48	53	0.97
NOV	53.1	36.2	44.6	65	24	42	45	1.76
DEC	47.4	35.9	41.6	55	28	40	45	1.70
YEAR	67.6	43.5	55.6	109	17	30	71	9.82

FREEZEOUT MOUNTAIN, IDAHO
Estimated elev. 5950'
Lat. 47°1'N., Long. 116°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-	-
MAY	-	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-	-
JUL	-	-	-	78	-	-	59	-
AUG	-	-	-	86	34	-	-	1.80
SEP	62.9	46.1	54.5	78	36	44	61	0.60
OCT	-	-	-	60	18	22e	46	4.68e
NOV	-	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-	-
YEAR	-	-	-	86	-	-	-	-

e = estimated

AVERAGE RELATIVE HUMIDITIES - PER CENT

	Ave. Daily	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Wawawai,	Max.	83	90	90	86	87	80	74	71	81	85	93	94	84
Snake R.	Min.	55	51	40	34	31	31	27	30	32	41	58	62	41
Canyon	Mean	69	70	65	60	59	56	50	50	56	63	76	78	62
Wawawai	Max.	86	83	80	69e	-	-	53	-	-	-	90	86	-
Canyon	Min.	62	54	45	38e	-	-	28	-	-	-	65	65	-
(3 mi.SE)	Mean	74	68	62	54e	-	-	40	-	-	-	78	76	-
Ridge above	Max.	95	91	85e	74	68	68	53e	51	62e	83e	92	91	76e
Wawawai	Min.	73	63	46e	41	35	37	28e	30	33e	44e	68	71	47e
(4 mi. SE)	Mean	84	77	66e	58	52	52	40e	40	48e	64e	80	81	62e
S.Palouse	Max.	96	95	96	94	95	97	97	88	91	92	97	94	94
Flat (1 mi.	Min.	72	68	50	39	37	42	33	34	38	48	69	77	51
S of Moscow)	Mean	84	82	73	66	66	70	65	61	64	70	83	86	72
Viola	Max.	96	93	88e	80	70e	80	65	60	70	83	94	93	81
Hill	Min.	76	68	53e	40	36e	42	32	31	34	46	68	77	50
	Mean.	86	80	70e	60	53e	61	48	46	52	64	81	85	66
Harvard	Max.	99e	99e	99	98	97	99	99	98	99	99	99	99	99
Valley Flat	Min.	74e	62e	44	34	31	39	33	34	38	50	71	79	49
	Mean.	86e	80e	72	66	64	69	66	66	68	74	85	89	74
Emida Ridge	Max.	98e	97	92	84	77	86	75	74	81	87	97	100	87
(N-S Ski	Min.	85e	68	54	43	36	46	36	37	40	50	74	89	55
Bowl)	Mean	92e	82	73	64	56	66	56	56	60	68	86	94	71
Bald Mtn.	Max.	-	-	-	-	-	-	-	70	77	89	-	-	-
Lookout	Min.	-	-	-	-	-	-	-	44	47	62	-	-	-
	Mean	-	-	-	-	-	-	-	57	62	76	-	-	-
Bovill	Max.	98	98	99	99	99e	99	99	99	99	99	100	99	99
(2½ mi. N)	Min.	72	64	52	39	36e	43	33	30	35	48	75	88	51
	Mean	85	81	76	69	62e	71	66	64	66	74	88	94	75
Subalpine	Max.	98e	98	99	-	98	-	-	-	-	-	-	-	-
Fir Meadow	Min.	72e	62	50	-	33	-	-	-	-	-	-	-	-
	Mean	85e	80	74	-	66	-	-	-	-	-	-	-	-
Hilltop near	Max.	-	-	-	86	79	-	-	71	84	-	97	97	-
Subalpine	Min.	-	-	-	42	38	-	-	30	34	-	64	71	-
Fir Meadow	Mean	-	-	-	64	58	-	-	50	59	-	80	84	-
Genesee	Max.	-	-	-	81	-	86	71	66	-	87	95	95	-
Hill	Min.	-	-	-	42	-	44	36	34	-	48	69	76	-
	Mean	-	-	-	62	-	65	54	50	-	68	82	86	-
Lewiston	Max.	89	80	88	76	67	72	61	58	71	86	94	88	78
Airport	Min.	61	56	42	29	23	30	24	22	29	44	64	65	41
(Weather Bureau)	Mean	75	68	65	52	45	51	42	40	50	65	69	76	60

GROWING SEASON - LENGTH OF PERIOD BETWEEN LAST AND FIRST FREEZING TEMPERATURES

1966

Station	Last 32°	First 32°	Growing Season
Wawawai, Washington (Snake River Canyon)	Apr. 19	Nov. 8	210 days
Wawawai Canyon (3 mi. SE of Wawawai)	Apr. 19	Nov. 8	210
Wawawai Ridge	Apr. 23	Nov. 8 (33 Oct. 14)	206 (almost 184)
Union Creek Flat	June 1	Sept. 30	121
South Palouse Flat (1 mi. S. of Moscow)	June 30	July 21	20
Moscow, Univ. of Idaho	Apr. 26 (33 May 23)	Oct. 9 (34 Oct. 3 when actual frost)	166 (really 134)
Viola Hill	Apr. 27 (33 May 23)	Oct. 13	169 (really 142)
Potlatch Valley Flat	June 30	July 21	20
Harvard Valley Flat	June 30	July 2	20
Emida Ridge	June 4	Oct. 9	126
Bald Mountain Lookout	July 3 (e)	Oct. 2	91 (e)
Bovill (2½ mi. N.)	June 30	July 21	20
Subalpine Fir Meadow	June 30	July 21	20
Hilltop near Subalpine Fir Meadow	May 22 (33e June 1)	Oct. 3	133 (almost 123)
Genesee Flat	June 30	July 26 (33 July 21)	25 (almost 20)
Genesee Hill	Apr. 28 (34 Jun. 1)	Oct. 13 (33 Oct. 9)	168 (almost 130)
Lewiston Airport	April 19 (33 April 28)	Oct. 14 (34 Oct. 9)	178 (almost 164)
Lewiston Downtown	April 28	Oct. 14	169

(e) estimated

WAWAWAI, SNAKE RIVER CANYON, WASHINGTON
Elevation 675 feet
Lat. 46°38' N., Long. 117°23'W

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	51.5e	35.2e	43.8e	66	24	37	47	-
MAR	56.0	32.7	44.4	79	18	39	44	0.68
APR	66.5	45.1	55.8	82	34	51	63	2.48
MAY	72.5	47.4	60.0	89	38	57	59	0.60
JUN	81.2	53.3	67.2	95	45	61	63	-
JUL	91.1	61.2	76.2	107	51	62	72	0.74
AUG	87.7	61.2	74.4	108	45	68	77	0.66
SEP	75.5	49.4	62.4	90	32	52	59	0.19
OCT	71.8e	47.8e	59.8e	86	36	58	57	-
NOV.	54.5	42.1	48.4	68	32	40	52	1.82
DEC.	45.4	34.8	40.1	65	22	31	48	0.58
YEAR	-	-	-	108	18	31	77	-

WAWAWAI CANYON, WASHINGTON
(3 miles SE of Wawawai)
Elev. 1500 feet
Lat. 46°37'N., Long. 117°20'W

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	61.6	46.2	54.6	76	36	47	62	-
MAY	66.1	47.3	56.7	85	33	50	63	-
JUN	76.1	54.5	65.3	91	47	57	63	-
JUL	87.4	63.4	74.4	102	52	60	75	-
AUG	83.6	62.7	73.2	104	48	65	79	-
SEP	70.8	50.3	60.6	85	33	55	62	-
OCT	68.5	49.7	59.1	82	35	56	59	-
NOV	51.9	40.6	46.2	66	25	36	50	-
DEC	41.9	32.5	37.2	62	16	24	50	-
YEAR	-	-	-	104	-	24	79	-

RIDGE ABOVE WAWAWAI, WASHINGTON
(4 miles SE of Wawawai)
Elev. 2500'
Lat. 46°36'N., Long. 117°19'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-	-
MAY	62.6	44.1	53.4	80	30	47	60	0.76
JUN	70.9	52.3	61.6	86	43	51	63	2.29
JUL	-	-	-	-	-	-	-	0.72
AUG	80.5	58.9	69.7	102	44	61	73	0.75
SEP	66.8	47.0	56.9	82	30	50	58	0.26
OCT	64.9	46.0	55.4	79	32	50	55	-
NOV	46.7	37.5	42.1	60	29	34	51	1.47+
DEC	36.7	28.0	32.4	55	15	24	46	0.86
YEAR	-	-	-	102	-	24	73	-

UNION CREEK FLAT, WASHINGTON
(6 miles SSW of Pullman)
Elev. 2436'
Lat. 46°41'N., Long. 117°15'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-	-
MAY	63.8	38.2	51.0	82	26	49	50	-
JUN	72.5	43.4	56.0	86	33	54	57	-
JUL	82.6	48.2	65.4	96	37	56	61	-
AUG	80.4	48.5	64.4	100	30	62	64	-
SEP	68.0	36.6	52.3	82	19	50	51	-
OCT	67.5	37.3	52.4	83	22	52	49	-
NOV	49.3	32.1	40.7	69	20	34	45	-
DEC	38.4	25.2	31.8	54	10	26	44	-
YEAR	-	-	-	100	-	26	64	-

e = estimation necessary due to missing data.

MOSCOW, - UNIVERSITY OF IDAHO
Elev. 2610 feet
Lat. 46°44'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	36.6	26.9	31.8	50	12	27	40	3.41
FEB	39.8	30.3	35.0	55	19	28	41	1.51
MAR	45.3	27.1	36.7	68	11	27	40	1.01
APR	57.4	38.9	48.2	75	30	36	55	2.65
MAY	62.9	40.7	51.8	82	29	47	56	0.93
JUN	71.4	47.5	59.4	86	41	53	58	1.78
JUL	82.4	55.7	69.0	96	47	55	65	0.38
AUG	78.8	55.3	67.0	100	39	59	71	1.06
SEP	66.1	42.8	54.4	78	27	51	54	0.27
OCT	64.7	43.8	54.2	80	27	50	54	0.39
NOV	47.3	36.7	42.0	64	25	33	47	1.82
DEC	37.1	28.9	33.0	51	17	27	42	0.86
YEAR	57.5	39.6	48.6	100	11	27	71	16.07

VIOLA HILL, IDAHO
(4 miles N of Moscow)
Elev. 3150 feet
Lat. 46°47'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	34.4	27.2	30.8	47	17	25	37	-
FEB	38.2	30.0	34.1	53	20	27	41	-
MAR	43.0	29.2	36.1	65	11	25	46	-
APR	54.3	39.9	47.1	69	28	32	56	-
MAY	60.4	43.3	51.8	80	27	44	61	-
JUN	68.1	50.9	59.5	83	38	49	61	-
JUL	79.5	59.8	69.6	93	45	52	78	-
AUG	76.5	58.8	67.6	97	42	55	77	-
SEP	63.5	45.8	54.6	77	31	45	55	-
OCT	63.0	47.5	55.2	79	32	46	58	-
NOV	45.8	35.9	40.8	65	27	33	49	-
DEC	35.1	28.0	31.6	51	15	24	44	-
YEAR	55.2	41.4	48.3	97	11	24	78	-

GENESEE FLAT, IDAHO
(½ mile NE of Genesee)
Elev. 2690 feet
Lat. 46°32'N., Long. 116°54'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-	-
MAY	61.9e	37.1e	49.5e	82	-	-	54	-
JUN	71.2	41.4	56.3	86	28	52	57	-
JUL	80.9	47.2	64.0	95	34	55	63	-
AUG	79.8	47.7	63.8	99	27	60	62	-
SEP	-	-	-	-	-	-	-	-
OCT	65.8	36.8	51.3	81	20	49	50	-
NOV	46.3	31.9	39.1	66	10	33	45	-
DEC	36.9	25.6	31.2	51	6	25	38	-
YEAR	-	-	-	99	-	60	63	-

POTLATCH VALLEY FLAT, IDA.
(1 mile E of Potlatch)
Elev. 2510 feet
Lat. 46°54'N., Long. 116°53'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	36.3	26.1	31.2	51	7	28	39	2.78
FEB	41.6	28.5	35.0	58	14	31	38	1.37
MAR	(45e)	(24e)	(34.5e)	68	8	-	-	0.78
APR	-	-	-	72	28	36	-	3.17
MAY	61.8e	36.1e	49.0e	80	27	-	51	1.43
JUN	70.6e	40.5e	56.6e	86	32	53	53	1.61
JUL	81.5	44.8	63.2	96	32	56	59	0.50
AUG	79.3e	46.3e	62.8e	99	30	58	61	2.28
SEP	66.0	34.3	50.2	78	21	50	51	0.77
OCT	66.9	35.8	51.4	83	20	48	49	0.46e
NOV	-	-	-	66	-	-	47	-
DEC	38.7	25.6	32.2	57	-2	26	39	0.96
YEAR	-	-	-	99	-2	26	61	-

e = estimation necessary due to missing data.

HARVARD VALLEY FLAT, IDAHO
(1¼ miles NE of Harvard)
Elev. 2590 feet
Lat. 46°55'N., Long. 116°42'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	35.8	23.0	29.4	49	8	26	38	4.92
FEB	41.0	24.2	32.6	57	8	29	35	2.69
MAR	46.2	18.4	32.3	69	1	27	30	0.94
APR	57.3	32.1	44.7	72	21	34	48	3.66
MAY	62.6	34.0	48.3	82	24	46	49	1.53
JUN	71.3	38.3	54.8	86	29	53	51	2.90
JUL	82.1	42.9	62.5	94	31	54	55	0.47
AUG	79.7	45.1	62.4	99	27	61	60	2.66
SEP	66.4	32.2	49.3	80	19	50	49	1.13
OCT	66.6	28.8	47.7	83	15	43	46	0.58
NOV.	47.6	27.2	37.4	67	8	32	45	2.00e
DEC	37.1e	20.3e	30.8e	50	0	-	34	1.17
YEAR	57.8	30.5	44.2	99	0	-	60	24.65e

EMIDA RIDGE, IDAHO
(11 miles NNE of Harvard)
(Near N-S Ski Bowl)
Elev. 3700 feet
Lat. 47°4'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	32.7	25.1	28.9	43	18	23	36	-
FEB	36.3	24.2	30.2	55	12	25	37	3.30
MAR	-	-	-	63	3	-	38	-
APR	52.2	35.7	44.0	70	22	37	50	5.31
MAY	58.4	39.5	49.0	80	28	40	56	2.05
JUN	66.7	47.9	57.3	85	35	52	60	2.78
JUL	76.9	54.7	65.8	89	42	52	65	0.47
AUG	73.7	53.5	63.6	91	36	51	70	3.00
SEP	60.5	40.2	50.4	74	25	43	51	1.24
OCT	62.7	43.1	52.9	81	27	40	55	0.67
NOV	42.9	33.1	38.0	67	23	30	43	2.51
DEC	32.9	24.8	28.8	48	14	20	38	-
YEAR	53.1e	36.8e	45.0e	91	3	20	70	-

BALD MOUNTAIN, IDAHO
(11 miles NE of Harvard)
Elev. 5330 feet
Lat. 47°2'N., Long. 116°34'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN.	-	-	-	-	-	-	-	-
FEB.	-	-	-	-	-	-	-	-
MAR.	-	-	-	-	-	-	-	-
APR.	-	-	-	-	-	-	-	-
MAY	-	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-	-
JUL	71.9	52.8	62.4	83	38	45	66	0.71
AUG	67.6	51.0	59.3	86	32	44	66	5.15
SEP	54.0	37.6	45.8	67	19	37	50	1.53+
OCT	55.1e	41.2e	48.2e	72	24	34	53	1.16
NOV	-	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-	-
YEAR	-	-	-	86	-	-	66	-

2½ MILES N. OF BOVILL, IDAHO
(at Purdue Creek)
Elev. 2880 feet
Lat. 46° 3'N., Long. 116°23'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	66	-	-	-	-
APR	56.1	30.0	43.0	70	20	32	41	5.42
MAY	62.5	31.9	47.2	80	22	45	47	1.89
JUN	71.0	36.3	53.6	86	28	53	52	2.56
JUL	81.8	40.5	61.2	94	30	54e	51	0.73
AUG	77.2	43.6	60.4	97	25	55	58	3.02
SEP	64.4	30.2	47.2	77	19	50	46	1.05
OCT	64.0	29.1	46.6	80	17	44	46	0.97
NOV	45.4	26.8	36.1	61	4	30	43	-
DEC	33.4	19.1	26.2	48	-4	25	31	1.61
YEAR	-	-	-	97	-	-	58	-

ONE MILE SOUTH OF GIANT WHITE PINES
(6 MILES NNE OF HARVARD, IDAHO)
Elev. 2880 feet
Lat. 46°59'N., Long. 116°40'W.

e = estimation necessary because of missing records.

PRECIPITATION ONLY

January	4.92	August	2.84
February	3.54	September	1.17
March	0.98	October	0.66
April	4.51	November	3.12
May	1.79	December	1.55
June	2.72		
July	0.37	YEAR	28.17

SUBALPINE FIR MEADOW, IDAHO
(Halfway between Troy and Deary)
Elev. 2635 feet
Lat.46°46'N., Long.116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	36.2e	21.4e	28.8e	45	0	25	34	-
FEB	40.2	21.5	30.8	53	0	29	34	2.58
MAR	46.4	18.3	32.4	67	3	28	31	0.95
APR	57.7	32.3	45.0	75	21	36	46	4.25
MAY	-	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-	-
JUL	-	-	-	97	30	55	-	-
AUG	-	-	-	99	24	-	-	-
SEP	66.8	31.0	48.9	80	17	51	50	-
OCT	67.2	26.8	47.0	84	14	47	45	-
NOV	49.0	25.2	37.1	64	2	34	44	-
DEC	38.2	17.9	28.0	51	-1	26	30	-
YEAR	-	-	-	99	-1	25	-	-

HILLTOP NEAR SUBALPINE FIR MEADOW
(Halfway between Troy and Deary)
Elev. 2865 feet
Lat.46°46'N., Long.116°39'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	37.0e	26.9e	32.0e	51	14	26	35	-
FEB	-	-	-	56	12	-	-	-
MAR	44.4	23.8	34.1	67	6	26	35	-
APR	-	-	-	-	-	-	-	-
MAY	-	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-	-
JUL	-	-	-	93	-	-	70	-
AUG	-	-	-	98	33	-	-	-
SEP	64.7	40.7	52.7	77	25	48	50	-
OCT	65.2	42.1	53.6	82	26	46	51	-
NOV	46.2	33.5	39.9	64	22	33	45	-
DEC	36.2	25.9	31.0	52	14	26	38	-
YEAR	-	-	-	98	6	26	70	-

LEWISTON, IDAHO - AIRPORT
(U. S. Weather Bureau Office)
Elev. 1413 feet
Lat.46°23'N., Long.117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	38.8	29.2	34.0	50	12	30	41	2.99
FEB	47.9	32.3	40.1	64	21	35	44	0.40
MAR	51.9	28.6	40.2	73	12	36	41	0.54
APR	62.7	42.3	52.5	78	32	43	54	1.99
MAY	69.5	44.5	57.0	86	34	53	60	0.48
JUN	79.0	51.8	65.4	91	43	60	60	0.91
JUL	89.5	59.4	74.4	102	48	64	70	0.82
AUG	85.7	59.5	72.6	104	42	68	75	1.41
SEP	72.2	46.8	59.5	87	28	57	61	0.28
OCT	69.0	43.5	56.2	82	32	55	55	0.34
NOV	51.7	37.5	44.6	64	26	38	48	1.10
DEC	43.0	30.1	36.6	63	17	33	41	0.14
YEAR	63.4	42.1	52.8	104	12	30	75	11.40

LEWISTON, IDAHO - DOWNTOWN
(Lewiston Morning Tribune Office)
Elev. 760 feet
Lat.46°26'N., Long. 117°1'W.

Month	Temperature Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	42.4	29.2	35.8	54	13	35	42	-
FEB	50.2	31.1	40.6	66	19	37	42	-
MAR	54.8	27.7	41.2	77	13	38	41	-
APR	66.4	40.8	53.6	82	29	44	55	-
MAY	73.8	42.9	58.4	90	33	58	57	-
JUN	83.1	49.0	66.0	94	41	-	60	-
JUL	93.0	58.6	75.8	108	45	70	75	-
AUG	89.2	59.5	74.4	109	41	72	79	-
SEP	76.0	45.9	61.0	90	28	60	60	-
OCT	72.7	41.3	57.0	85	31	58	51	-
NOV	54.6	35.7	45.2	66	26	42	46	-
DEC	45.2	31.0	38.1	66	18	36	40	-
YEAR	66.8	41.1	54.0	109	13	35	79	-

e = estimation necessary due to missing data.

AVERAGE RELATIVE HUMIDITIES - PER CENT

	Ave. Daily	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Wawawai,	Max.	-	-	89	93	88	89	-	77	81	80	88	84	-
Snake R.	Min.	-	-	34	43	34	34	-	28	29	32	52	52	-
Canyon	Mean	-	-	62	68	61	62	-	52	55	56	70	68	-
Wawawai	Max.	-	-	-	-	-	69e	-	65	62	67	86	85	-
Canyon	Min.	-	-	-	-	-	37e	-	32	31	38	58	59	-
(3 mi SE)	Mean	-	-	-	-	-	53e	-	48	46	52	72	72	-
Ridge above	Max.	-	-	-	-	77	70	-	68	61	74	93	92	-
Wawawai	Min.	-	-	-	-	41	42	-	36	34	42	66	66	-
(4 mi SE)	Mean	-	-	-	-	59	56	-	52	48	58	80	79	-
S.Palouse	Max.	98*	8 -	-	-	-	-	-	-	-	-	96	93	-
Flat (1 mi	Min.	80*	-	-	-	-	-	-	-	-	-	66	64	-
S of Moscow)	Mean	89*	-	-	-	-	-	-	-	-	-	81	78	-
Genesee Flat	Max.	-	-	-	-	-	-	-	-	-	90	97	94	-
	Min.	-	-	-	-	-	-	-	-	-	42	60	66	-
	Mean	-	-	-	-	-	-	-	-	-	66	82	80	-
Viola Hill	Max.	98	94	71	89	80	74	67	73	73	69	93	90	81
	Min.	83	69	39	46	38	42	34	38	38	37	66	66	50
	Mean	90	82	55	68	59	58	50	56	56	53	80	78	66
Harvard	Max.	98	98	97	99	99	100	99	99	99	100	100	100	99
Valley Flat	Min.	78	57	36	44	37	37	29	35	35	36	67	67	46
	Mean	88	78	66	72	68	68	64	67	67	68	84	84	72
Emida Ridge	Max.	98	98	-	92	85	78e	79	85	89	86	99	96	89#
(N-S Ski	Min.	90	66	-	51	44	45e	39	46	47	47	79	77	56#
Bowl)	Mean	94	82	-	72	64	62e	59	66	68	66	89	86	72#
Bald	Max.	-	-	-	-	-	-	75	81	87	78	-	-	-
Mountain	Min.	-	-	-	-	-	-	43	54	54	55	-	-	-
Lookout	Mean	-	-	-	-	-	-	59	68	70	66	-	-	-
Bovill	Max.	-	-	-	99	-	-	-	-	-	100	100	98	-
(2½ mi. N)	Min.	-	-	-	46	-	-	-	-	-	41	75	92	-
	Mean	-	-	-	72	-	-	-	-	-	70	88	95	-
Lewiston	Max.	95	86	80	87	88	73	68	77	75	86	95	89	82
Airport	Min.	77	51	33	42	34	27	21	30	29	39	66	59	42
(Weather Bureau)	Mean	86	68	56	64	61	50	44	54	52	62	80	74	62

*College of Mines Building, Univ. of Idaho record, January

#Yearly average obtained after placing an estimate for March of 80% ave. daily max. and 45% ave. daily min. (based upon correlation with records at other stations)

MOSCOW, IDAHO
224 East 5th St.*
Elev. 2565 feet
Lat. 46°44'N., Long. 117° 0'W

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.	Precip. Month Total
JAN	36.4	26.8	31.6	52	13	28	39	4.36
FEB	39.7	26.2	33.0	48	17	33	36	0.47
MAR	43.8	30.1	37.0	67	19	33	47	2.01
APR	52.5	33.5	43.0	65	23	41	47	1.10
MAY	63.4	41.2	52.3	84	31	42	53	0.77
JUN	71.6	48.9	60.2	86	37	50	58	2.42
JUL	80.5	53.0	66.8	98	44	66	65	2.03
AUG	75.2	49.5	62.4	88	39	60	62	1.12
SEP	67.2	44.2	55.8	84	34	52	54	0.85
OCT	61.3	40.4	50.8	80	31	43	51	0.82
NOV	41.7	31.5	36.6	61	19	28	47	2.93
DEC	35.2	23.3	29.2	49	-15	-6	44	5.68
YEAR	55.7	37.4	46.6	98	-15	-6	65	24.56

VIOLA HILL, IDAHO
(4 miles N. of Moscow)
Elev. 3150 feet
Lat. 46°47'N., Long. 117°1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.
JAN	33.7	27.2	30.4	45	19	27	38
FEB	36.5	26.8	31.6	43	20	28	37
MAR	39.9	29.1	34.5	65	18	30	49
APR	49.6	34.7	42.2	63	25	37	46
MAY	59.6	42.7	51.2	81	30	42	58
JUN	66.7	50.3	58.5	81	39	53	60
JUL	76.3	57.9	67.1	94	47	61	73
AUG	73.3	53.6	63.4	89	43	58	65
SEP	65.0	48.1	56.6	81	39	48	55
OCT	59.2	43.4	51.3	81	34	40	57
NOV	38.6	30.4	34.5	57	20	27	48
DEC	32.3	22.5	27.4	49	-15	-8	40
YEAR	52.6	38.9	45.8	94	-15	-8	73

GENESEE FLAT, IDAHO
(½ mile NE of Genesee)
Elev. 2660 feet
Lat. 46°32'N., Long. 116°54'W.

Month	Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.
JAN	36.3	21.8	29.0	47	-2	26	34
FEB	39.1	19.3	29.2	46	3	32	34
MAR	44.4	26.2	35.3	68	11	34	42
APR	52.3	31.3	41.8	66	18	39	45
MAY	62.2	37.4	49.8	82	24	40	52
JUN	69.1	45.0	57.0	85	29	56	55
JUL	80.0	45.3	62.6	96	35	65	63
AUG	76.4	41.3	58.8	92	31	60	56
SEP	68.7	35.0	51.8	83	25	51	48
OCT	61.2	32.9	47.0	80	18	40	52
NOV	41.0	27.6	34.3	59	13	29	42
DEC	-	-	-	49	-23	-	-
YEAR	-	-	-	96	-23	-	63

GENESEE HILL, IDAHO
(3 miles E of Genesee)
Elev. 2900 feet
Lat. 46°32'N., Long. 116°52'W

Month	Ave. Max.	Ave. Min.	Mean Month	Extreme Low Mx.	Extreme Low Mn.	High Mx.	High Mn.
JAN	-	-	-	45	15	-	-
FEB	36.2	24.8	30.5	45	15	31	33
MAR	-	-	-	67	18	-	-
APR	-	-	-	66	25	38	47
MAY	-	-	-	80	30	-	54
JUN	67.7	49.1	58.4	84	41	54	58
JUL	78.8	55.5	67.2	96	43	64	68
AUG	76.2	52.2	64.2	92	43	59	62e
SEP	68.3	46.9	57.6	84	35	50e	51
OCT	-	-	-	77	31	-	51
NOV	-	-	-	57	19	-	-
DEC	-	-	-	-	-	-	-
YEAR	-	-	-	96	-	-	-

*Moscow record kept at College of Mines Building, Univ. of Idaho, (elev. 2610 feet) from September through December.

HARVARD VALLEY FLAT, IDAHO
(1¼ miles NE of Harvard)
Elev. 2590 feet
Lat.46°55'N., Long.116°42'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	34.7	18.7	26.7	44	-9	28	31	-
FEB	38.0	13.8	25.9	46	-5	29	30	-
MAR	42.9	23.8	33.4	68	11	32	33	-
APR	52.6	30.3	41.4	65	20	40	40	-
MAY	62.0	35.1	48.6	85	26	36	48	-
JUN	69.7	42.8	56.2	84	29	50	52	-
JUL	79.7	43.5	61.6	99	34	66	60	-
AUG	75.0	40.1	57.6	93	32	57	55	-
SEP	67.1	33.8	50.4	82	23	50	45	-
OCT	61.9	29.9	45.9	85	19	38	47	1.64
NOV	41.8	25.9	33.4	62	13	28	41	5.78
DEC	34.7	17.2	26.0	51	-28	-4	40	4.57
YEAR	55.0	29.6	42.3	99	-28	-4	60	-

GIANT WHITE PINE FOREST
(7 miles N. of Harvard, Idaho)
Elev. 2800 feet
Lat.47°0'N. Long.116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.
JAN	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-
APR	-	-	-	48	18	-	34e
MAY	53.7	34.1	43.9	75	28	34	48
JUN	-	-	-	80	33e	-	-
JUL	74.0	47.0	60.5	92	40	58	60
AUG	66.7	44.2	55.4	80	37	50	56
SEP	57.5	38.6	48.0	68	30	49	47
OCT	49.5	34.6	42.0	62	26	34	47
NOV	35.7	28.5	32.1	49	18	28	39
DEC	-	-	-	-	-	-	-
YEAR	-	-	-	92	-	-	-

EMIDA RIDGE, IDAHO
(11 miles NNE of Harvard)
(Near N-S Ski Bowl)
Elev. 3700 feet
Lat. 47°4'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	-	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-
APR	-	-	-	57	22	32	40	-
MAY	-	-	-	79	28	31	48	-
JUN	65.2	47.2	56.2	80	38	44	56	-
JUL	-	-	-	94	42	61	-	-
AUG	69.5	49.3	59.4	87	38	51	62	-
SEP	61.6	42.1	51.8	79	32	46	50	2.34
OCT	56.8	39.6	48.2	77	25	38	57	1.69
NOV	-	-	-	57	-	-	45	-
DEC	-	-	-	-	-	-	-	-
YEAR	-	-	-	94	-	-	-	-

BALD MOUNTAIN, IDAHO
(11 miles NE of Harvard)
Elev. 5330 feet
Lat. 47° 2'N., Long. 116°34'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme High Mx.	Extreme Low Mn.	Low Mx.	High Mn.
JAN	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-
APR	-	-	-	-	-	-	-
MAY	-	-	-	-	-	-	-
JUN	-	-	-	-	-	-	-
JUL	-	-	-	89	36	57	69
AUG	63.8e	45.0e	54.4e	82	32	-	56
SEP	54.9e	40.4e	47.6e	71	30	39	50
OCT	-	-	-	-	-	-	-
NOV	-	-	-	-	-	-	-
DEC	-	-	-	-	-	-	-
YEAR	-	-	-	89	-	-	69

e = estimated because of some missing records.

SUBALPINE FIR MEADOW, IDAHO
(Halfway between Troy and Deary)
Elev. 2635 feet
Lat. 46°46'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	-	-	-	-	-	-	-
FEB	-	-	-	-	-5	-	-
MAR	39.5	20.8	30.2	55	8	30	31
APR	50.4	28.6	39.5	63	17	37	40
MAY	61.1	34.7	47.9	84	23	36	46
JUN	69.0	41.7	55.5	83	28	49	49
JUL	78.6	43.3	61.0	95	35	64	62
AUG	75.9	38.3	57.1	92	29	54	52
SEP	68.2	31.3	49.8	82	20	50	48
OCT	61.1	25.5	43.3	81	15	40	42
NOV	39.4	23.0	31.2	57	6	28	39
DEC	-	-	-	-	-35	-5	36
YEAR	-	-	-	95	-35	-5	62

HILLTOP NEAR SUBALPINE FIR MEADOW
(Halfway between Troy and Deary)
Elev. 2865 feet
Lat. 46°46'N., Long. 116°39'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	-	-	-	-	-	-	-
FEB	-	-	-	-	-	-	-
MAR	40.7	26.8	33.8	65	13	30	42
APR	49.6	32.1	40.8	62	24	36	44
MAY	60.5	39.8	50.2	82	29	36	50
JUN	67.5	47.7	57.6	81	36	54	57
JUL	78.6	52.5	65.6	96	44	68	63
AUG	74.7	49.1	61.9	92	42	54	61
SEP	67.5	43.5	55.8	83	36	49	51
OCT	61.7	39.8	50.8	83	30	40	50
NOV	-	-	-	59	-	-	46
DEC	-	-	-	-	-16	-	-
YEAR	-	-	-	96	-16	-	63

LEWISTON, IDAHO - AIRPORT
(U. S. Weather Bureau Office)
Elev. 1413 feet
Lat. 46°23'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
JAN	43.3	31.3	37.3	58	22	36	42	0.49
FEB	46.4	28.3	37.4	53	19	39	39	0.21
MAR	51.5	32.9	42.2	76	23	39	47	0.63
APR	58.7	36.6	47.7	72	25	46	49	0.93
MAY	69.6	45.6	57.6	89	34	48	54	0.27
JUN	75.9	53.4	64.6	91	44	56	63	3.11
JUL	86.6	58.9	72.8	105	52	70	70	1.67
AUG	82.0	55.5	68.6	96	47	66	66	0.66
SEP	73.9	48.1	60.5	90	41	58	56	0.87
OCT	64.1	41.2	52.6	80	33	42	55	0.94
NOV	45.0	33.6	39.3	62	21	32	44	1.35
DEC	38.9	25.8	32.4	57	-11	5	43	3.28
YEAR	61.3	40.9	51.1	105	-11	5	70	14.81

LEWISTON, IDAHO - DOWNTOWN
(Lewiston Morning Tribune Office)
Elev. 760 feet
Lat. 46°26'N., Long. 117° 1'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
JAN	43.8	30.6	37.2	59	16	32	40
FEB	48.1	28.2	38.2	55	20	41	40
MAR	53.3	32.4	42.8	78	19	40	52
APR	63.8	39.2	51.5	75	28	50	50
MAY	73.8	46.2	60.0	93	36	50	58
JUN	80.1	53.1	66.6	93	44	64	61
JUL	90.8	59.6	75.2	109	53	74	71
AUG	85.7	56.1	70.9	99	47	69	68
SEP	77.4	46.5	62.0	92	38	60	57
OCT	67.7	38.4	53.0	83	30	45	51
NOV	47.4	33.6	40.5	65	20	35	48
DEC	40.5	25.5	33.0	58	-6	10	45
YEAR	64.4	40.8	52.6	109	-6	10	71

AVERAGE RELATIVE HUMIDITIES - PER CENT

	Ave. Daily	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Lewiston	Max.	80	80	75	77	71	82	70	73	80	88	93	92	80
Airport	Min.	52	43	39	34	28	36	26	26	29	45	66	67	41
(Weather Bureau)	Mean	66	62	57	56	49	59	48	50	54	66	80	80	60
Moscow, Univ.	Max.	-	-	-	-	-	-	-	-	-	-	98	98	-
of Idaho	Min.	-	-	-	-	-	-	-	-	-	-	71	75	-
	Mean	-	-	-	-	-	-	-	-	-	-	84	86	-
Viola Hill	Max.	-	83	88	88	77	87	69	77	82	81	97	95	84#
	Min.	-	61	55	43	40	48	33	34	40	44	73	75	50#
	Mean.	-	72	72	66	59	67	51	56	61	62	85	85	67#
Harvard	Max.	-	98	96	98	98	98	98	99	99	99	99	98	98#
Valley Flat	Min.	-	56	55	44	41	46	33	33	36	42	69	75	48#
	Mean	-	77	76	71	70	72	66	66	68	70	84	86	73#
Giant White	Max.	-	-	-	-	99	-	-	-	-	100	100	-	-
Pine Forest	Min.	-	-	-	-	51	-	-	-	-	85	97	-	-
	Mean	-	-	-	-	75	-	-	-	-	92	98	-	-
Emida Ridge	Max.	-	-	-	-	-	-	-	-	91	95	-	-	-
(N-S Ski Bowl)	Min.									48	54	-	-	-
	Mean									70	74			
Bald Mountain	Max.	-	-	-	-	-	-	-	-	88	-	-	-	-
Lookout	Min.	-	-	-	-	-	-	-	-	56	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	72	-	-	-	-
Genesee Flat	Max.	-	-	-	-	-	97	97	96	97	-	-	-	-
	Min.	-	-	-	-	-	46	34	34	36	-	-	-	-
	Mean	-	-	-	-	-	72	66	65	66	-	-	-	-
Hilltop near	Max.	-	-	90	94e	-	-	-	-	-	-	-	-	-
Subalpine Fir	Min.	-	-	57	47e	-	-	-	-	-	-	-	-	-
Meadow	Mean	-	-	74	70e	-	-	-	-	-	-	-	-	-

11 months average, February through December, Viola Hill and Harvard Valley Flat

e = estimate necessary because of missing records.

1963 CLIMATOLOGICAL DATA

MOSCOW - UNIVERSITY OF IDAHO
Elev. 2610 feet
Lat. 46°44'N., Long. 117° 1'W

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.	Precip. Month Total
AUG	82.4	52.9	67.7	94	44	68	65	0.82
SEP	78.8	52.8	65.8	92	39	54	63	0.99
OCT	62.3	43.5	52.9	83	30	48	54	1.27
NOV	45.3	35.2	43.1	58	20	31	43	3.25
DEC	35.5	26.9	31.2	44	6	19	37	2.92
YEAR	-	-	-	-	-	-	-	-

VIOLA HILL, IDAHO
(4 miles N of Moscow)
Elev. 3150 feet
Lat. 46°47'N., Long. 117° 1'W

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
AUG	-	-	-	-	-	-	-
SEP	77.2	58.4	67.8	91	44	52	68
OCT	60.4	45.6	53.0	83	32	44	60
NOV	43.1	34.5	38.8	56	20	28	49
DEC	34.1	26.5	30.3	43	6	17	37
YEAR	-	-	-	-	-	-	-

GENESEE FLAT, IDAHO
(½ mile NE of Genesee)
Elev. 2660 feet
Lat. 46°32'N., Long. 116°54'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
AUG	84.1	43.6	63.8	95	32	70	62
SEP	80.3	42.1	61.2	94	28	51	59
OCT	63.5	35.1	49.3	84	20	46	50
NOV	46.1	31.1	38.6	60	15	33	41
DEC	35.5	23.4	29.4	45	-7	16	36
YEAR	-	-	-	-	-	-	-

GENESEE HILL, IDAHO
(3 miles E of Genesee)
Elev. 2900 feet
Lat. 46°32'N., Long. 116°52'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
AUG	-	-	-	-	44e	65	-
SEP	77.9	53.3	65.6	91	42	49	63
OCT	61.9	43.4	52.6	81	29	47	54
NOV	-	-	-	59	19	-	-
DEC	-	-	-	-	9	-	-
YEAR	-	-	-	-	-	-	-

HARVARD VALLEY FLAT, IDAHO
(1½ miles NE of Harvard
Elev. 2590 feet
Lat. 46°55'N., Long. 116°42'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
AUG	-	-	-	-	31	66	-
SEP	79.8	37.8	59.8	93	27	52e	52
OCT	62.9	30.9	46.9	85	14	48	45
NOV	44.8	27.6	36.2	60	11	30	38
DEC	34.5	19.0	26.9	47	-6	19	31
YEAR	-	-	-	-	-	-	-

EMIDA RIDGE, IDAHO
(11 miles NNE of Harvard)
(Near N-S Ski Bowl)
Elev. 3790 feet
Lat. 47°0'N., Long. 116°40'W.

Month	Temperatures Ave. Max.	Ave. Min.	Mean Month	Extreme Mx.	Extreme Mn.	Low Mx.	High Mn.
AUG	76.4*	54.1*	65.2*	90	-	60	63
SEP	72.8	52.0	62.4	86	36	48	63
OCT	-	-	-	77	-	-	54
NOV	-	-	-	54	15	-	39
DEC	-	-	-	-	7	-	-
YEAR	-	-	-	-	-	-	-

*Record missing for first 4½ days of August at Emida Ridge.