1965

TECHNICAL BULLETIN 248

# CLIMATE OF MINNESOTA

## Part III. Temperature and Its Application

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## PART III. TEMPERATURE AND ITS APPLICATION

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This bulletin, one of a series (3, 4) dealing with Minnesota's climate, describes the state's normal and extreme temperatures, growing and heating degree days, and effective day and night temperatures.

Adjacent to the earth's surface is an environment that differs greatly from place to place and is subject to tremendous extremes and rapid fluctuations. The environment in which we live is still largely uncontrolled. This fact is particularly true of climate—the dominating factor of the physical environment.

The farmer obtains some protection against the vicissitudes of weather and climate by growing recommended crops and varieties. He may also take advantage of local microclimatic differences induced by physical features such as large bodies of water and local relief. Moreover, he can effect limited or quasi-control of climate by irrigating, shading, and following various low temperature protection measures. However, these practices are seldom used in Minnesota. Due to this nearly passive position of agriculture and other climatically dependent industries, any advantage to be obtained respecting climate rests essentially upon knowledge of it.

This bulletin's objective is to describe the climatic element temperature. The information should benefit not only climatically dependent industries but also such groups as animal and plant physiologists and geneticists. Although an attempt is made to present certain recognized temperature influences and effects upon various organisms, this bulletin is essentially a reference source of temperature and its associated derived quantities.

All data in this publication are based on temperatures measured within the standard Weather Bureau shelter: a louvered, white, double-roofed, wooden structure whose base stands 4 feet above ground. In spite of precautions taken to provide adequate ventilation and prevent the thermometer from radiational heating or cooling effects, a protection provided by the shelter, there are objections to this data source.

For one thing, thermometers are frequently well above the environment in which most organisms live. This is a serious objection owing to the large temperature gradients that frequently exist between the shelter's height and the soil or crop surface. Furthermore, the housing itself is an artificial environment quite unlike that of the natural environment. Nevertheless, the temperature shelter is the best means for general use and uniformity of conditions. And, in the final analysis, it must be accepted; there are no other long-term, statewide, standardized temperature measurements available.

Basic data were collected and compiled by the U.S. Department of Commerce Weather Bureau (30, 31, 33, 34, 35, 36).

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The authors wish to acknowledge the valuable service rendered by the U.S. Department of Commerce Weather Bureau and by the many volunteer cooperative weather observers who assume the duty of regularly recording necessary measurements.

# Air Temperature Effects

Temperature is easily measured and is the most frequently recorded climatic element. Although there are exceptions, it is the element to which humans are apparently most sensitive and, therefore, in which they are most interested. This sensitiveness to temperature is also evident in the behavior of most plants and animals. Determination of the cardinal temperatures—maximum, optimum, and minimum—for any organism including man is a fascinating subject worthy of study for both economic and academic reasons. However, determination of the cardinal temperature limits is so fraught with difficulties that this problem is far from being resolved.

When analyzing any climatic element individually, there is a tendency to consider that the element acts independently and that its effects are readily apparent and easily determined. If this was the case, questions related to temperature effects could be quickly resolved. However, climatic elements such as radiation, temperature, humidity, and precipitation depend upon each other. They react with each other and act in concert upon the environment. To further complicate investigation, the environment in turn influences climate.

The attempt to separate each climatic element and determine its respective effects is a difficult though not insurmountable problem. One approach is the Baconian method of holding all elements constant except one. This method requires an enclosure such as a greenhouse or climate control chamber. So introduced is the problem of the artificiality of the surroundings and how closely they simulate a natural environment. Of the numerous climate control chambers in use, which ordinarily are superior to a greenhouse, only a limited number even begin to duplicate the natural environment.

**Table 1. Maximum, normal, and minimum rectal temperatures and critical air temperatures of certain animals (24)**

| | Rectal temperature, °F. | | | Critical air temperature, °F.* | |
|---|---|---|---|---|---|
| Animal | Maximum | Normal | Minimum | High | Low |
| Man | 111 | 99 | 72 | 90 | 63-72 |
| Cat | 108 | 99-102 | 63 | 90 | ..... |
| Cow, dairy | 109 | 100-102 | ..... | 70-81 | —40 |
| Dog | 109 | 102 | 63 | 84 | —40 |
| Mouse | ..... | 95-100 | 55 | 89 | 55 |
| Rabbit | 107 | 103 | 68 | 82-86 | 19 |
| Rat | 109 | 96-100 | 59-61 | 83 | 19 |
| Sheep | 108 | 100 | ..... | 106-109 | ..... |
| Squirrel | 108 | 96-101 | 32-36 | ..... | ..... |
| Swine | 107 | 100-103 | ..... | 85 | ..... |
| Chicken | 113 | 104-108 | 77-81 | 90 | —29 |
| Pigeon | 117 | 108-109 | 68 | ..... | —40 |

* The critical air temperature is defined as the "air temperature at which the first indication of a change in the rectal temperature occurs in the unanesthesized animal."

**Table 2. Efficiency of workers outdoors (16)**

| Factor | Level | | | | | | |
|---|---|---|---|---|---|---|---|
| Air temperature, °F. | 70 | 20 | 0 | —23 | —40 | —50 | —80 |
| Efficiency, percent | 100 | 75 | 50 | 25 | 14 | 10 | 0 |

Even when all climatic elements except one are kept constant, various side reactions and effects may occur. These may not be recognized; therefore, results are incorrectly ascribed solely to the independent climatic variable.

Some published temperature effects must be applied with caution. For example, there is not one set of cardinal temperatures for a particular organism. Undoubtedly, there is a series of temperatures that vary with the organism's age, condition, and even environment. Furthermore, temperatures conducive to optimum growth of the organism often differ from those conducive to optimum development. (Growth refers to cell enlargement; development refers to cell differentiation.) An added complication is that for some organisms the light period (day) temperature may be more, equally, or less important than the dark period (night) temperature.

Temperatures a little above 32° F. and a little below 122° F. mark the activity limits for most organisms (11). Within this range, organisms exhibit varying degrees of sensitivity changes. The greatest activity for each kind of organism ordinarily occurs in a restricted temperature region within this range.

Table 1 lists the body (rectal) temperature normals and ranges and the critical air temperatures for man and some common animals. Note that the critically high air temperatures, with one exception, are below the normal body temperatures. Therefore, higher orders animals at least are better able to produce and conserve heat—in some cases with the aid of hair, fur, or feathers—than to dissipate heat.

Normally, animals must continually give off heat. If the environment is too warm, an excessive heat load is impressed upon the animal, decreasing the normal rate of heat loss. But if the surroundings are too cool, the animal's heat loss rate exceeds its ability to produce heat. In the first case, the heat exchange between the environment and the animal is restricted; in the second case, it is excessive. Warm blooded animals cannot accept either situation without internal changes that may be serious.

Man's efficiency decreases rapidly as the ambient (surrounding) temperature goes above or below the critical values. Some of the decreasing efficiency during low temperatures (see table 2) is due to the protective clothing that must be worn. Below —40° F. almost all energy is devoted to survival—there can be no useful work (16).

**Table 3. Upper limit of comfort and bearable zones for man (28)**

| Factor | | Level | | | | |
|---|---|---|---|---|---|---|
| Comfort zone occurs just below | Air temperature, °F. | 71 | 80 | 90 | 100 | 102 |
| | Relative humidity, percent | 100 | 66 | 43 | 7 | 0 |
| Upper limit of just bearable zone occurs at | Air temperature, °F. | 100 | 110 | 120 | 130 | 134 |
| | Relative humidity, percent | 100 | 74 | 55 | 27 | 0 |

**Table 4. Air temperature and humidity limits when dismissal of employees is permitted (32)**

| Factor | Level | | | | | |
|---|---|---|---|---|---|---|
| Temperature, °F. | 95 | 96 | 97 | 98 | 99 | 100 |
| Relative humidity, percent | 55 | 52 | 49 | 45 | 42 | 38 |

That there are factors affecting temperature tolerances of the same kind of animals is recognized. For example, the "comfort zone" for cows of European origin, Holstein and Jersey, ranges from about 30-60° F. (5, 13). For cows of Indian origin, Brahman cattle, the comfort zone lies between 50-80° F. Santa Gertrudis cattle, a genetic combination of Brahman and Shorthorn breeds, nearly equal Brahman cattle in heat tolerance but are much more cold tolerant. Furthermore, the average daily gain in weight of hogs is greatest between temperatures of about 60-73° F. (8). However, within this range, the optimum temperature for weight gain is inversely proportional to the hog's initial weight.

A factor complicating temperature effects is the influence of humidity and air movement. High temperatures are easier to endure when there is appreciable air movement; cold air is less penetrating when air movement is slight. The efficiencies listed in table 2 would certainly decrease at an even greater rate with increasing wind speed. The animal body is also less sensitive to either high or low temperatures when the atmosphere's vapor content is low. Who hasn't heard, "It isn't the heat, it's the humidity?"

Numerous attempts have been made using various combinations of temperature, wind speed, and humidity to provide a single numerical index which describes environmental conditions in terms of comfort or discomfort (9, 14, 16, 25). To date none has been accepted for general public use.

Particular combinations of temperature and humidity produce varying degrees of comfort or discomfort upon man (table 3). Recognizing that man's stress and decreasing efficiency are effects of temperature and humidity, some governmental agencies dismiss workers in non-air-conditioned offices when certain environmental conditions occur (table 4).

Table 5 lists high and low temperature limits exhibited by certain insects. The great temperature range exhibited by European corn borer larva, perhaps the most outstanding feature shown, at least partly accounts for the difficulty in eliminating this troublesome insect.

Temperature limits of a few micro-organisms and mosses are listed in table 6.

Concerning the influence of temperature upon plants, Went (40) made an important statement as a result of his research at the Earhart phytotron:

> In most plants, one particular climatic factor, such as nyctotemperature [night temperature] or photoperiod, overshadows all others in importance, since it generally seems [to be] the factor controlling the developmental process which is limiting. If we ask now which of these is the most commonly controlling climatic fac-

**Table 5. Insect tolerance to air temperature (24)**

| Insect | | Heat death, °F. | Activity range, °F. | Biological zero, °F.* | Cold death, °F. |
|---|---|---|---|---|---|
| Diving beetle *(Dysticus marginalis)* | Egg | 88 | 50-81 | 32 | ..... |
| | Larva | ..... | ..... | 35 | ..... |
| Granary weevil *(Sitophilus granarius)* | Adult | 120 | 77 | 49 | 25-30 |
| House fly *(Musca domestica)* | Egg | 109 | ..... | ..... | ..... |
| | Larva | 120 | 111-118 | 41 | ..... |
| | Pupa | ..... | 46 | 50 | 32-34 |
| | Adult | 112 | 60 | 44-45 | 32 |
| Greenbug *(Toxoptera graninum)* | Adult | 100-104 | ..... | 35-40 | 17 |
| Honey bee *(Apis mellifera)* | Adult | 115-118 | 50-95 | ..... | 28-30 |
| European corn borer *(Pyrausta nubilalis)* | Larva | 136 | ..... | ..... | —15 |

* Temperature at which all vital processes are arrested by cold.

**Table 6. Micro-organism and moss tolerance to air temperature (24)**

| Object | Heat death, °F. | Maximum tolerated, °F. | Optimum, °F. | Minimum tolerated, °F. |
|---|---|---|---|---|
| Micro-organisms: | | | | |
| Most bacteria | 122-140 | ..... | ..... | ..... |
| Most plant pathogens (fungi) | ..... | ..... | 68-86 | ..... |
| Blue-green algae | ..... | 185 | ..... | ..... |
| Mesophilic bacteria (1) | ..... | 113* | 77-95 | 59* |
| Nitrification bacteria (1) | ..... | 104* | 86-95 | 41* |
| Ammonification bacteria (1) | ..... | ..... | 104-140 | ..... |
| Mesophilic actinomycetes (1) | ..... | 102* | 82-99 | 41* |
| Thermophilic fungi (1) | ..... | 149* | 102 | ..... |
| Mosses: | | | | |
| Most sensitive of 50 species tested | ..... | 149-167 | ..... | ..... |
| Least sensitive of 50 species tested | ..... | 212-239 | ..... | ..... |
| Majority of 30 species tested | ..... | ..... | ..... | 14-—4 |
| Least sensitive of 30 species tested | ..... | ..... | ..... | —4-—22 |

* Rather than maximum or minimum temperature tolerated this is noted in the reference (1) as a temperature at which growth or activity still occurs.

**Table 7. Upper and lower air temperature limits of specified metabolic activity in four crops (24)**

| Crop | Maximum temperature, °F. | Minimum temperature, °F. | Metabolic activity |
|---|---|---|---|
| Barley (*Hordeum vulgare*) | ..... | 41 | Growth |
| Corn (*Zea mays*) | 115 | 49 | Growth |
| Corn (*Zea mays*) | ..... | 55-57 | Chlorophyll formation |
| Pea (*Pisum sativum*) | 104 | 28 | Growth |
| Wheat (*Triticum aestivum*) | 108 | 41 | Growth |

tor, then this seems to be temperature, particularly the nyctotemperature. Photoperiod comes in the second or third place, and affects flowering in a number of annuals, and vegetative growth in trees and shrubs . . . The emphasis on experiments with photoperiod has probably caused a somewhat warped idea of its importance in controlling growth in general.

The temperature range of metabolic activity of four crops is shown in table 7. In table 8 appear generalized statements on air temperature requirements of common garden and field crops.

Wang (37, 38, 39) prepared models of the temperature response of tomatoes, canning peas, and sweet corn. These were models constructed from data obtained by numerous investigators under many different conditions. Therefore, responses are not suited to application in any one locality but are generalized pictures. Nevertheless, they come closest to fulfilling the need for the information being sought. For example, these figures show the lethal maximum and minimum, upper and lower threshold, and the optimum temperature range during the plant's life from planting to harvest. It is clearly illustrated that plants (and other organisms as well) seldom do best under a uniform temperature and also that response varies with age.

**Table 8. Air temperature requirements of common garden and field crops (24)**

| Crop | Temperature requirements |
|---|---|
| Garden beet (*Beta vulgaris*) | Vegetative growth optimum 60-70° F.; growth retarded at >70° F.; can tolerate repeated mild freezing temperatures at market stage |
| Cabbage (*Boleracea capitata*) | Vegetative growth optimum 60-70° F.; plant remains vegetative with slow and abnormal growth at >70° F. |
| Spinach (*Spinacia oleracea*) | Vegetative growth optimum 50-60° F. |
| Turnip (*Brassica rapa*) | Vegetative growth optimum 60-70° F. |
| Carrot (*Daucus carota*) | Vegetative growth optimum 60-70° F.; lack of normal growth at <50° F. and >70° F. |
| Cauliflower (*Brassica oleracea botrytis*) | Vegetative growth optimum 60-70° F. |
| Celery (*Apium graveolens dulce*) | Vegetative growth optimum 60-70° F. |
| Lettuce (*Lactuca sativa*) | Vegetative growth optimum 55-65° F. |
| Garden pea (*Pisum sativum*) | Vegetative growth optimum 55-65° F. |
| Potato (*Solanum tuberosum*) | Young sprouts' most rapid development at constant 75° F.; later best growth at 64° F.; excessive branching of young sprouts at soil temperature >75° F. |
| Bean (*Phaseolus spp.*) | Vegetative growth optimum 60-70° F. |
| Corn (*Zea mays*) | Vegetative growth optimum mean summer temperature 70-80° F. and night temperature >58° F. |
| Cucumber (*Cucumis sativus*) | Vegetative growth optimum 65-75° F. |
| Muskmelon (*Cucumis melo*) | Vegetative growth optimum 65-75° F. |
| Tomato (*Lycopersicon esculentum*) | Vegetative growth optimum 70-75° F.; tolerance range 65-80° F. |

# Temperature Normals

Before 1950, normals of various climatic elements were the average values for any continuous record period of at least 10 years. Due to the varying length of record possible between stations, established normals or averages were not strictly comparable.

The World Meteorological Organization, of which the United States is a member, recently established a uniform method of determining normals for worldwide comparability. The period for which normals are calculated in this scheme will always be 30 years; at the end of each decade the 30-year normal period will be advanced 10 years. For example, the present 30-year normal period is 1931-60 and will remain so until the end of 1970. Then the new normal period for the decade 1971-80 will become 1941-70. So recently established weather stations will be on an equal footing with older stations immediately or in a relatively short time. Although the valuable long records of older stations, with several in Minnesota dating from before 1900, will not be used in their entirety, such data will remain available for special studies.

Arithmetically, a normal is the same as the mean or average. However, as used here, the average calculated for the 30-year period 1931-60 is defined as the normal. It therefore has a precise definition and cannot be used interchangeably with average or mean.

Establishment of normals based upon a standard time period serves useful purposes. The normal provides a standard or frame of reference necessary for comparison. It is a useful statistic to reduce data to manageable terms and also provides a ready summary of general conditions.

However, normals do have a serious flaw. Variations in original data are masked; therefore, this single statistic can be most deceiving. For example, two stations with the same normal may be subject to entirely different climatic regimes. One station may lie within the heart of a continent where great daily and monthly temperature differences are usual. The other station, if in a typical maritime climate, has only minor daily and monthly temperature differences. The normal is incapable of registering these variations. For this reason at least one additional statistic, such as the range or the standard deviation, should accompany normals.

For most weather stations, only two temperatures are recorded daily: maximum and minimum. The mean daily temperature, as calculated by the U.S. Weather Bureau, is the average of these two. Although actual mean daily temperature may differ from the calculated value, in the long run there is little difference. Monthly and annual means are in turn the average of the mean daily maxima and mean daily minima.

The normal daily temperatures, plus daily maxima and minima, are shown in figures 1-5 and appendix table 1 for five Minnesota stations: Duluth, International Falls, Minneapolis-St. Paul, Rochester, and St. Cloud. To increase the area represented the daily normals for Fargo, North Dakota, and Sioux Falls, South Dakota, are included in figures 6 and 7, respectively. Figures 1-7 and appendix table 1 also include heating degree days (HDD) and growing degree days (GDD), which are discussed in following sections.

Daily normals of temperature maxima, minima, and HDD obviously were smoothed. This was done by the U.S. Weather Bureau to make certain computational procedures easier. Unfortunately, however, this masks such interesting climatological features as the apparently real "January thaw." Though not a feature every year, it does occur frequently enough to be of concern to certain local enterprises. The "January thaw," which brings about a marked loss

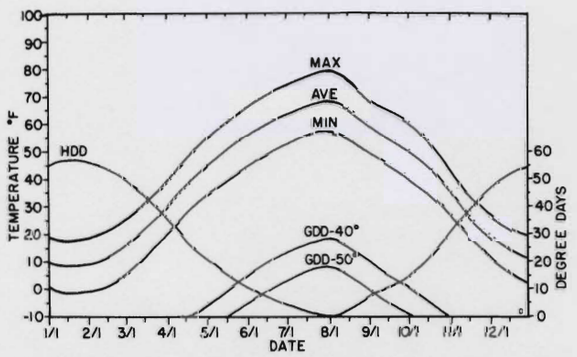


Figure 1. Daily temperature normals, HDD ($T_b = 65°$ F.), and GDD ($T_b = 40°$ and $50°$ F.) at Duluth.[1]

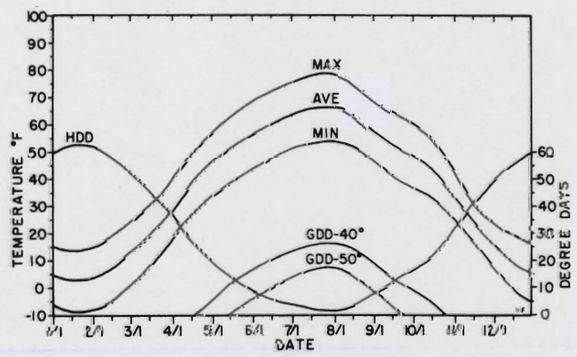


Figure 2. Daily temperature normals, HDD ($T_b = 65°$ F.), and GDD ($T_b = 40°$ and $50°$ F.) at International Falls.

[1] For definition of terms, see pages 28 and 32.

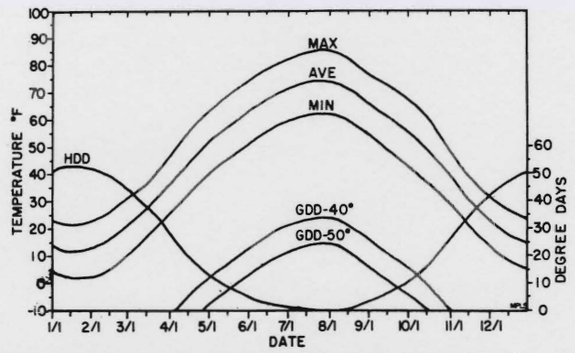


Figure 3. Daily temperature normals, HDD ($T_b = 65°$ F.), and GDD ($T_b = 40°$ and $50°$ F.) at Minneapolis-St. Paul.

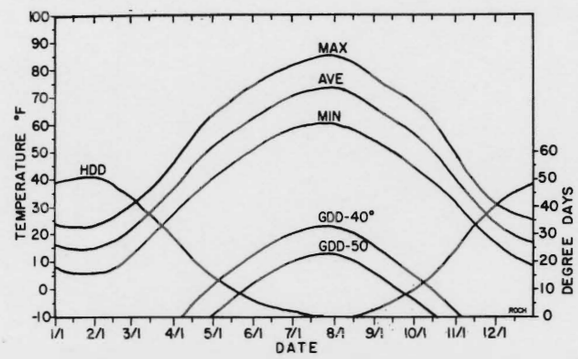


Figure 4. Daily temperature normals, HDD ($T_b = 65°$ F.), and GDD ($T_b = 40°$ and $50°$ F.) at Rochester.

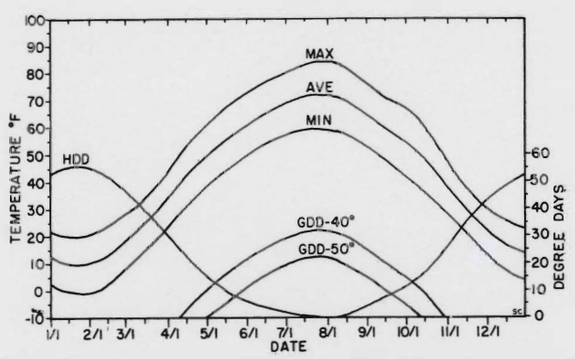


Figure 5. Daily temperature normals, HDD ($T_b = 65°$ F.), and GDD ($T_b = 40°$ and $50°$ F.) at St. Cloud.

in snow cover, tends to occur around January 21-24, especially in southeastern Minnesota.

Monthly, seasonal, and annual normals at the 66 stations that had a continuous record during the normal period are included in appendix table 2. Monthly normals are illustrated in figures 8-19, seasonal normals in figures 20-23, and annual normal temperatures in figure 24.

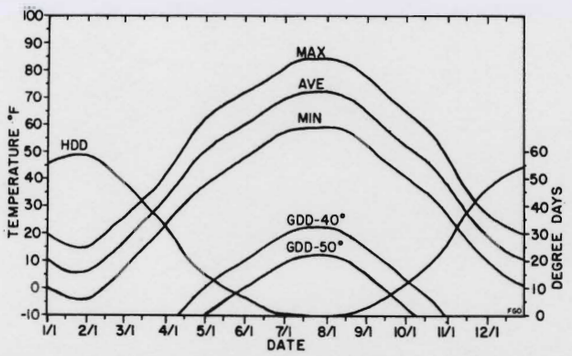


Figure 6. Daily temperature normals, HDD ($T_b = 65°$ F.), and GDD ($T_b = 40°$ and $50°$ F.) at Fargo, North Dakota.

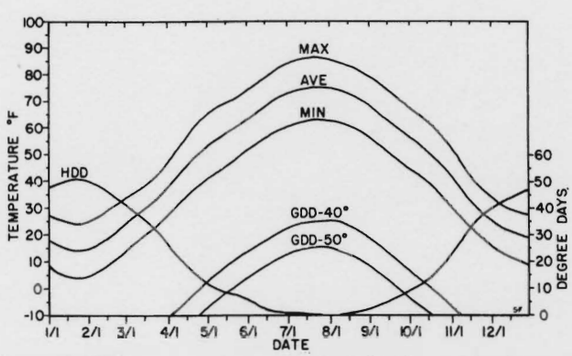


Figure 7. Daily temperature normals, HDD ($T_b = 65°$ F.), and GDD ($T_b = 40°$ and $50°$ F.) at Sioux Falls, South Dakota.

In the northern one-quarter of the state, particularly in the north central and northeast, weather stations are sparse. So lines of equal temperature, isotherms, might be altered appreciably in the future as information on this area increases.

As shown in figures 8-19, five areas might be termed cold spots. Minnesota's northwestern corner generally is the coldest—it is the farthest north and usually the first to receive cold air masses originating in Canada. The Misquah hills of the extreme northeast are believed to be another chronically low temperature area. Although there admittedly are no supporting records for this supposition, it is based upon the altitude of the hills and the fact that air temperature generally decreases with increasing altitude.

Other areas of relatively low temperatures are found centered around Becker, Hubbard, and Clearwater Counties; in southern St. Louis County west and north of Duluth; and in the southeast, particularly Mower and Olmsted Counties.

In part at least, all three areas may appear to be cold spots because of local cold air drainage at the weather stations representing these regions. West of Duluth is a large area of organic soils that are very

poor in heat economy. Other and more comprehensive explanations are not possible at this time.

Along the Lake Superior shoreline, temperatures are out of phase with the rest of the state. That is, they are relatively higher in cold months and cooler in warm months. This is due, of course, to the proximity of the lake which acts as a heat reservoir in cool periods and as a cooling source in warm periods. However, the lake effect does not extend far inland due essentially to prevailing westerly winds and also to the upland that rises quite abruptly from the lakeshore.

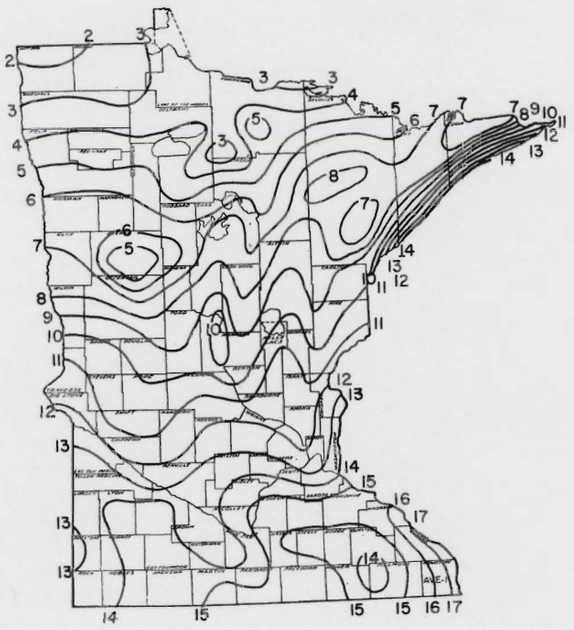

Figure 8. January normal temperature.

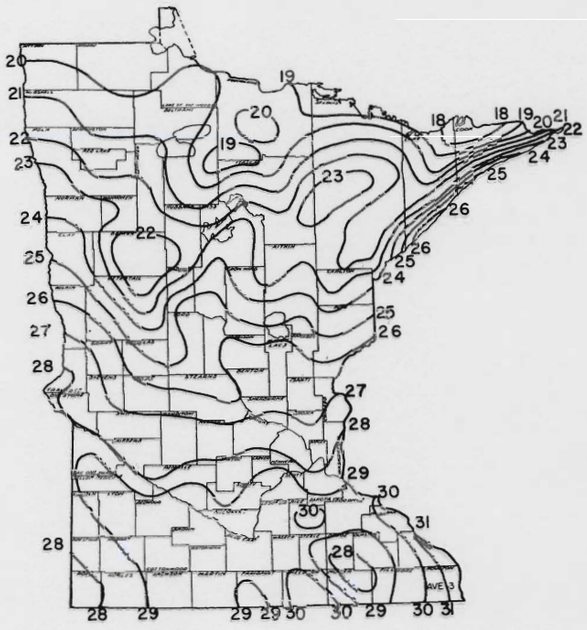

Figure 10. March normal temperature.

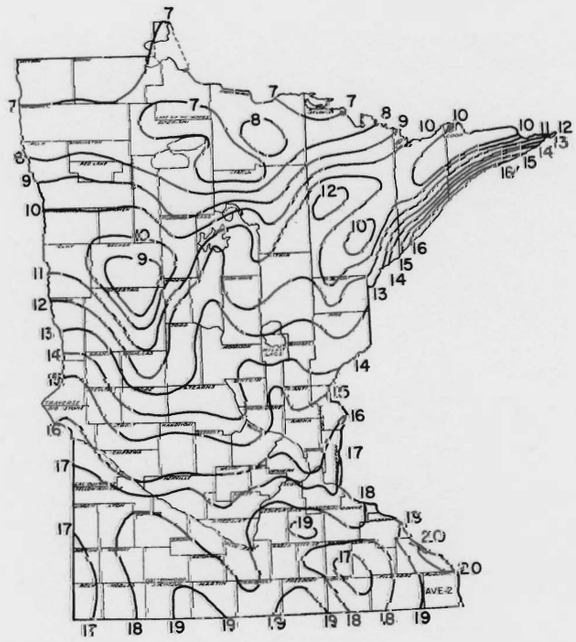

Figure 9. February normal temperature.

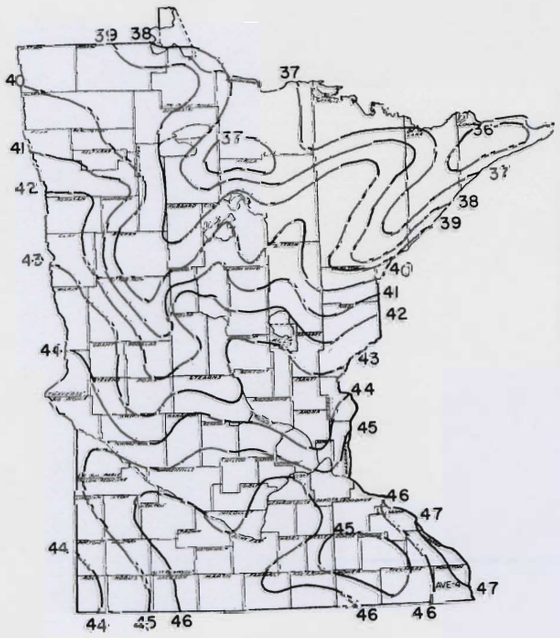

Figure 11. April normal temperature.

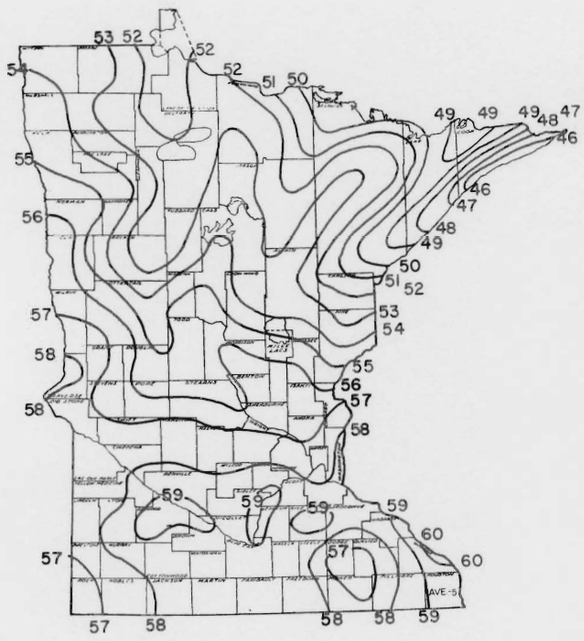


Figure 12. May normal temperature.

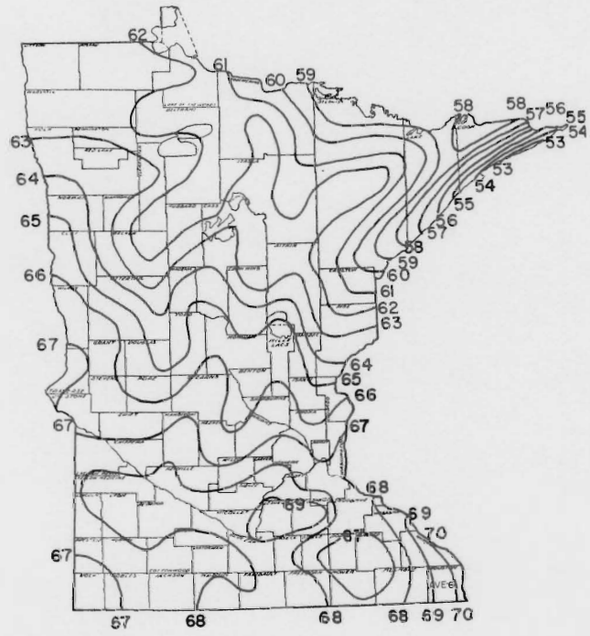


Figure 13. June normal temperature.

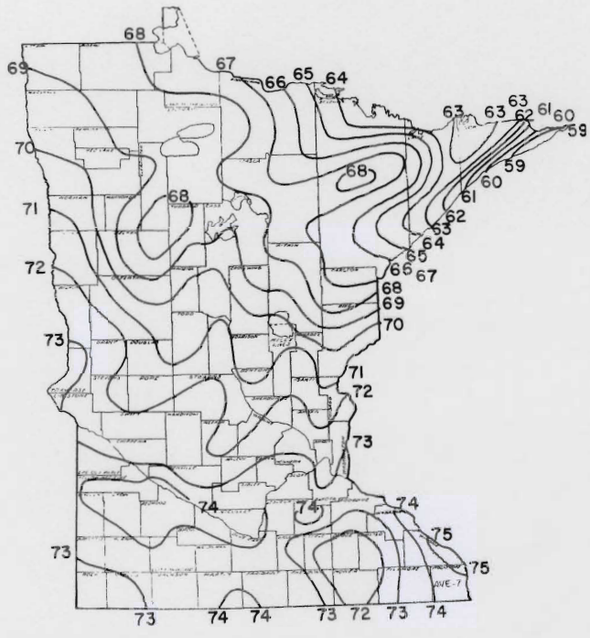


Figure 14. July normal temperature.

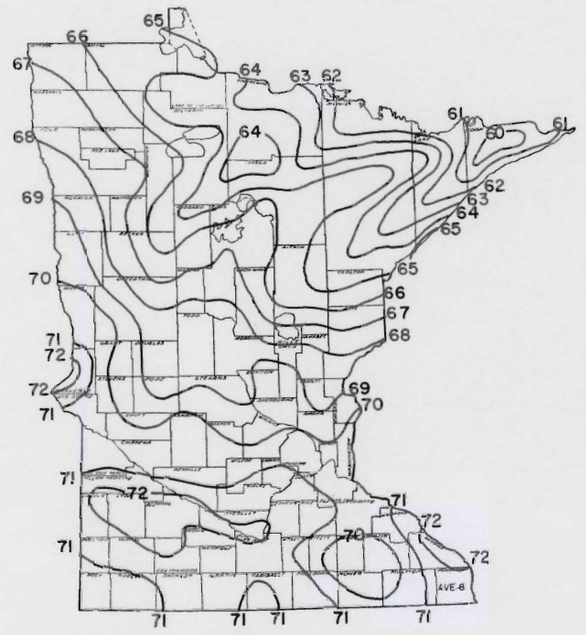


Figure 15. August normal temperature.

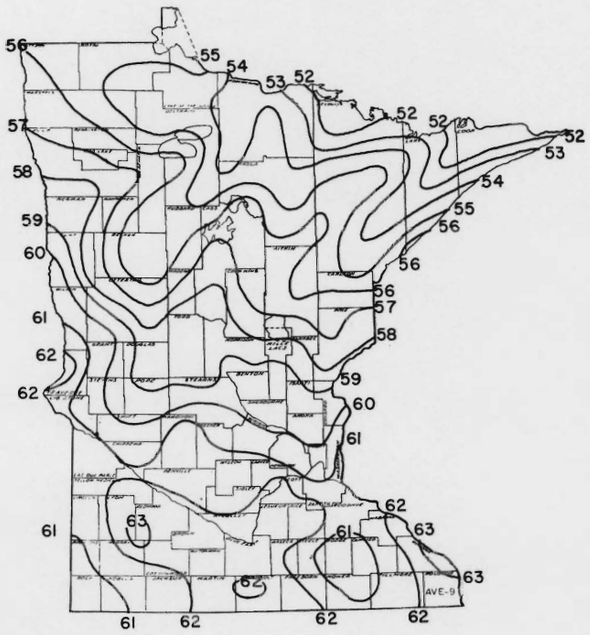

Figure 16. September normal temperature.

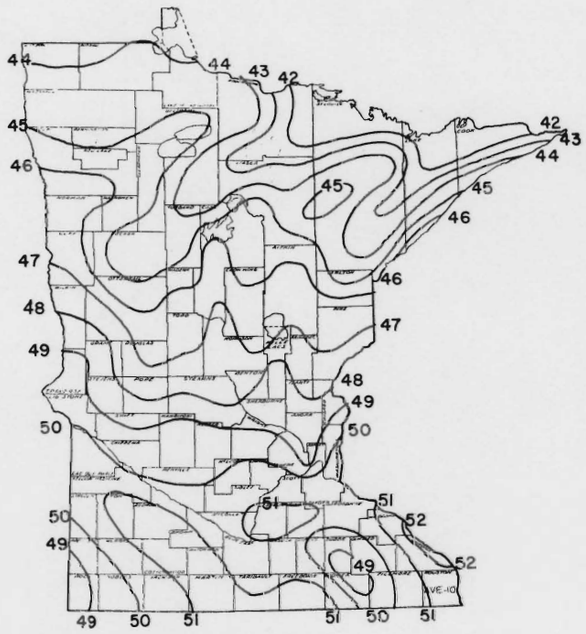

Figure 17. October normal temperature.

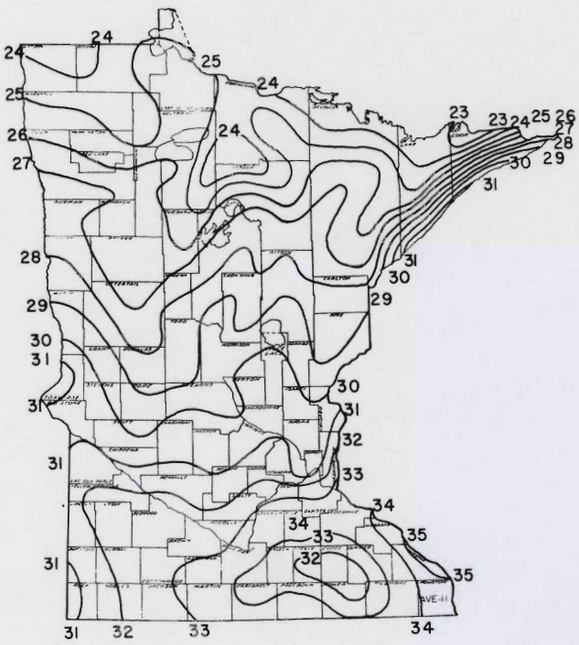

Figure 18. November normal temperature.

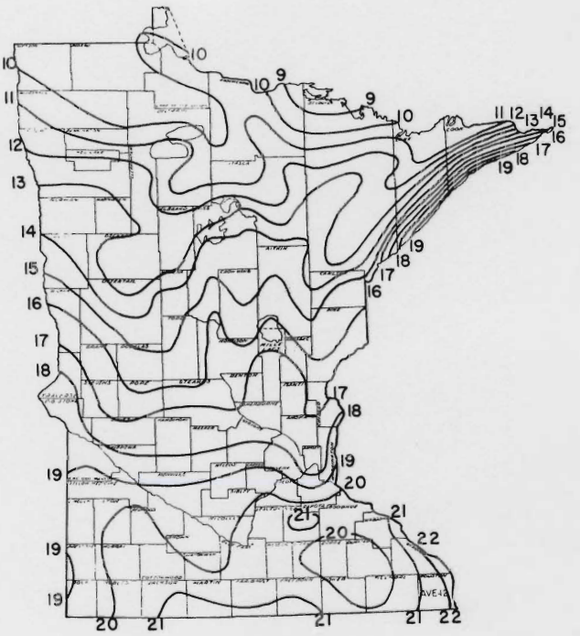

Figure 19. December normal temperature.

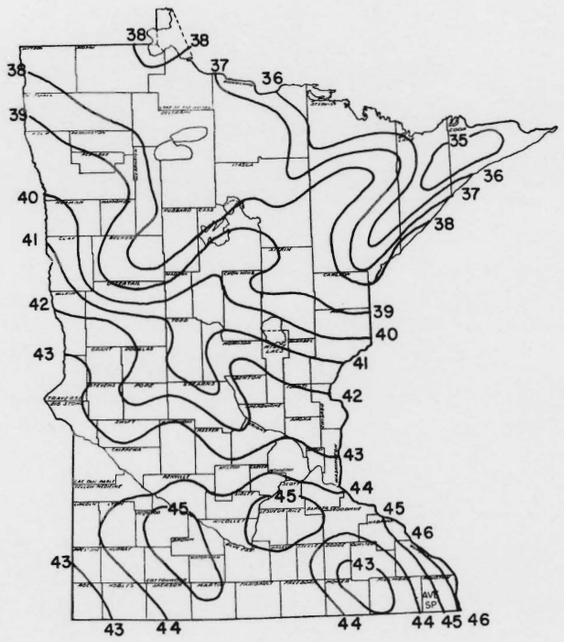


Figure 20. Spring (March, April, and May) normal temperature.

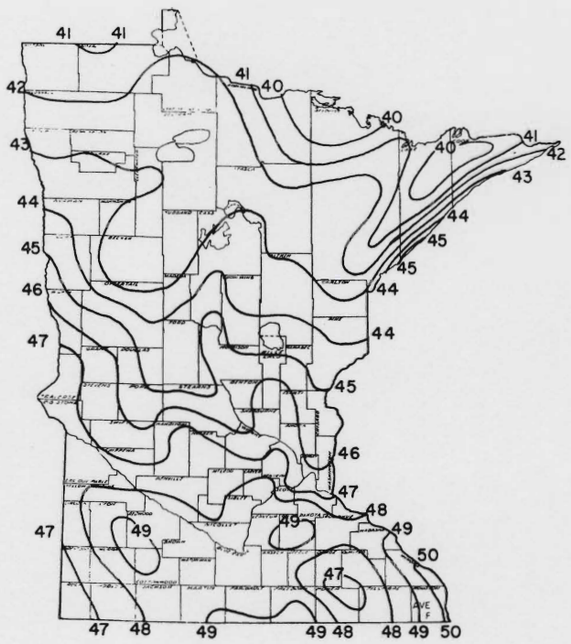


Figure 22. Fall (September, October, and November) normal temperature.

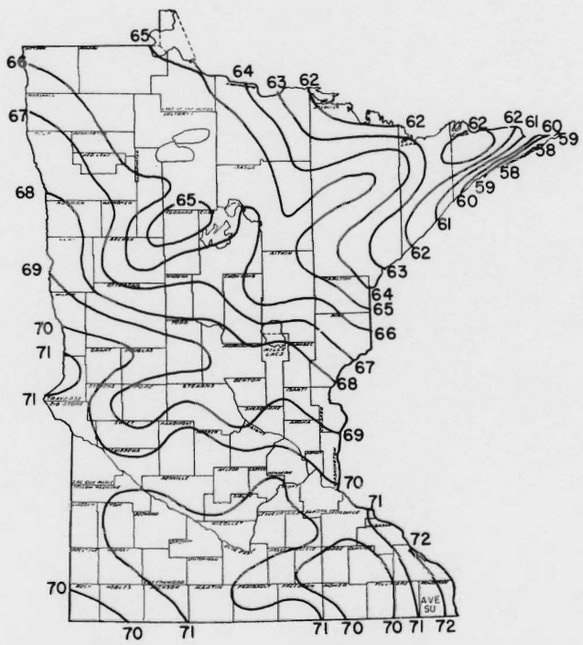


Figure 21. Summer (June, July, and August) normal temperature.

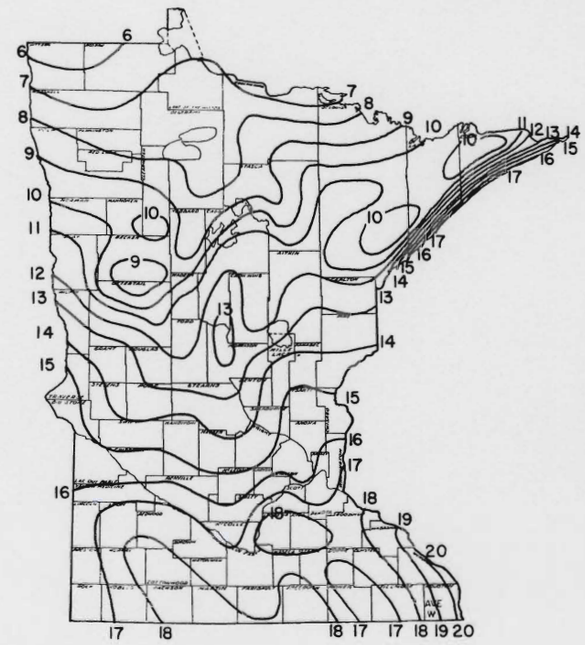


Figure 23. Winter (December, January, and February) normal temperature.

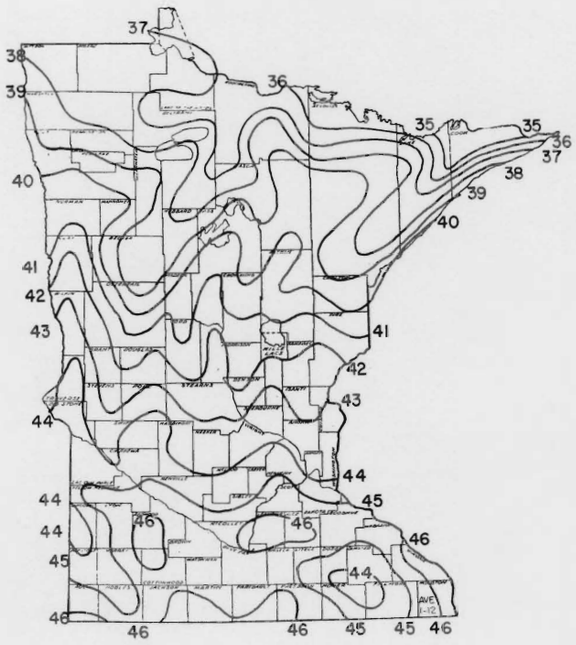

Figure 24. Annual normal temperature.

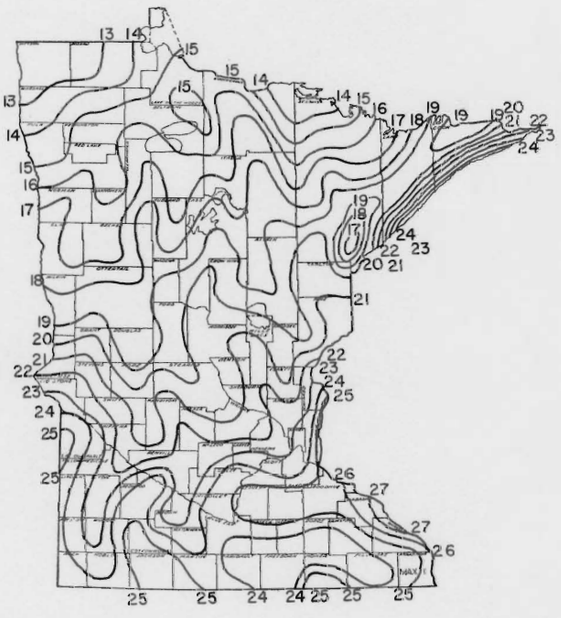

Figure 25. Average daily January maximum temperature.

Figure 26. Average daily January minimum temperature.

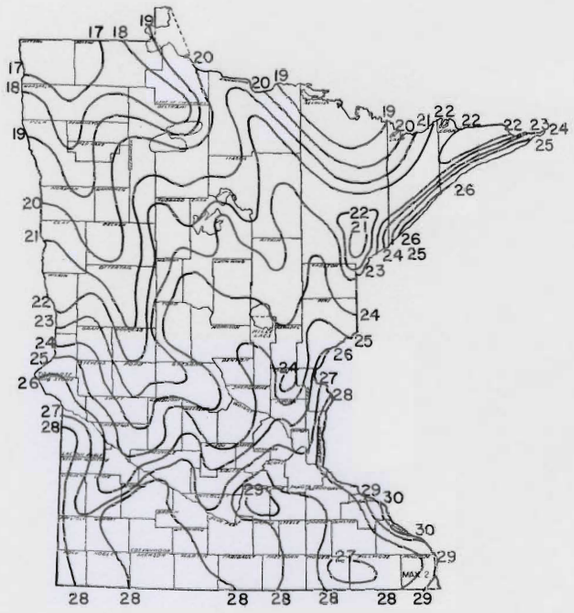

Figure 27. Average daily February maximum temperature.

# Temperature Extremes

Temperature maxima and minima, although they may last for only a short period during any 1 day, are of great import to exposed organisms. Temperature extremes constitute the temperature factor largely responsible for the presence or absence, success or failure, of an organism in a particular area. These temperatures and effective day and night temperatures, discussed in a following section, are the temperature data of concern to those interested in the natural aerial environment of earth-bound organisms. The average or normal temperature is inadequate since temperature differences are effectively masked.

Minnesota, lying within the heart of the North American land mass, displays a typically continental climate. It has great extremes in temperature, not only from season to season and month to month, but on a diurnal basis as well. The only water body of sufficient size to modify climate on more than an extremely localized basis is Lake Superior. However, its influence in Minnesota is restricted essentially to confines of the shoreline for reasons already given.

Daily normal maxima and minima for five Minnesota stations plus Fargo and Sioux Falls are found in appendix table 1 and figures 1-7.

Average daily maxima and minima for each month are shown in figures 25-48; data are listed in appendix table 2. These average (not normal) daily maxima and minima are based on the period of record 1931-52 which is 8 years less than the standard normal period. Inclusion of the 8 years' data probably would not alter appreciably the data presented here.

Earlier, some objections to the temperature shelter were presented. Chief among them is the fact that thermometers within are about 5½ feet above ground. Even this small distance results in frequent large temperature differences between the shelter and the adjacent plant or soil surface. Tables 9 and 10 show some differences that were measured.

The differences essentially depend upon the kind of surface. For example, a snow cover is an effective insulator that prevents a rapid loss of heat and, therefore, a rapid change in soil temperature. However, just above the snow surface, temperature minima much lower than the shelter minima frequently occur. Of course, snow effectively masks temperature differences between various surfaces; not until the snow disappears do differences appear.

Over a green transpiring surface such as sod, maximum temperatures are about the same as in the shelter but minimum temperatures are much lower. In contrast, over a bare soil (uncultivated), minimum temperatures are usually only a few degrees cooler than

**Table 9. Comparison between maximum temperatures, ° F., measured in the standard shelter and in the microenvironment at St. Paul, Minnesota**

| Date | Shelter temperature* | | Microenvironment temperature† | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | In air 10 cm. above sod | | In soil 1 cm. under | | | | | |
| | | | | | Sod soil | | Bare soil | | Soybean soil | |
| | Average maximum | Extreme maximum | Average maximum‡ | Extreme maximum | Average maximum‡ | Extreme maximum | Average maximum‡ | Extreme maximum | Average maximum‡ | Extreme maximum |
| 1961: | | | | | | | | | | |
| October | 63 | 83 | ..... | ..... | 56 | 65 | 64 | 81 | ..... | ..... |
| November§ | 41 | 63 | 39 | 51 | 37 | 55 | 39 | 61 | ..... | ..... |
| December§ | 24 | 53 | 21 | 50 | 32 | 42 | 31 | 47 | ..... | ..... |
| 1962: | | | | | | | | | | |
| January§ | 18 | 36 | 16 | 35 | 29 | 32 | 23 | 32 | ..... | ..... |
| February§ | 21 | 39 | 24 | 35 | 28 | 31 | 25 | 32 | ..... | ..... |
| March§ | 34 | 50 | 31 | 47 | 31 | 32 | 30 | 34 | ..... | ..... |
| April | 54 | 88 | 52 | 88 | 45 | 69 | 53 | 82 | ..... | ..... |
| May | 71 | 87 | 67 | 86 | 67 | 82 | 76 | 102 | ..... | ..... |
| June | 76 | 90 | 75 | 91 | 77 | 91 | 89 | 108 | ..... | ..... |
| July | 78 | 87 | 75 | 87 | 78 | 89 | 89 | 110 | 89 | 104 |
| August | 80 | 90 | 78 | 92 | 77 | 84 | 94 | 111 | 93 | 121 |
| September | 68 | 80 | 67 | 80 | 67 | 76 | 77 | 93 | 62 | 74 |
| Average | 52 | ..... | ..... | ..... | 52 | ..... | 57 | ..... | ..... | ..... |
| Extreme | 80 | 90 | 78 | 92 | 78 | 91 | 94 | 111 | 93 | 121 |

* Obtained from daily measurements using the standard, maximum-type, mercury thermometer.

† Air temperatures were recorded hourly using aspirated shielded thermocouples over sod at 10 cm. above soil surface. Soil temperatures were recorded hourly using thermocouples buried at 1 cm. under soil surface; thermocouples in soybean plot were between rows.

‡ Strictly speaking, these are not average maxima but are the highest average hourly temperature obtained for 1 of the 24 hours during each month.

§ Unusually heavy snows, maximum depth of 17 inches measured in March, frequently buried the temperature-sensing element placed at 10 cm. above the soil surface. The snow also acted as an effective insulator keeping the soil at a higher than usual winter temperature.

**Table 10. Comparison between minimum temperatures, ° F., measured in the standard shelter and in the microenvironment at St. Paul, Minnesota**

| Date | Shelter temperature* | | Microenvironment temperature | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | In air above | | | | | | In soil 1 cm. under | | | | | |
| | | | Bare soil† | | Sod† | | Sod‡ | | Sod soil§ | | Bare soil§ | | Soybean soil§ | |
| | Average minimum | Extreme minimum | Average minimum | Extreme minimum | Average minimum | Extreme minimum | Average minimum‡‡ | Extreme minimum | Average minimum‡‡ | Extreme minimum | Average minimum‡‡ | Extreme minimum | Average minimum‡‡ | Extreme minimum |
| 1961: | | | | | | | | | | | | | | |
| October | 40 | 26 | 37 | 21 | 34 | 14 | ..... | ..... | 47 | 37 | 41 | 29 | ..... | ..... |
| November | 26 | 14 | 25 | 11 | 22 | 4 | 29 | 13 | 34 | 30 | 30 | 21 | ..... | ..... |
| December | 9 | —12 | 8 | —22 | 8 | —22 | 18 | —9 | 32 | 30 | 29 | 16 | ..... | ..... |
| 1962: | | | | | | | | | | | | | | |
| January | 1 | —24 | —2 | —25 | —2 | —25 | 8 | —21 | 28 | 24 | 21 | 12 | ..... | ..... |
| February | 7 | —23 | 3 | —25 | 3 | —25 | 18 | —19 | 27 | 18 | 23 | 5 | ..... | ..... |
| March | 19 | —24 | 14 | —37 | 14 | —37 | 29 | 11 | 31 | 28 | 29 | 25 | ..... | ..... |
| April | 32 | 9 | 32 | 5 | 31 | 5 | 33 | 9 | 36 | 31 | 35 | 23 | ..... | ..... |
| May | 51 | 39 | 49 | 34 | 47 | 27 | 52 | 35 | 55 | 42 | 52 | 38 | ..... | ..... |
| June | 56 | 42 | 53 | 40 | 51 | 31 | 56 | 41 | 61 | 53 | 58 | 46 | ..... | ..... |
| July | 58 | 47 | 54 | 36 | 52 | 33 | 59 | 47 | 66 | 62 | 61 | 51 | 59 | 50 |
| August | 59 | 53 | 55 | 43 | 53 | 38 | 58 | 44 | 66 | 60 | 62 | 52 | 62 | 53 |
| September | 49 | 33 | 45 | 30 | 43 | 27 | 48 | 30 | 59 | 52 | 50 | 37 | 53 | 42 |
| Average | 34 | ..... | 31 | ..... | 30 | ..... | ..... | ..... | 45 | ..... | 41 | ..... | ..... | ..... |
| Extreme | 1 | —24 | —2 | —37 | —2 | —37 | 8 | —21 | 28 | 18 | 21 | 5 | ..... | ..... |

* Obtained from daily measurements using the standard, minimum-type, alcohol thermometer.

† Obtained from daily measurements using the standard, minimum-type, alcohol thermometers maintained at 2 cm. above bare soil and at height of grass blades in sod plot. When snow was present, November-March, both thermometers were maintained at about 2 cm. above the snow surface.

‡ Air temperatures were recorded hourly using aspirated shielded thermocouples over sod at 10 cm. above soil surface; this element was frequently buried by heavy snows during November-March.

§ Soil temperatures were recorded hourly using thermocouples buried at 1 cm. under soil surface; thermocouples in soybean plot were between rows. Soil was at a higher than usual winter temperature due to heavy snows from November-March.

‡‡ Strictly speaking, these are not average minima but are the lowest average hourly temperature obtained for 1 of the 24 hours during each month.

in the shelter. Strictly comparable maximum temperatures over a bare soil are not available, but temperatures at 1 cm. depth under bare soil are acceptable for purposes of comparison. A bare soil and the air layer immediately adjacent register much higher maxima than occur in the shelter (table 9).

The extreme maxima of 121° F. at 1 cm. depth within a soybean field occurred due to two factors:

1. The soil had been cultivated earlier in the spring so heat conduction to lower depths was decreased.

2. Although plants did not yet completely shade the ground, they were tall enough to effectively decrease convective heat losses through reduction of wind movement. (As wind movement increases, the temperature difference between the shelter and plant or soil surface decreases.)

So, in review, shelter temperature extremes apparently may be used to approximate the microenvironment when other temperature measurements are not available. In addition, shelter maxima approximate quite well the maximum temperatures over a green

**Table 11. Officially accepted shelter temperature extremes in ° F. (7, 19, 21, 22)**

| Maximum | Place | Date | Minimum | Place | Date | Range |
|---|---|---|---|---|---|---|
| | | | World | | | |
| 136° | El-Azizia, Libya | 9/13/1922 | —127° | Vostok, Antartica | 8/24/1960 | 263° |
| 136° | San Luis, Mexico | 8/11/1933 | | | | |
| | | | Continental United States* | | | |
| 134° | Death Valley, California | 7/10/1913 | — 70° | Rogers Pass, Montana | 1/20/1954 | 204° |
| | | | Minnesota | | | |
| 114° | Beardsley | 7/29/1917 | — 59° | Leech Lake Dam | 2/9/1899 | 173° |
| 114° | Moorhead | 7/6/1936 | — 59° | Pokegama Dam | 2/16/1903 | 173° |

* A —78° F. was recorded at Fort Yukon, Alaska. In Canada the record is —81° F. at Snag, Yukon Territory, on February 3, 1947.

Figure 28. Average daily February minimum temperature.

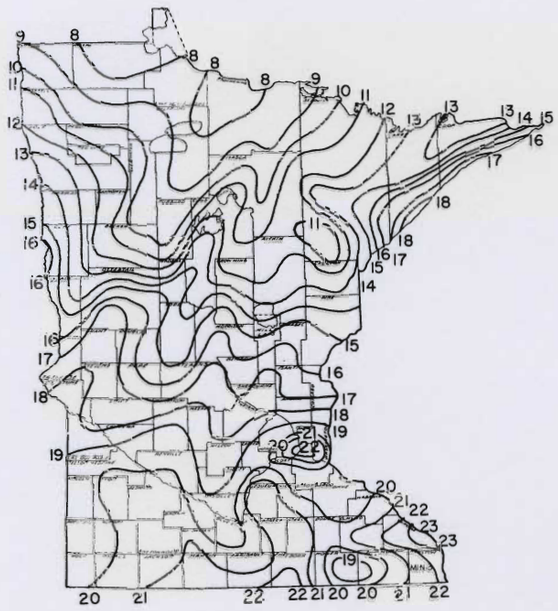

Figure 30. Average daily March minimum temperature.

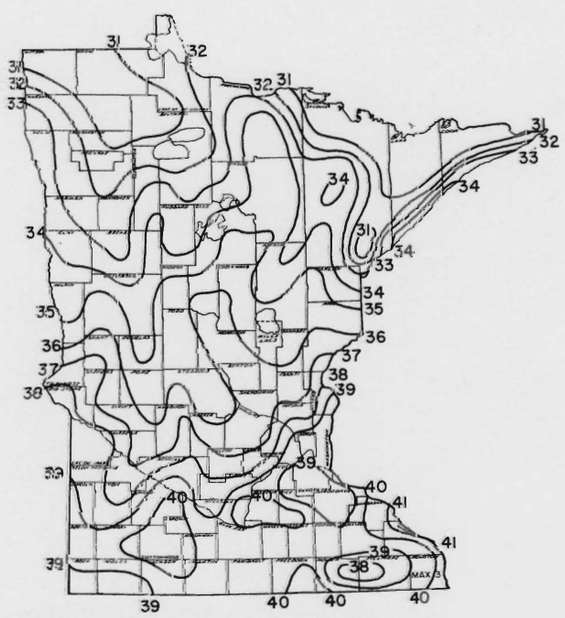

Figure 29. Average daily March maximum temperature.

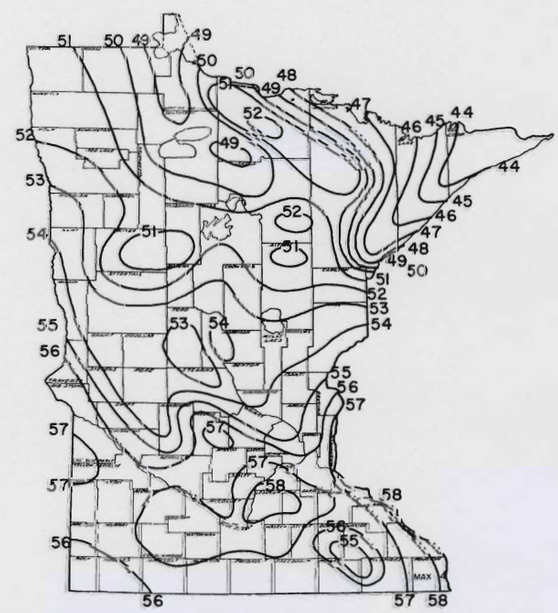

Figure 31. Average daily April maximum temperature.

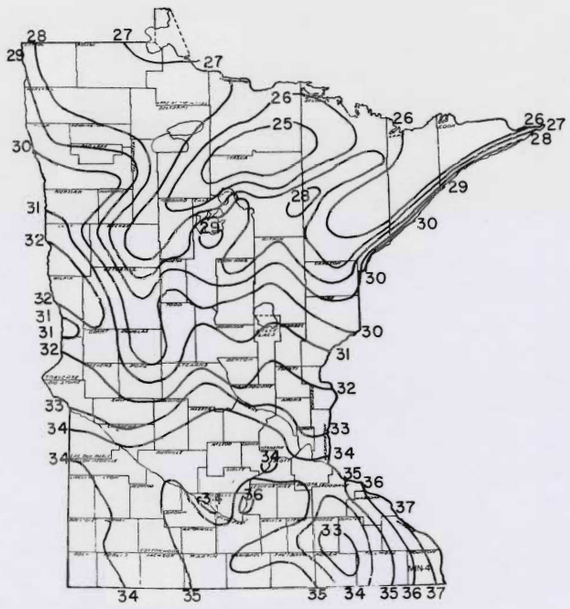

Figure 32. Average daily April minimum temperature.

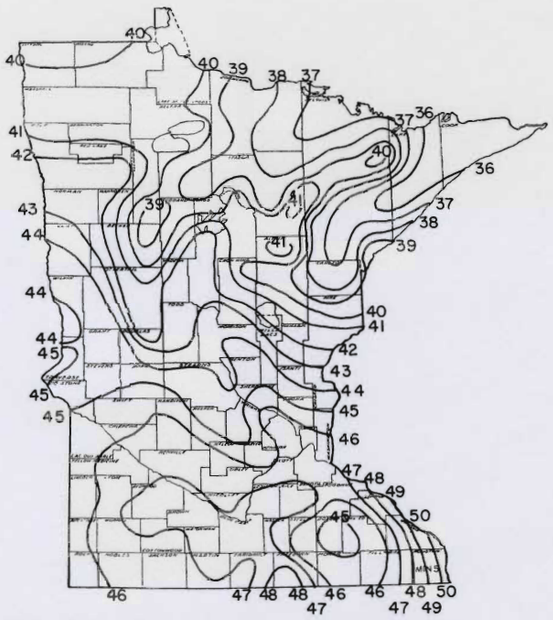

Figure 34. Average daily May minimum temperature.

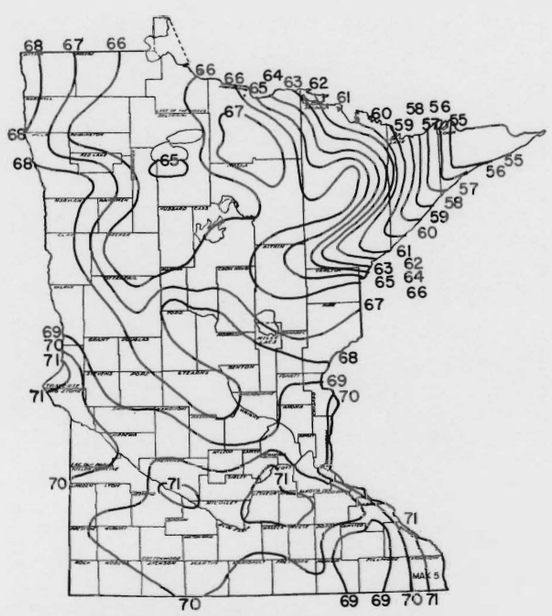

Figure 33. Average daily May maximum temperature.

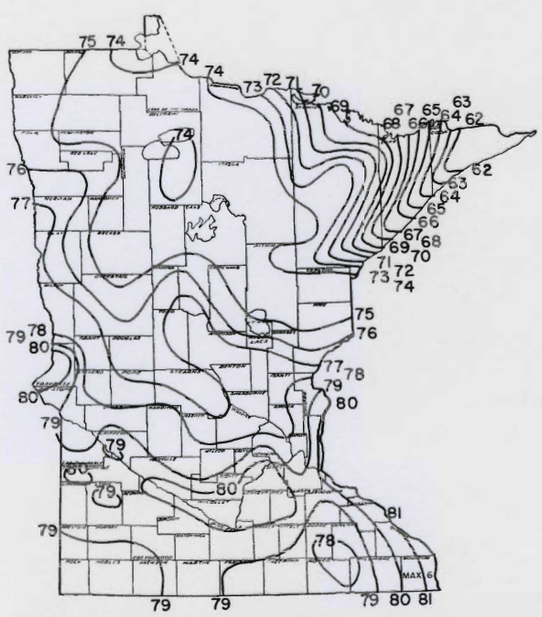

Figure 35. Average daily June maximum temperature.

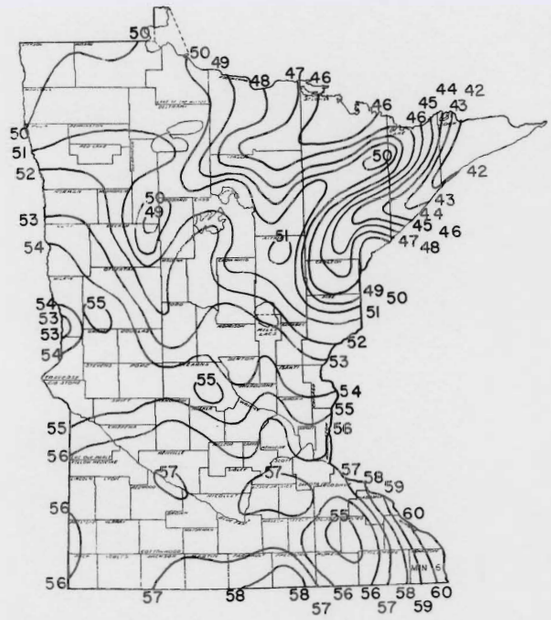

Figure 36. Average daily June minimum temperature.

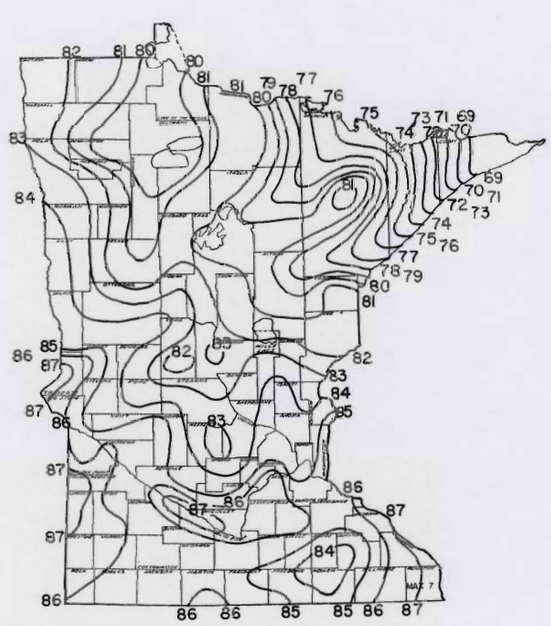

Figure 37. Average daily July maximum temperature.

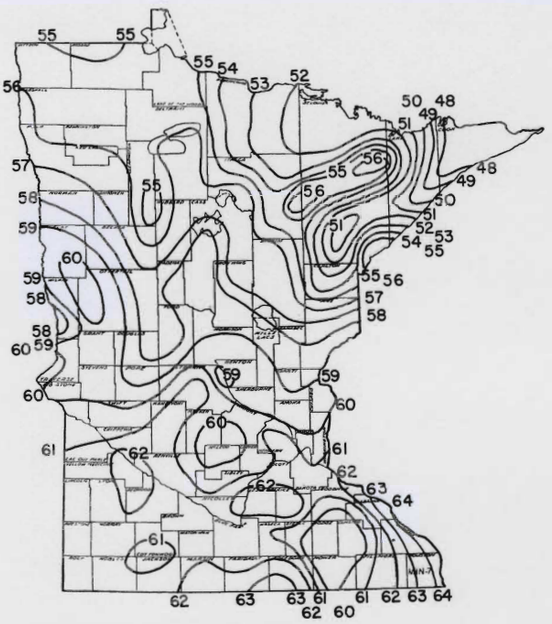

Figure 38. Average daily July minimum temperature.

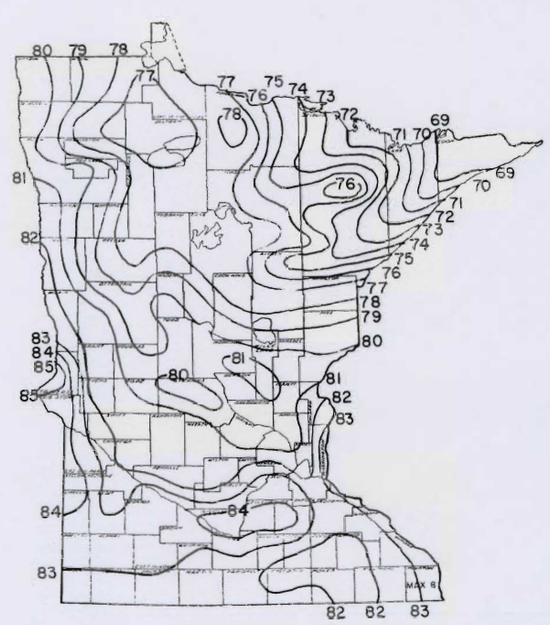

Figure 39. Average daily August maximum temperature.

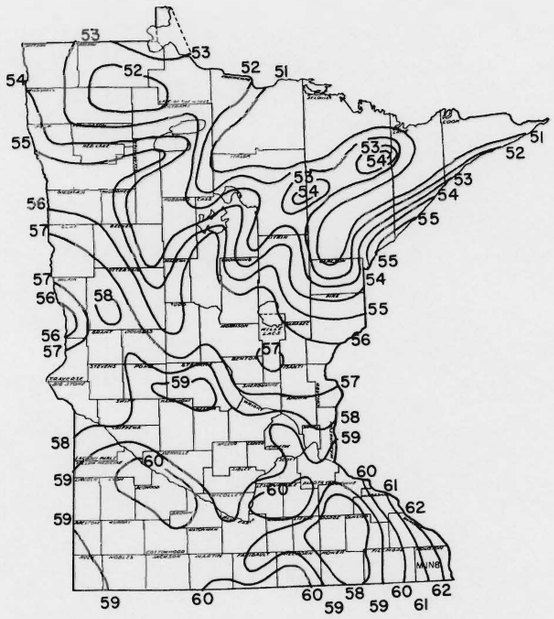

Figure 40. Average daily August minimum temperature.

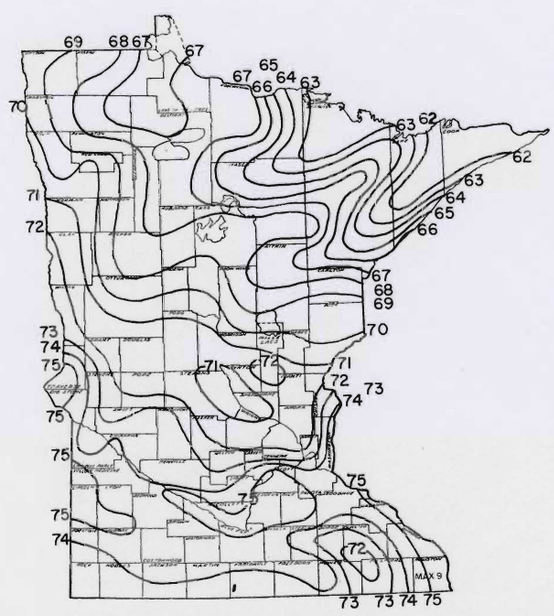

Figure 41. Average daily September maximum temperature.

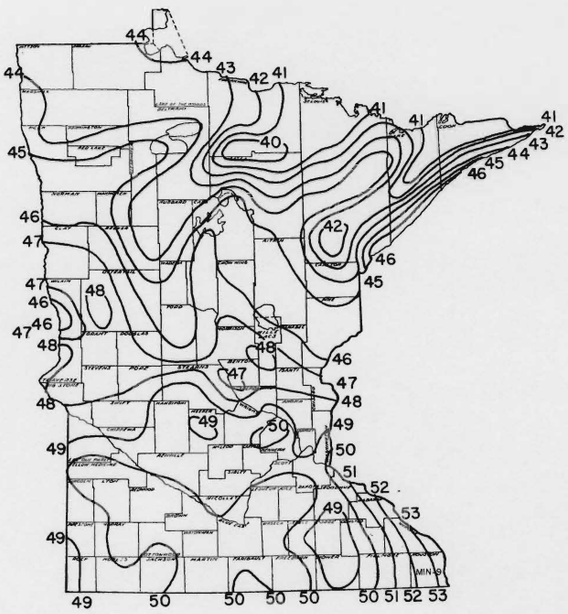

Figure 42. Average daily September minimum temperature.

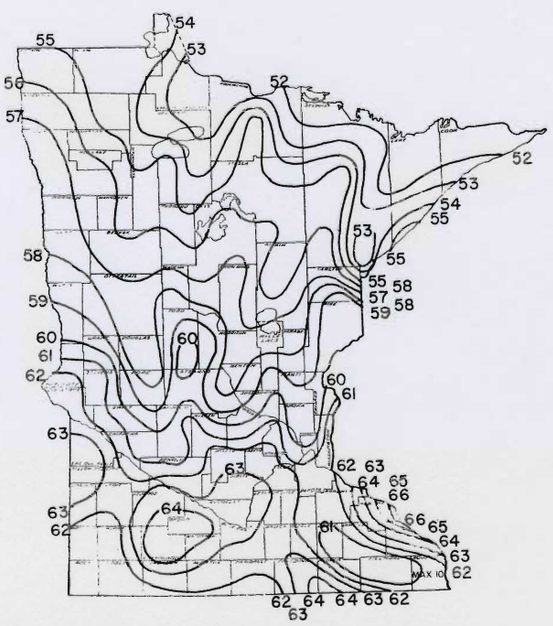

Figure 43. Average daily October maximum temperature.

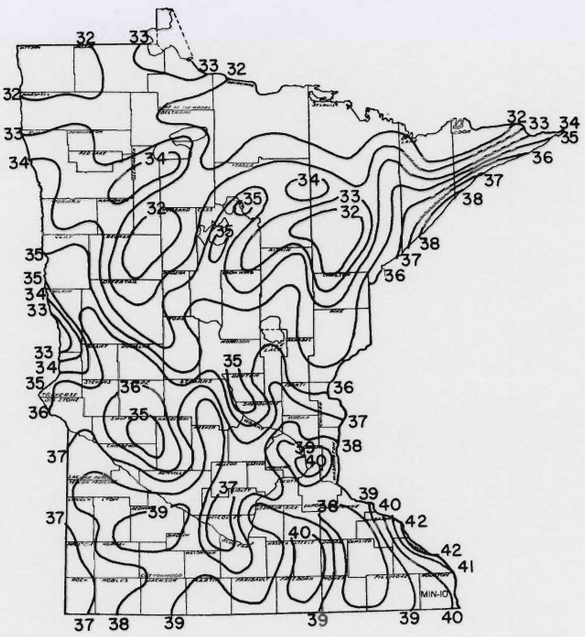


Figure 44. Average daily October minimum temperature.

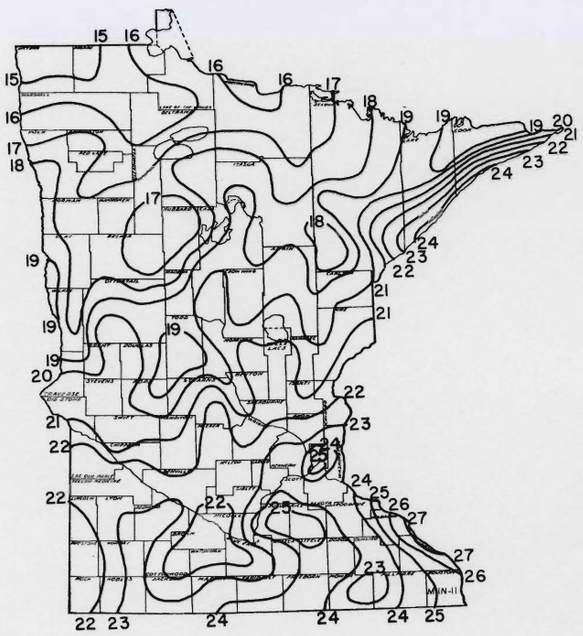


Figure 46. Average daily November minimum temperature.

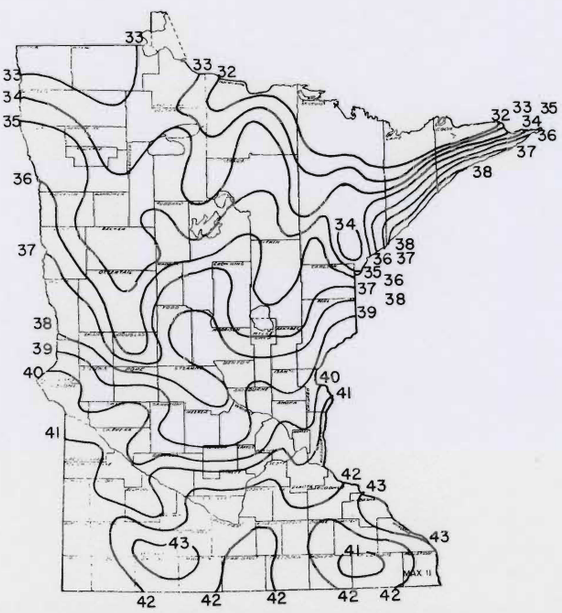


Figure 45. Average daily November maximum temperature.

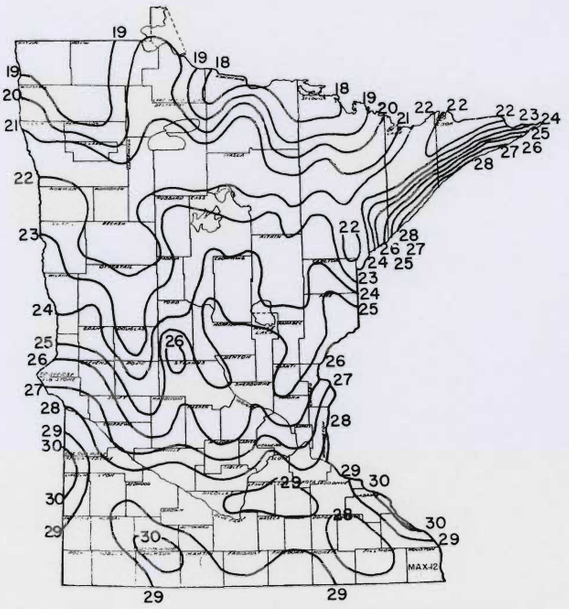


Figure 47. Average daily December maximum temperature.

transpiring surface; shelter minima are consistently a few degrees warmer than the minima over a bare soil. Shelter temperature extremes are poorest when compared to minima over green transpiring surfaces and to maxima over bare soil. Both maxima and minima over a bare cultivated soil are poorly estimated by shelter temperature extremes but differences decrease as crop-shading increases. As the crop matures and shading of the ground increases, a point is reached where temperature extremes within the crop canopy are much less than the shelter extremes.

The highest and lowest temperatures measured in the standard shelter during the entire record period for each station are shown in appendix table 2 and figures 49 and 50. With few exceptions, extreme maxima were recorded in July and lowest minima in January. Ada recorded the greatest temperature range, 164° F., due to a maximum and a minimum of 111° and —53° F., respectively. The modifying influence of Lake Superior is evident for the two lakeshore stations, Grand Marais and Two Harbors. They had the smallest absolute temperature ranges, 134° and 135° F., respectively.

The Duluth airport station (appendix table 2) recorded the smallest range, 132°, because of extremes of 97° and —35° F. This small range was undoubtedly due to the relatively short record period, since the Duluth city station recorded extremes of 106° and —41° in a much longer period.

Table 11 lists the officially accepted extreme temperatures of the world, the United States, and Minnesota. The continentality of the Minnesota climate is apparent with an absolute range of 173° F.—only 31° F. less than the absolute range measured anywhere in continental United States.

If 173° F. is the extreme temperature range in Minnesota as measured in a shelter (table 11), what might be a conservative estimate of the microenvironment extreme range? From measurements made in St. Paul, the maximum could be 30° F. higher and the minimum 15° F. lower—a maximum and minimum of 144° F. and —74° F., respectively; a range of 218° F.

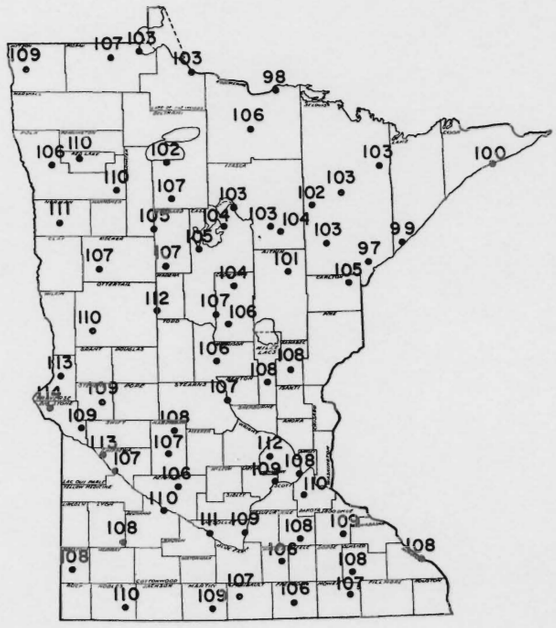

Figure 49. Extreme maximum air temperatures recorded during the total record period.

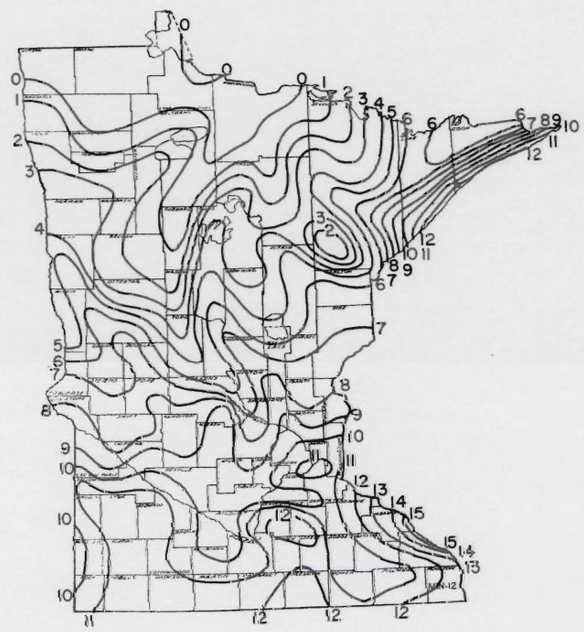

Figure 48. Average daily December minimum temperature.

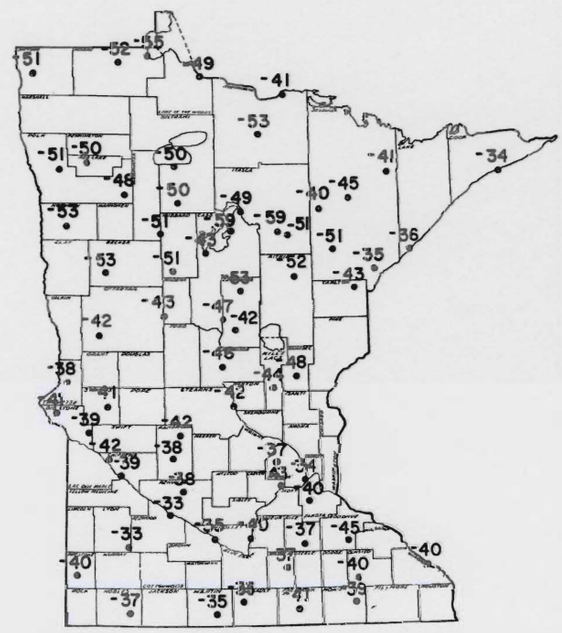

Figure 50. Extreme minimum air temperatures recorded during the total record period.

# Effective Day and Night Temperatures

During a day, air temperature normally rises from a minimum at about sunrise to a maximum in the early afternoon. Then it begins to drop, reaching a minimum again at sunrise the following day. This regular rise and fall, which may be interrupted by a change in the air mass or cloud cover conditions, reflects the sun's apparent daily movement through the heavens.

At most weather stations only the daily maximum and minimum temperatures are recorded; these are the peak and trough of the actual course of the daily temperature. The duration of these two temperatures during any 24-hour period is ordinarily short. Although these two temperatures indicate the extremes that existed, they do not represent the general temperature during the period. In order to obtain some measure of the general temperature for the period in question, the average—mean of the maximum and minimum—is ordinarily the statistic used.

However, the 24-hour day is divided into two distinct parts for plants. One is the photoperiod or daylight when photosynthesis is dominant; the other is the dark period or night when only respiration occurs. That plant growth occurs mainly at night was found to be true for many plants including tomatoes, potatoes, chili peppers, and corn (40). Therefore, there is good reason to attempt to separate temperature measurements into day and night temperatures. Were it not for the usual cyclic rise and fall of the daily temperature, this would be virtually impossible to do, based upon only the maximum and minimum.

Formulas for estimating the average daylight temperature and night temperature, frequently termed the "effective day temperature" (6) or "phototemperature" (40) and the "effective night temperature" or "nyctotemperature," respectively, are:

Effective day temperature (EDT) = Tmax − ¼ (Tmax − Tmin)

Effective night temperature (ENT) = Tmin + ¼ (Tmax − Tmin).[2]

Preferably, effective day and night temperatures are calculated using the daily maxima and minima but they can be estimated using the average monthly maxima and minima. Based upon the latter and more simple method, the average monthly effective day and night temperatures are listed in appendix table 2 and illustrated for April through September in figures 51-62.

Went (40) perhaps has done the most work concerning the effect of day and night temperatures upon plants. A few interesting results are outlined below.

## Corn

At relatively low light intensities, if the day temperature was 73° F., the optimum night temperature

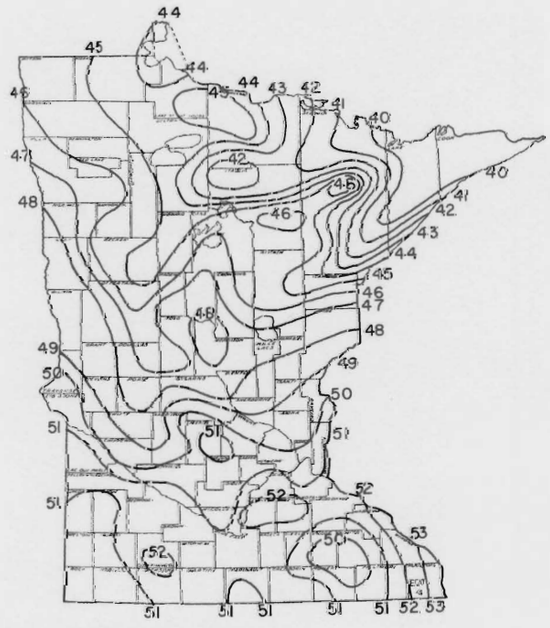

Figure 51. Average April EDT.

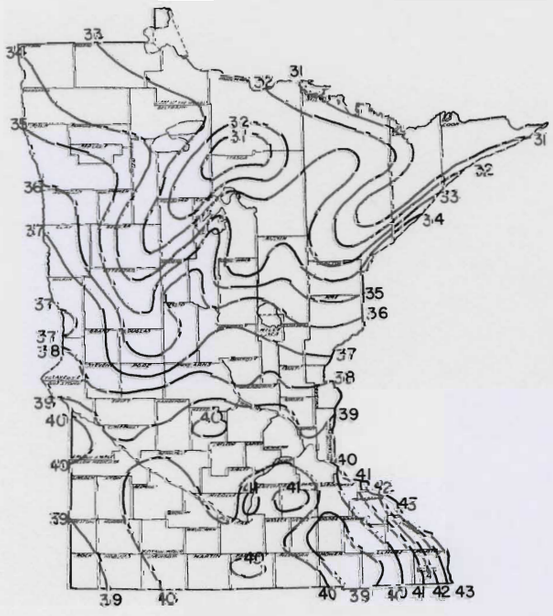

Figure 52. Average April ENT.

[2] Tmax = maximum temperature; Tmin = minimum temperature.

was 63° F.; at a 86° F. day temperature the night temperature optimum was 68° F. The optimum day temperature was either 73° F. or 79° F., depending upon the night temperature.

At high light intensities, summer conditions, optimum day and night temperatures were slightly higher.

Ears formed only when night temperatures were greater than 54° F.

### ● Flax

The best production of flax seeds occurred with a 68-73° F. day temperature and a 50° F. night temperature.

### ● Tomato

In the early development the optimum night temperature was quite high. As the plant grew and matured, the night temperature optimum gradually decreased.

During germination (in the dark) the optimum temperature was 79° F.

For emerging seedlings the most rapid development occurred at 79° F. day and 68° F. night temperatures.

The optimum night temperature for young plants was about 79-86° F.; with age it decreased to 57-63° F.

In the vegetative development the photoperiod was quite important. However, in its fruiting behavior this plant was relatively uninfluenced by the photoperiod but greatly influenced by temperature.

### ● Chili pepper

This plant was similar to the tomato in its reactions to temperature. As seedlings the optimum night temperature was high, about 79-86° F., but decreased soon thereafter.

For example, with a day temperature of 64° F. the optimum night temperature was 86° F. and decreased in 2, 4, and 12 weeks to 79°, 70°, and 61° F., respectively.

Growth rates could have been doubled if, instead of a day temperature of 64° F., plants were grown at 81° F.

### ● Potato

Tuber production, like the fruiting behavior of tomatoes, was largely controlled by night temperatures.

Day and night temperatures of 68° F. and 57°F., respectively, appeared optimum.

Tuber production was poor at a night temperature of 63° F.; when greater than 68° F., no tubers were produced.

When temperatures were sufficiently low, especially night temperatures, the potato did not behave as a short day plant.

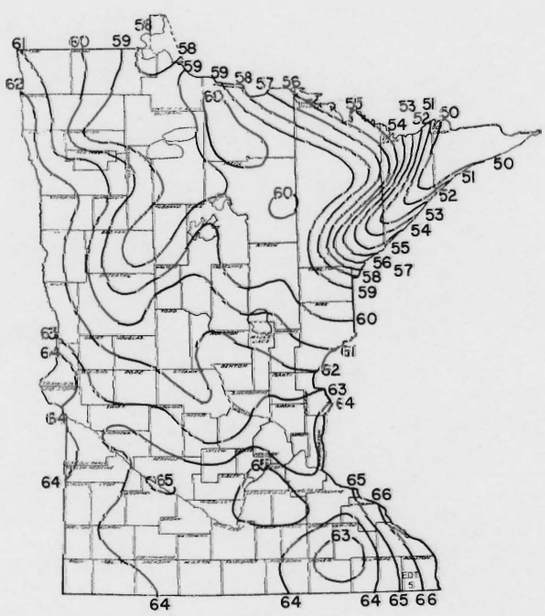


Figure 53. Average May EDT.

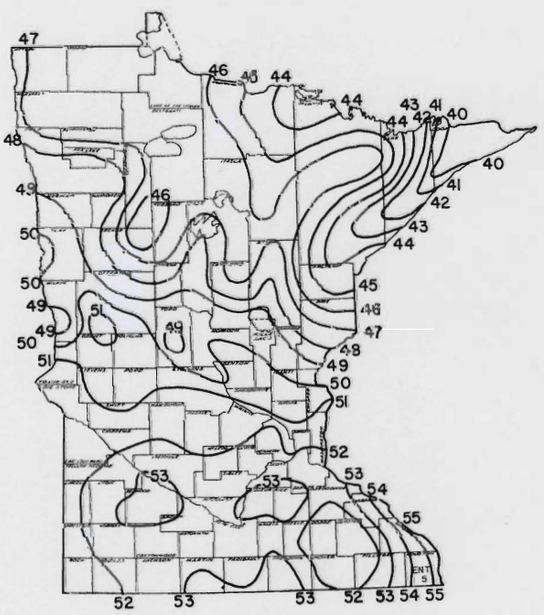


Figure 54. Average May ENT.

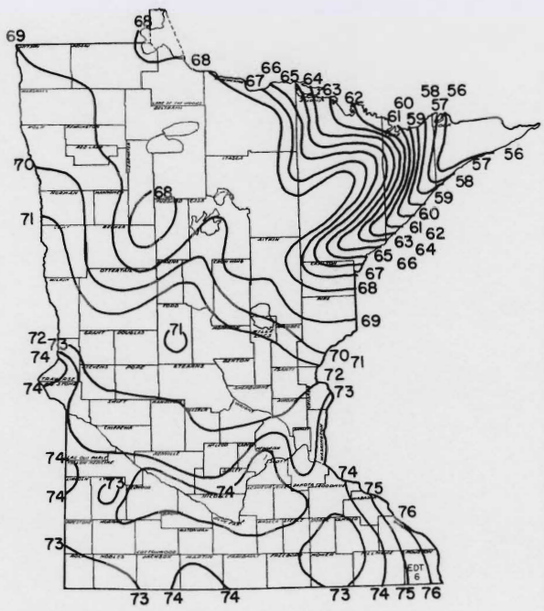

Figure 55. Average June EDT.

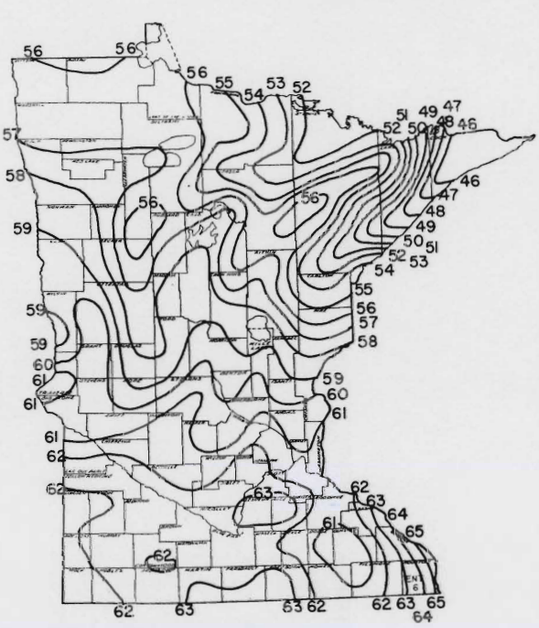

Figure 56. Average June ENT.

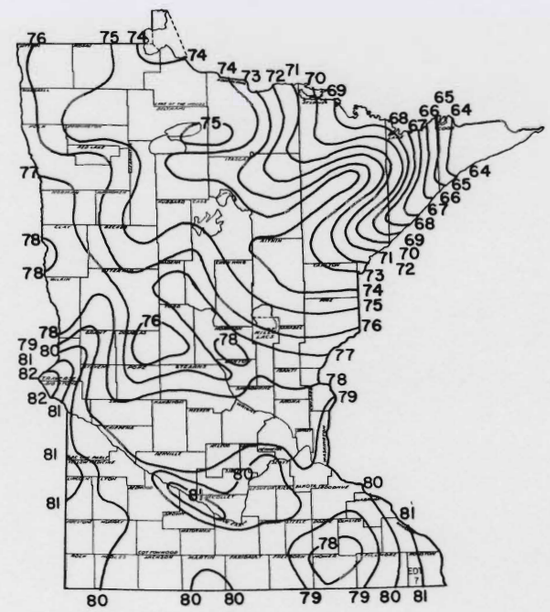

Figure 57. Average July EDT.

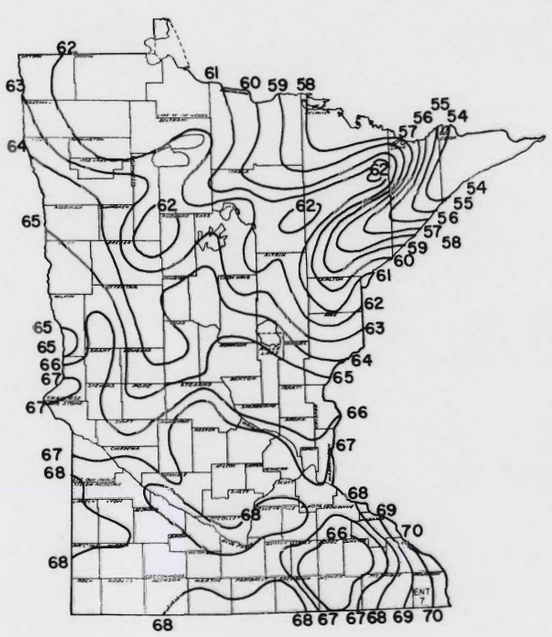

Figure 58. Average July ENT.

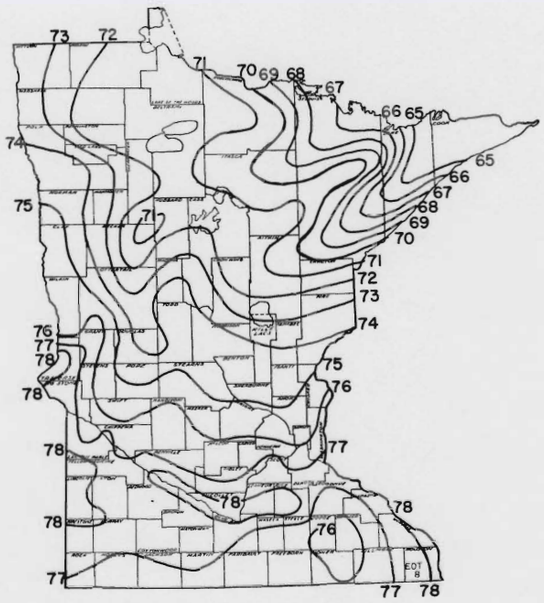


Figure 59. Average August EDT.

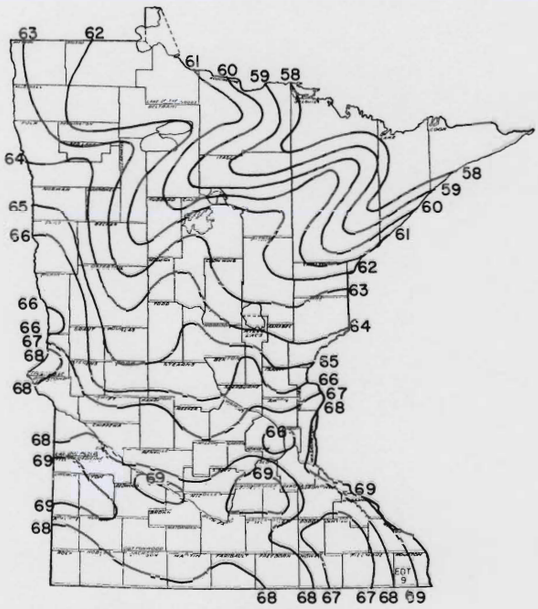


Figure 61. Average September EDT.

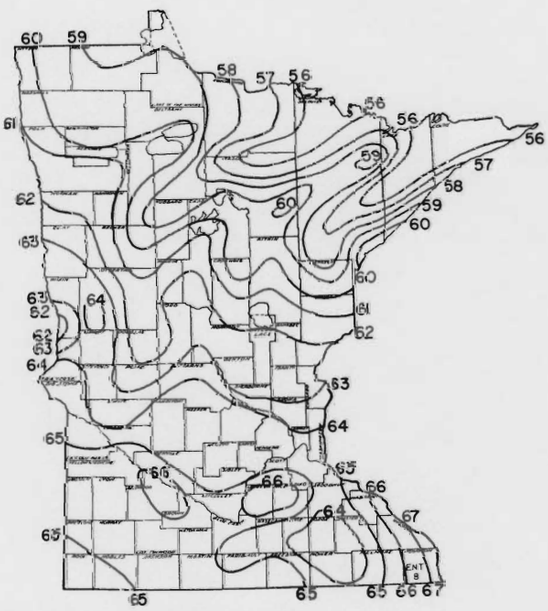


Figure 60. Average August ENT.

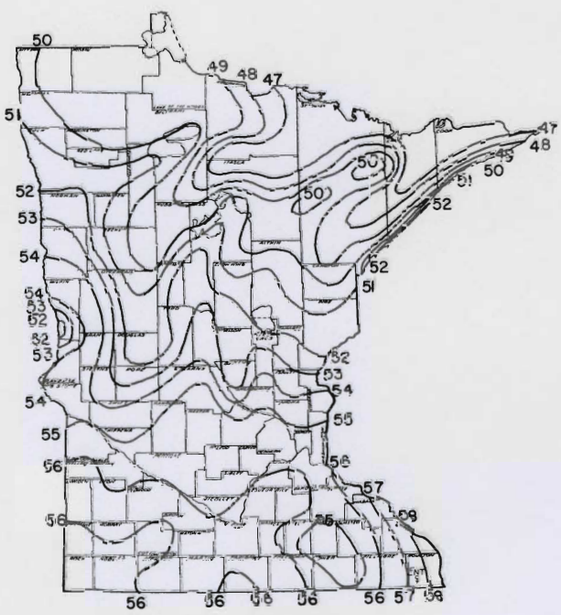


Figure 62. Average September ENT.

● **Peas**

In order of decreasing importance the pea was influenced by light intensity and photoperiod, day temperature, and night temperature.

In the early period of growth, optimum temperatures were 68-73° F., decreasing to 50-63° F. 4 weeks after germination and dropping even lower after 6 weeks.

● **Strawberries**

Optimum conditions for fruit growth were 63° F. day and 54° F. night temperatures.

Size of fruit was not influenced by night temperatures but was inversely proportional to day temperatures.

For development of aromatic taste, the day temperature could not exceed 59° F.

● **African violet**

This was the only plant investigated where the optimum night temperature, 68-73° F., exceeded the optimum day temperature, 50° F. These were the best temperatures for both vegetative growth and flowering.

This plant was typical of those investigated because under artificial light conditions the optimum temperature decreased with increasing light intensity.

● **Sugar beets (29)**

Although both day and night temperatures were important, night temperatures had a more pronounced effect upon the beet crop.

On a percentage basis the sugar content was inversely proportional to temperature; the night temperature was slightly more effective than the day temperature.

Based upon the average of results obtained at day temperatures of 68°, 73°, and 79° F., the percent of sugar content was highest at the lowest night temperature tested, 39° F., and decreased with increasing night temperatures. The beet weight increased with increasing night temperatures to a maximum at 73° F. and decreased thereafter. Total weight of sugar showed results similar to the beet weight with the maximum weight of sugar obtained at night temperatures of 57-63° F.

In an attempt to determine which Minnesota areas have the most suitable temperature climate, a com-

**Table 12. Stations ranked in descending order of the adequacy of their average monthly day and night temperatures to meet optimum day and night temperatures of five crops, May through September***

| Crop | Station | Rank | Station | Rank |
|---|---|---|---|---|
| Corn | Winona | 100 | Milaca | 82 |
| | Waseca | 97 | Crookston | 69 |
| | Bird Island | 94 | Grand Rapids | 50 |
| | Worthington | 89 | Cloquet | 47 |
| | Morris | 89 | International Falls | 33 |
| | Minneapolis | 88 | Grand Marais | 0 |
| Sugar beets | Morris | 100 | Minneapolis | 93 |
| | Bird Island | 100 | Cloquet | 93 |
| | Milaca | 99 | Worthington | 92 |
| | Crookston | 96 | International Falls | 77 |
| | Grand Rapids | 96 | Winona | 66 |
| | Waseca | 94 | Grand Marais | 29 |
| Potatoes | Grand Rapids | 100 | Waseca | 71 |
| | International Falls | 95 | Minneapolis | 68 |
| | Crookston | 87 | Bird Island | 66 |
| | Cloquet | 86 | Worthington | 63 |
| | Milaca | 81 | Grand Marais | 53 |
| | Morris | 79 | Winona | 41 |
| Flax | Cloquet | 100 | Worthington | 65 |
| | International Falls | 95 | Minneapolis | 65 |
| | Grand Rapids | 94 | Waseca | 65 |
| | Crookston | 82 | Grand Marais | 65 |
| | Milaca | 71 | Bird Island | 60 |
| | Morris | 67 | Winona | 38 |
| Strawberries | International Falls | 100 | Morris | 46 |
| | Cloquet | 93 | Minneapolis | 41 |
| | Grand Rapids | 90 | Bird Island | 39 |
| | Grand Marais | 89 | Waseca | 36 |
| | Crookston | 67 | Worthington | 34 |
| | Milaca | 49 | Winona | 17 |

* Expressed as a percentage of the station with the highest rank.

parison was made between the optimum day and night temperatures obtained by Went (40) for several crops and the average monthly effective day and night temperatures of selected stations. This was done for May through September (see figures 63-67).

The optimum day and night temperatures used for corn (figure 63) are 80° and 65° F., respectively Depending upon the variety of corn grown, optimum temperatures may differ. This is true for other crops as well. Incidentally, Wang (39) showed temperatures of about 80° and 65° F. as being optimum for sweet corn after about one-third of growth occurred. According to Wang, wider optimum temperature limits are the order during the early growth period.

It is evident from figure 63 why the north central and northeast, as represented by Cloquet, Grand Marais, Grand Rapids, and International Falls, should not be considered for production of warm season crops such as corn and soybeans. Based upon table 8 data, certain vegetable crops such as cauliflower, celery, lettuce, and spinach might be considered insofar as temperature is a factor. Strawberries (see figure 66) appear to be a suitable crop for both the north and northeast.

In order to obtain a semiquantitative measure of how each station meets crop temperature requirements, areas in figures 63-67 mutual to both crop optimum temperatures and station effective day and night temperatures were determined. Obviously, the more nearly that the crop and station temperatures coincide the greater the area measured.

In table 12 the stations are ranked in descending order of the overlapping areas measured for each crop during the May through September period. Therefore, the numbers upon which the stations are ranked represent the degree of coincidence between day and night temperatures of the station and the optimum day and night temperatures of each crop (see figures 63-67). The higher the number the more nearly the station satisfies the crop's temperature requirements.

The growing season for many crops is not May through September, as implied in table 12, but is often some shorter period. Therefore, the amount by which the station and crop temperatures coincide for any desired period can be found by determining the overlapping area or simply the vertical distance common to the two sets of temperatures each month. In this way a crude quantitative measure may be obtained for the stations.

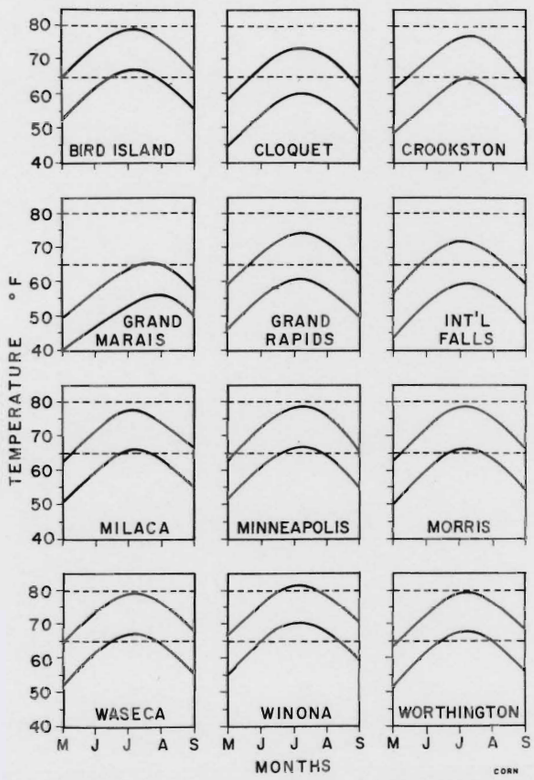


Figure 63. Optimum day and night temperatures of corn (dashed lines at 80° and 65° F., respectively) compared to effective day and night temperatures (solid line) at selected stations.

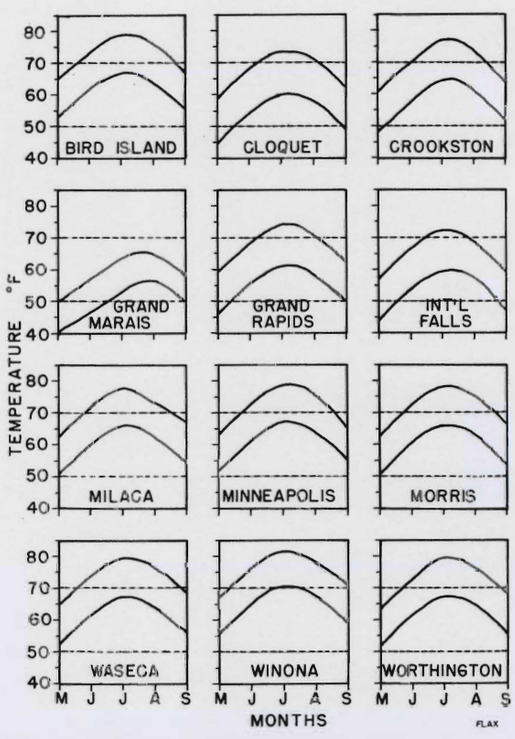


Figure 64. Optimum day and night temperatures of flax (dashed lines at 70° and 50° F., respectively) compared to effective day and night temperatures (solid lines) at selected stations.

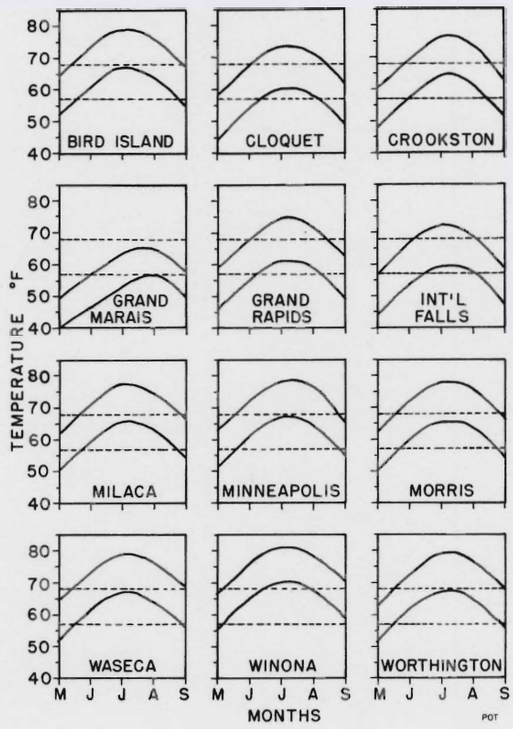


Figure 65 (upper left). Optimum day and night temperatures of potatoes (dashed lines at 68° and 57° F., respectively) compared to effective day and night temperatures (solid lines) at selected stations.

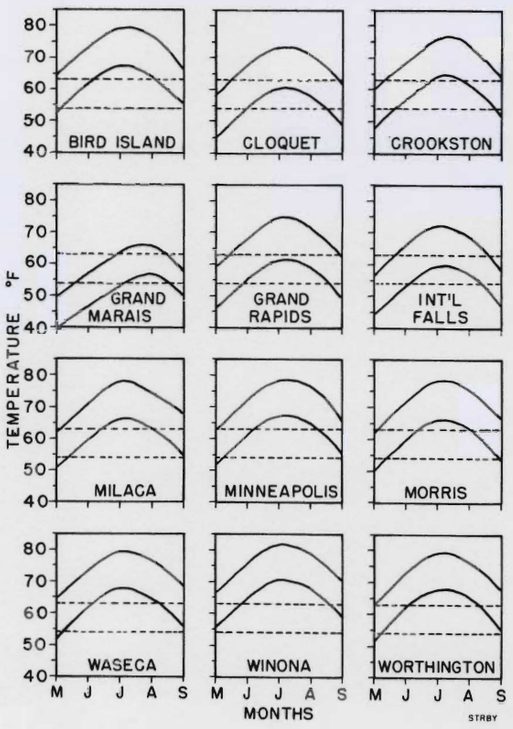


Figure 66 (upper right). Optimum day and night temperatures of strawberries (dashed lines at 63° and 54° F., respectively) compared to effective day and night temperatures (solid lines) at selected stations.

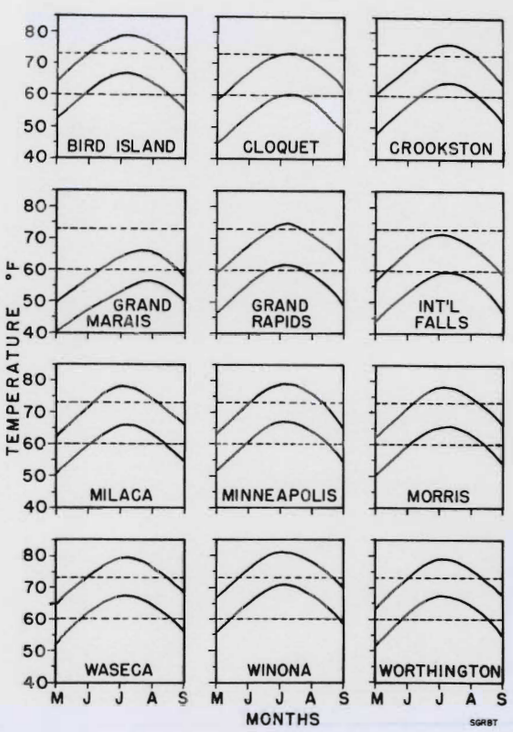


Figure 67 (lower right). Optimum day and night temperatures of sugar beets (dashed lines at 73° and 60° F., respectively) compared to effective day and night temperatures (solid lines) at selected stations.

# Growing Degree Days

An interesting and frequently useful means of predicting various stages of plant growth or development is the calculation of growing degree days (GDD), sometimes termed the heat sum or remainder index method. Mathematically the expression is:

$$GDD = \Sigma(\overline{T} - T_b)$$

$\overline{T}$ = average daily temperature; $T_b$ = a base temperature dependent upon crop in question; $\Sigma$ indicates that the difference between $\overline{T}$ and $T_b$ is to be summed cumulatively day by day.

$T_b$ presumably represents the highest temperature at which no growth occurs. When the daily temperature average is greater than this base figure then so much growth, supposedly proportional to and expressed as GDD, occurs within the plant. Within usually tolerable limits a certain number of GDD can be allotted to various stages of growth and development. For various reasons caution must be exercised in the application of this method.

Occasionally, hourly temperatures are used in place of the average daily temperature $\overline{T}$ (15). Total GDD, or more correctly growing degree hours, assigned to the growth or developmental stages then have to be revised accordingly.

For purposes of expediency the formula is sometimes altered to:

$$GDD = \Sigma[(Tm - T_b) \times N]$$

Tm = average monthly temperature; $T_b$ = base temperature; N = number of days in the month; $\Sigma$ indicates that the value obtained within the brackets is to be summed cumulatively.

An example using the first formula and applying it to sweet corn may explain the use of this method more clearly. For example, if $\overline{T}$, the average temperature for the day, is 80° F. and $T_b$ is 50° F., the base temperature frequently used for sweet corn, then total GDD for this day equal the difference between 80° and 50° F. or 30 GDD. Upon accumulating these day-by-day values from planting to canning time, about 1,750-2,000 GDD are usually obtained for sweet corn.

Of course, canning companies, the most frequent users of this method, do not depend upon this method alone to determine proper harvesting time. After a certain sum has been reached during the current season, field inspections are greatly increased; the decision to harvest is based upon these inspections. As one canning company official stated, "the growing degree day method is a yardstick, not a micrometer."

Canning companies frequently use the heat sum or growing degree method for another practical purpose—to schedule plantings so that harvest does not occur within too brief a period for canning facilities. Since temperatures for the growing period are not known at planting time, schedules are based upon GDD calculated from the normal or average temperature of the area.

Moreover, at least one canning company uses this method to estimate root growth of corn in order to determine when it is advisable to cease cultivation.

Some typical values of $T_b$ and total GDD calculated from planting to maturity or harvest are shown in table 13. The GDD totals are general figures and vary because of differences in climate, soil fertility, and varieties (12).

Entomologists have also used this method to predict the hatching date of various insects (10). Undoubtedly this procedure has been applied to many other phenological occurrences.

Nevertheless, at best this method is merely a practical guide and not a research tool. It is very questionable whether it deserves further efforts in seeking improvement. As Went (40) stated, it is amazing that this method works as well as it does, since growth is not a straight line function with temperature as the formula implies. Admittedly this method is a most tempting one: by knowing only the base and maximum and minimum temperatures any stage of plant growth supposedly can be determined.

In Minnesota the success of this method is limited essentially to the period from spring planting until early July—largely because soil moisture normally remains adequate only through this period—without addition of various modifications determined only by experience. With sufficient soil moisture the available energy, essentially solar radiation, is more uniformly partitioned between evapotranspiration and sensible heat. Ordinarily, after early July, soil moisture reserves and precipitation cannot meet the evapotranspiration demand. So proportionally less energy is expended in evapotranspiration and more is available for heating the air and soil. The resultant high air temperatures,

**Table 13. Values frequently assigned to $T_b$ and the total GDD calculated for various crops in southern Minnesota**

| Crop | $T_b$ (°F.) | Total GDD, planting to harvesting |
|---|---|---|
| Corn, field | 50-55 | 2,200-2,600 ($T_b$ = 50° F.) |
| Corn, sweet | 49-50 | 1,750-2,000 ($T_b$ = 49° F.) |
| Soybeans | 50-55 | 2,000-2,400 ($T_b$ = 50° F.) |
| Barley | 40-43 | 2,000-2,400 ($T_b$ = 40° F.) |
| Flax | 40 | 1,900-2,200 ($T_b$ = 40° F.) |
| Oats | 40-43 | 2,100-2,500 ($T_b$ = 40° F.) |
| Wheat, spring | 40-43 | 2,000-2,400 ($T_b$ = 40° F.) |
| Asparagus | 40 | |
| Beans, lima | 50-53 | |
| Peas, canning | 40 | 1,200-1,800 ($T_b$ = 40° F.) |
| Peppers, chili | 60 | |
| Tomatoes | 50-53 | |

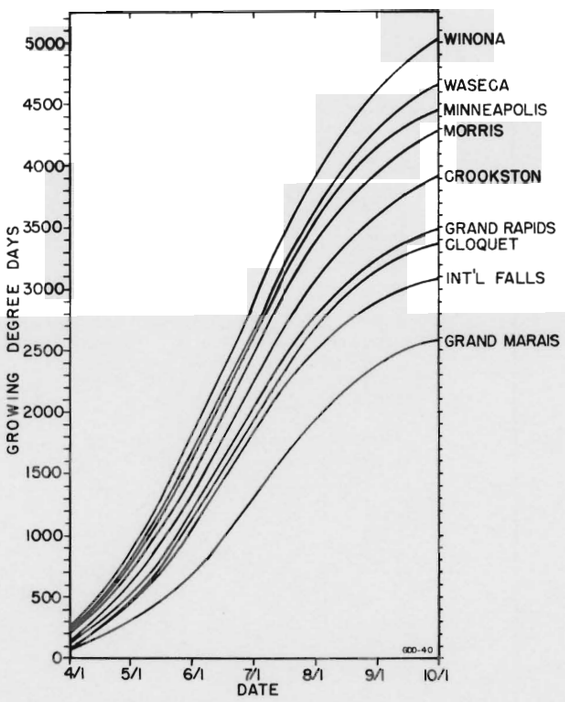


Figure 68. Cumulative GDD ($T_b = 40°$ F.) at selected stations.

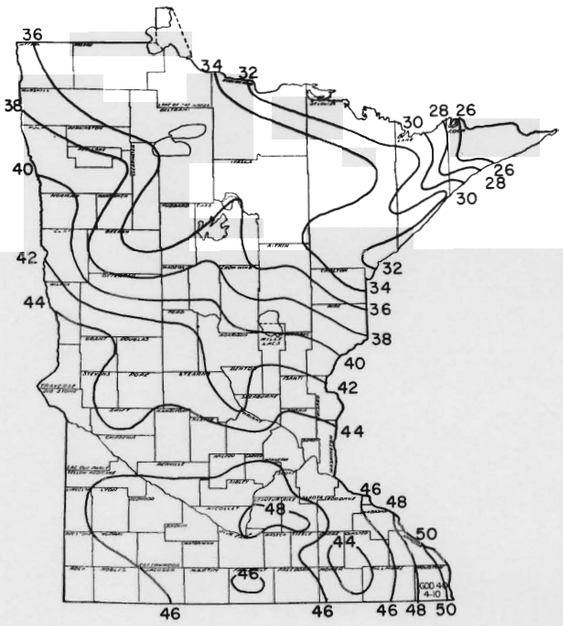


Figure 70. Average annual total GDD ($T_b = 40°$ F.) in hundreds.

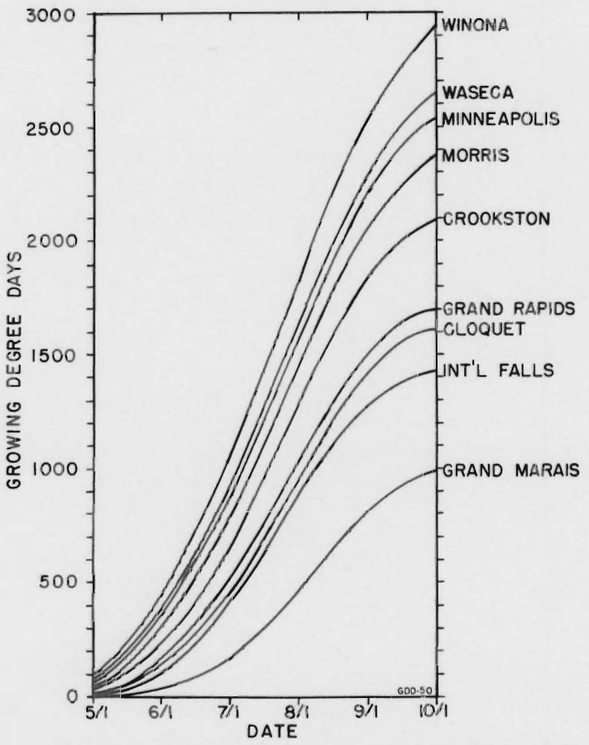


Figure 69. Cumulative GDD ($T_b = 50°$ F.) at selected stations. (Note change in scale from figure 68.)

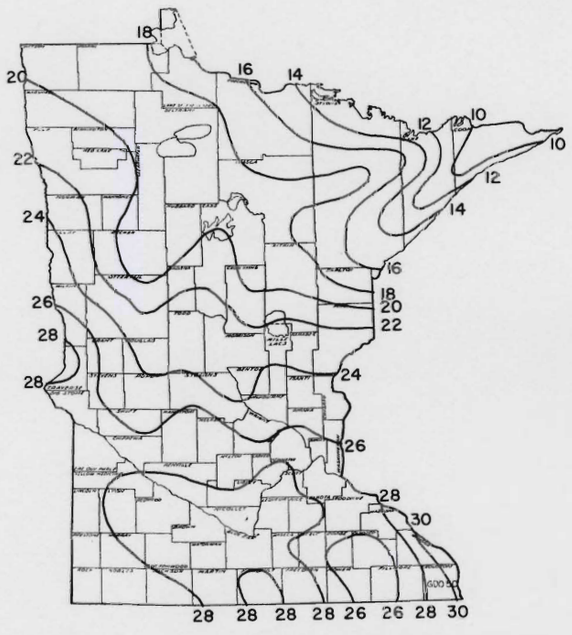


Figure 71. Average annual total GDD ($T_b = 50°$ F.) in hundreds.

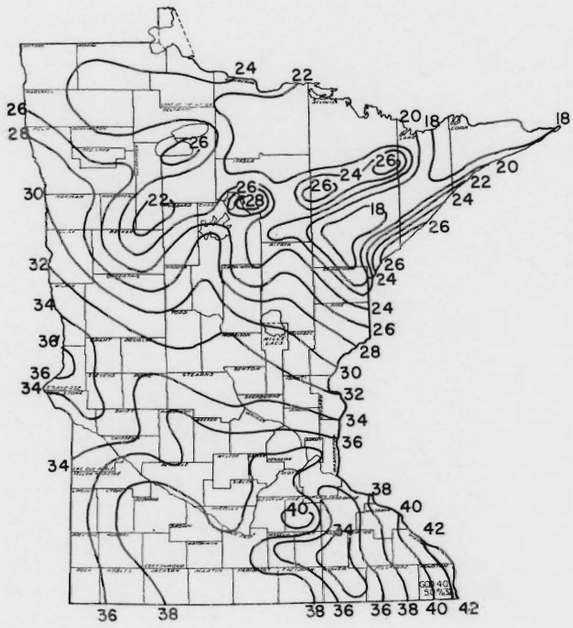

Figure 72. Average total GDD ($T_b = 40°$ F.) in hundreds for the period between the average date of the last occurrence in the spring and first occurrence in the fall of 32° F. or lower.

Figure 73. Average total GDD ($T_b = 50°$ F.) in hundreds for the period between the average date of the last occurrence in the spring and first occurrence in the fall of 32° F. or lower.

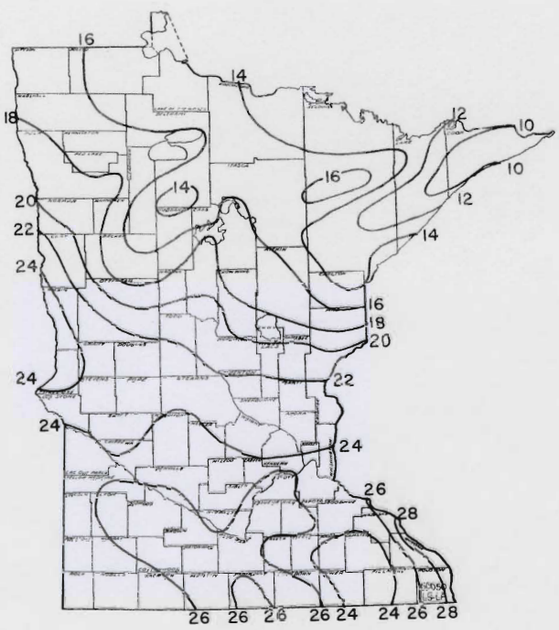

Figure 74. Average total GDD in hundreds ($T_b = 50°$ F.) accumulated during the warm season crop period (late spring through late fall).

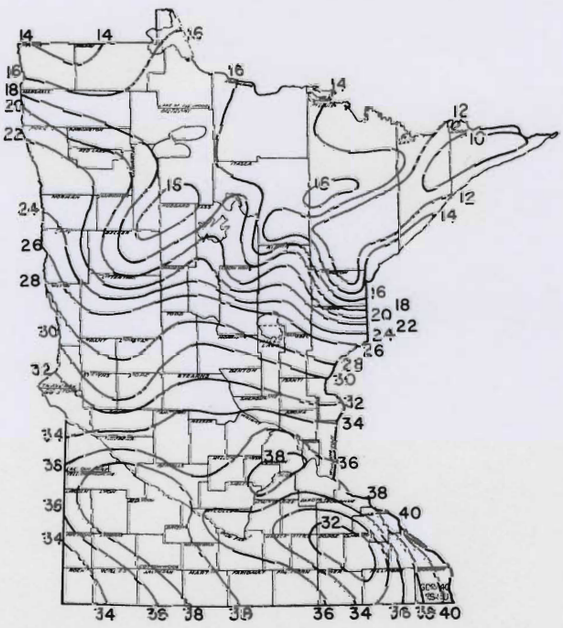

Figure 75. Average total GDD in hundreds ($T_b = 40°$ F.) accumulated during the cool season crop period (early spring through summer).

and the corresponding increase in heat sums, seemingly indicate a proportional increase in plant growth. Such is not the case, as experienced growers know.

To apply the method more satisfactorily a correction factor may be introduced. This reduces accumulated GDD to correspond more closely to actual growth and development during high temperature periods. Irrigation reduces this problem and brings calculations more nearly in line with the plant's behavior.

Data in appendix table 2 and figures 68-73 were not computed day by day for each of the 30 years, 1931-60, but rather from monthly temperature normals. Ordinarily such a method is not recommended because daily variations are then masked. However, Thom (26) developed a nomogram permitting the use of monthly normals which takes into account daily variations.

Figures 68 and 69 show how GDD accumulate month by month for selected stations using base temperatures of 40° and 50° F. Winona and Grand Marais represent the two extremes found in Minnesota.

The total annual GDD distribution across the state for the same two base temperatures are shown in figures 70 and 71. Figures 72 and 73 are similar except that totals shown are for the period between the average date of the last occurrence in the spring and the first occurrence in the fall of 32° F. or lower. These two figures depict the total GDD accumulating for the average duration of the "freeze-free" period.

Defining crop, soil, and native vegetation boundaries is always an intriguing consideration and one ultimate goal of climatic studies (17, 18, 27). Because of information now available for Minnesota conditions, perhaps another attempt to define crop or crop variety limits is in order.

Information resulting from this and two previous studies includes:

1. The average commencement date and duration of agricultural seasons (4) based upon crop phenology and occurrence of certain low temperatures (3).

2. Average cumulative GDD totals between average planting and harvesting dates of several crops as grown in southern Minnesota (see table 13).

3. Average GDD for two base temperatures, 40° and 50° F., at each station (see appendix table 2).

A solution has been sought for this problem: Based upon the apparent GDD requirement of a particular crop as grown in southern Minnesota, where does the northern limit occur beyond which, on the average, some other crops or varieties might better be grown?

For example, the crop period of field corn was defined (20) as extending from the beginning of the late spring to the end of late fall. At Morris the average commencement and ending dates of these two seasons are May 23 and October 26 (4), respectively. The average total GDD during this period at Morris equal 2,249, $T_b = 50°$ F. (see appendix table 2). The sum, 2,249, is on the lower limit of the 2,200-2,600 GDD obtained for southern Minnesota (see table 13). Therefore, Morris is in a marginal zone as defined here.

Figure 74 shows the average total GDD accumulated, $T_b = 50°$ F., during the warm season crop period that extends from the beginning of late spring to the end of late fall. Typical warm season crops in Minnesota are soybeans and corn. Total GDD for field corn are 2,200-2,600 (see table 13), but for safety the midvalue is used as the northern limit. Similarly the northern limit of soybeans is placed at 2,200 GDD, although the apparent requirement ranges from 2,000-2,400.

Although sweet corn requires only 1,750-2,000 GDD, this total must be reached in a shorter period than is the case with field corn. So its northern limit might coincide with that of field corn. According to this scheme there is a marginal area in southeastern Minnesota where totals are somewhat less than the 2,400 GDD limit. However, the total in this region, based upon available stations, is less than about 2,300 GDD.

Figure 75 shows the total accumulated GDD, $T_b = 40°$ F., between the beginning of early spring and the end of summer. Typical crops grown during this period include barley, flax, oats, and spring wheat. The 2,200 GDD line might be suggested as the northern limit of presently recommended varieties beyond which other better adapted varieties should be recommended or developed for use in this northerly region.

Boundaries established by this method vary from year to year since only averages are involved. A particular failing of the method is that it is based almost solely upon temperature—both low temperature occurrence frequency and average degree day totals. No consideration is given to the moisture factor. Although in a fairly humid state such as Minnesota this raises little difficulty, the moisture factor is of major concern further west. Inclusion of day length would move limits northward. But within this method's limitations, boundaries agree with what experience proved. This method's advantage is that northern crop limits may be delineated without the onerous task of determining them by experience. Apparently this method is suitable for determining only the northern limits of crops.

# Heating Degree Days

Heating degree days (HDD) are calculated by obtaining the difference between $T_b$ and $\overline{T}$, and then summing these values over the period in question. Mathematically the expression is:

$$HDD = \Sigma(T_b - \overline{T}).$$

Only positive values are considered and the HDD season begins July 1 rather than January 1.

The similarity between GDD and HDD is evident. However, they are used for two different purposes and essentially at two different times of the year. The greatest accumulation of GDD occurs in summer, while HDD accumulate most rapidly in winter.

Fuel and power companies commonly use HDD to determine probable fuel requirements of homes and industrial plants. Formulas (2) and nomograms (23) based upon HDD were developed to estimate fuel consumption.

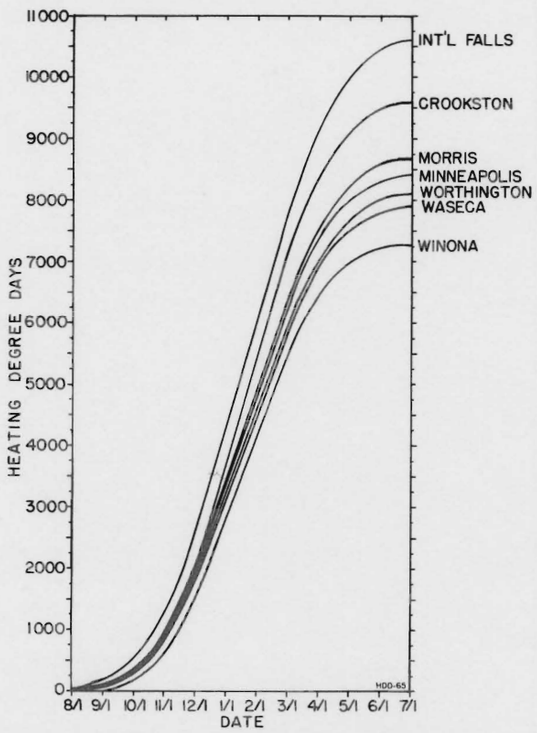


Figure 76. Average annual cumulative HDD ($T_b = 65°$ F.) at selected stations.

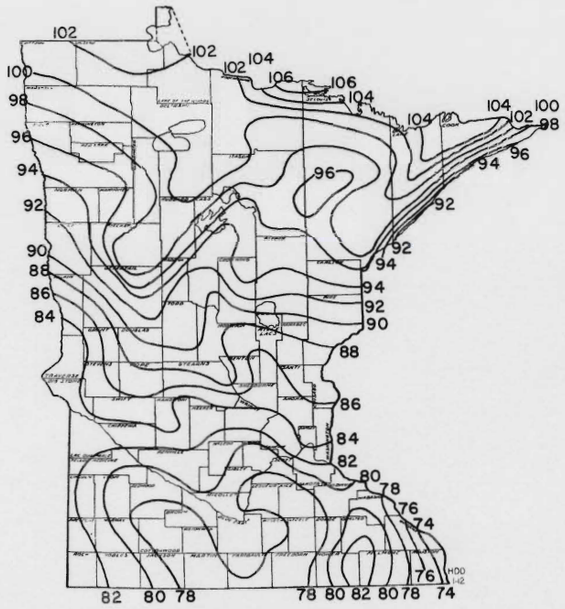


Figure 77. Average annual total HDD in hundreds ($T_b = 65°$ F.).

The American Gas Association found that residence gas consumption varied directly with the number of HDD calculated using 65° F. as the base temperature (2). Use of this base temperature was further substantiated in a National District Heating Association study relative to steam heated buildings served by district heating companies. Where interior temperatures are not so critical, such as in industrial plants, a lower base temperature, usually 5° F. lower than the desired inside temperature, is suggested.

Figure 76 shows month-by-month cumulative totals of HDD based upon a 65° F. $T_b$ for selected stations. International Falls and Winona are the stations with the highest and lowest HDD, respectively. The average annual total GDD are shown in figure 77.

Appendix Table 1. Daily temperature and heating degree day normals at Duluth, 1931-1960 (33).

| DAY | JANUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | FEBRUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | MARCH TEMPERATURE MAX | MIN | AVG | DEG DAY | APRIL TEMPERATURE MAX | MIN | AVG | DEG DAY | MAY TEMPERATURE MAX | MIN | AVG | DEG DAY | JUNE TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 19 | 1 | 10 | 55 | 19 | -2 | 9 | 56 | 26 | 5 | 16 | 50 | 38 | 19 | 29 | 36 | 55 | 33 | 44 | 21 | 67 | 43 | 55 | 10 |
| 2 | 19 | 1 | 10 | 55 | 19 | -2 | 9 | 56 | 26 | 5 | 16 | 49 | 39 | 20 | 30 | 35 | 55 | 33 | 44 | 21 | 67 | 44 | 56 | 9 |
| 3 | 18 | 0 | 9 | 55 | 19 | -2 | 9 | 56 | 26 | 5 | 16 | 49 | 39 | 20 | 30 | 35 | 56 | 34 | 45 | 21 | 67 | 44 | 56 | 9 |
| 4 | 18 | 0 | 9 | 56 | 19 | -2 | 9 | 56 | 27 | 6 | 17 | 49 | 40 | 21 | 31 | 34 | 56 | 34 | 45 | 20 | 68 | 44 | 56 | 9 |
| 5 | 18 | 0 | 9 | 56 | 19 | -2 | 9 | 56 | 27 | 6 | 17 | 48 | 41 | 21 | 31 | 34 | 56 | 34 | 45 | 20 | 68 | 45 | 57 | 9 |
| 6 | 18 | 0 | 9 | 56 | 19 | -2 | 9 | 56 | 27 | 7 | 17 | 48 | 42 | 22 | 32 | 34 | 57 | 34 | 46 | 20 | 68 | 45 | 57 | 8 |
| 7 | 18 | 0 | 9 | 56 | 19 | -2 | 9 | 56 | 28 | 7 | 18 | 48 | 42 | 23 | 33 | 33 | 57 | 35 | 46 | 19 | 68 | 45 | 57 | 8 |
| 8 | 18 | 0 | 9 | 56 | 20 | -1 | 10 | 56 | 28 | 8 | 18 | 47 | 43 | 23 | 33 | 32 | 57 | 35 | 46 | 19 | 69 | 45 | 57 | 8 |
| 9 | 18 | 0 | 9 | 56 | 20 | -1 | 10 | 56 | 28 | 8 | 18 | 47 | 43 | 24 | 34 | 32 | 58 | 35 | 47 | 18 | 69 | 46 | 58 | 8 |
| 10 | 18 | 0 | 9 | 56 | 20 | -1 | 10 | 56 | 29 | 8 | 19 | 46 | 44 | 25 | 35 | 31 | 58 | 36 | 47 | 18 | 69 | 46 | 58 | 7 |
| 11 | 18 | 0 | 9 | 57 | 20 | -1 | 10 | 55 | 29 | 9 | 19 | 46 | 45 | 25 | 35 | 30 | 59 | 36 | 48 | 18 | 69 | 46 | 58 | 7 |
| 12 | 18 | -1 | 9 | 57 | 21 | -1 | 10 | 55 | 29 | 10 | 20 | 46 | 45 | 26 | 36 | 29 | 59 | 36 | 48 | 17 | 70 | 47 | 59 | 7 |
| 13 | 17 | -1 | 8 | 57 | 21 | 0 | 11 | 55 | 30 | 10 | 20 | 45 | 46 | 26 | 36 | 29 | 59 | 36 | 48 | 17 | 70 | 47 | 59 | 7 |
| 14 | 17 | -1 | 8 | 57 | 21 | 0 | 11 | 55 | 30 | 10 | 20 | 45 | 47 | 27 | 37 | 28 | 60 | 37 | 49 | 17 | 70 | 47 | 59 | 7 |
| 15 | 17 | -1 | 8 | 57 | 21 | 0 | 11 | 55 | 30 | 11 | 21 | 45 | 47 | 27 | 37 | 28 | 60 | 37 | 49 | 16 | 70 | 47 | 59 | 7 |
| 16 | 17 | -1 | 8 | 57 | 21 | 0 | 11 | 54 | 31 | 11 | 21 | 44 | 48 | 28 | 38 | 27 | 61 | 37 | 49 | 16 | 70 | 48 | 59 | 6 |
| 17 | 17 | -1 | 8 | 57 | 22 | 0 | 11 | 54 | 31 | 12 | 22 | 44 | 49 | 28 | 39 | 27 | 61 | 38 | 50 | 16 | 71 | 48 | 60 | 6 |
| 18 | 17 | -1 | 8 | 57 | 22 | 0 | 11 | 54 | 32 | 12 | 22 | 43 | 49 | 29 | 39 | 26 | 61 | 38 | 50 | 15 | 71 | 48 | 60 | 6 |
| 19 | 17 | -1 | 8 | 57 | 22 | 1 | 12 | 54 | 32 | 12 | 22 | 43 | 49 | 29 | 39 | 26 | 62 | 38 | 50 | 15 | 71 | 48 | 60 | 6 |
| 20 | 18 | -1 | 9 | 57 | 23 | 1 | 12 | 53 | 32 | 13 | 23 | 42 | 50 | 29 | 40 | 25 | 62 | 39 | 51 | 14 | 71 | 48 | 60 | 6 |
| 21 | 18 | -1 | 9 | 57 | 23 | 1 | 12 | 53 | 33 | 14 | 24 | 42 | 50 | 30 | 40 | 25 | 63 | 39 | 51 | 14 | 72 | 49 | 61 | 6 |
| 22 | 18 | -1 | 9 | 57 | 23 | 2 | 13 | 53 | 33 | 14 | 24 | 41 | 51 | 30 | 41 | 24 | 63 | 40 | 52 | 13 | 72 | 49 | 61 | 5 |
| 23 | 18 | -1 | 9 | 56 | 23 | 2 | 13 | 52 | 33 | 14 | 24 | 41 | 51 | 30 | 41 | 24 | 63 | 40 | 52 | 13 | 72 | 49 | 61 | 5 |
| 24 | 18 | -1 | 9 | 56 | 24 | 2 | 13 | 52 | 34 | 15 | 25 | 40 | 52 | 31 | 42 | 23 | 64 | 41 | 53 | 13 | 72 | 49 | 61 | 5 |
| 25 | 18 | -1 | 9 | 56 | 24 | 3 | 14 | 52 | 34 | 16 | 25 | 40 | 52 | 31 | 42 | 23 | 64 | 41 | 53 | 12 | 72 | 50 | 61 | 5 |
| 26 | 18 | -1 | 9 | 56 | 24 | 3 | 14 | 51 | 35 | 16 | 26 | 39 | 53 | 32 | 43 | 23 | 64 | 41 | 53 | 12 | 73 | 50 | 62 | 5 |
| 27 | 18 | -1 | 9 | 56 | 25 | 3 | 14 | 51 | 35 | 16 | 26 | 39 | 54 | 32 | 43 | 22 | 65 | 41 | 53 | 12 | 73 | 50 | 62 | 5 |
| 28 | 18 | -1 | 9 | 56 | 25 | 4 | 15 | 50 | 36 | 17 | 27 | 38 | 54 | 32 | 43 | 22 | 65 | 42 | 54 | 11 | 73 | 50 | 62 | 4 |
| 29 | 18 | -1 | 9 | 56 | | | | | 37 | 18 | 28 | 37 | 54 | 33 | 44 | 22 | 66 | 42 | 54 | 11 | 73 | 50 | 62 | 4 |
| 30 | 18 | -1 | 9 | 56 | FEB. 29 VALUES | | | | 37 | 18 | 28 | 37 | 55 | 33 | 44 | 21 | 66 | 43 | 55 | 11 | 73 | 51 | 62 | 4 |
| 31 | 19 | -1 | 9 | 56 | SAME AS FEB. 28 | | | | 38 | 19 | 29 | 37 | | | | | 66 | 43 | 55 | 10 | | | | |

| DAY | JULY TEMPERATURE MAX | MIN | AVG | DEG DAY | AUGUST TEMPERATURE MAX | MIN | AVG | DEG DAY | SEPTEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | OCTOBER TEMPERATURE MAX | MIN | AVG | DEG DAY | NOVEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | DECEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 74 | 51 | 63 | 4 | 78 | 56 | 67 | 1 | 68 | 48 | 58 | 8 | 62 | 40 | 51 | 14 | 44 | 27 | 36 | 30 | 27 | 12 | 20 | 46 |
| 2 | 74 | 51 | 63 | 4 | 78 | 56 | 67 | 1 | 68 | 47 | 58 | 8 | 62 | 40 | 51 | 15 | 43 | 26 | 35 | 31 | 26 | 11 | 19 | 46 |
| 3 | 74 | 51 | 63 | 4 | 78 | 56 | 67 | 1 | 68 | 47 | 58 | 8 | 62 | 40 | 51 | 15 | 42 | 26 | 34 | 32 | 26 | 11 | 19 | 46 |
| 4 | 75 | 52 | 64 | 4 | 78 | 56 | 67 | 1 | 67 | 47 | 57 | 9 | 61 | 40 | 51 | 15 | 41 | 25 | 33 | 32 | 26 | 10 | 18 | 47 |
| 5 | 75 | 52 | 64 | 4 | 78 | 56 | 67 | 1 | 67 | 46 | 57 | 9 | 61 | 39 | 50 | 15 | 41 | 25 | 33 | 33 | 25 | 10 | 18 | 47 |
| 6 | 75 | 52 | 64 | 4 | 78 | 55 | 67 | 1 | 67 | 46 | 57 | 9 | 60 | 39 | 50 | 16 | 40 | 24 | 32 | 33 | 25 | 9 | 17 | 48 |
| 7 | 75 | 52 | 64 | 4 | 78 | 55 | 67 | 1 | 66 | 46 | 56 | 9 | 60 | 39 | 50 | 16 | 40 | 24 | 32 | 34 | 25 | 9 | 17 | 48 |
| 8 | 76 | 52 | 64 | 3 | 78 | 55 | 67 | 1 | 66 | 45 | 56 | 10 | 59 | 38 | 49 | 16 | 39 | 23 | 31 | 34 | 24 | 8 | 16 | 49 |
| 9 | 76 | 53 | 65 | 3 | 77 | 55 | 66 | 2 | 66 | 45 | 56 | 10 | 59 | 38 | 49 | 16 | 38 | 23 | 31 | 35 | 24 | 8 | 16 | 49 |
| 10 | 76 | 53 | 65 | 3 | 77 | 55 | 66 | 2 | 66 | 45 | 56 | 10 | 58 | 38 | 48 | 17 | 38 | 22 | 30 | 35 | 24 | 8 | 16 | 49 |
| 11 | 76 | 53 | 65 | 3 | 77 | 55 | 66 | 2 | 65 | 45 | 55 | 10 | 58 | 37 | 48 | 17 | 37 | 22 | 30 | 35 | 23 | 7 | 15 | 50 |
| 12 | 77 | 53 | 65 | 3 | 77 | 54 | 66 | 2 | 65 | 44 | 55 | 10 | 57 | 37 | 47 | 18 | 36 | 21 | 29 | 36 | 23 | 7 | 15 | 50 |
| 13 | 77 | 54 | 66 | 3 | 76 | 54 | 65 | 2 | 65 | 44 | 55 | 10 | 57 | 36 | 47 | 18 | 36 | 21 | 29 | 37 | 23 | 6 | 15 | 51 |
| 14 | 77 | 54 | 66 | 3 | 76 | 54 | 65 | 3 | 65 | 44 | 55 | 11 | 56 | 36 | 46 | 19 | 35 | 20 | 28 | 37 | 22 | 6 | 14 | 51 |
| 15 | 77 | 54 | 66 | 3 | 75 | 54 | 65 | 3 | 65 | 44 | 55 | 11 | 56 | 35 | 46 | 19 | 35 | 20 | 28 | 38 | 22 | 6 | 14 | 51 |
| 16 | 77 | 54 | 66 | 2 | 75 | 53 | 64 | 3 | 64 | 43 | 54 | 11 | 55 | 35 | 45 | 20 | 34 | 19 | 27 | 38 | 22 | 5 | 14 | 52 |
| 17 | 78 | 54 | 66 | 2 | 75 | 53 | 64 | 3 | 64 | 43 | 54 | 11 | 55 | 35 | 45 | 20 | 34 | 19 | 27 | 38 | 22 | 5 | 14 | 52 |
| 18 | 78 | 54 | 66 | 2 | 74 | 53 | 64 | 4 | 64 | 43 | 54 | 11 | 54 | 34 | 44 | 21 | 34 | 18 | 26 | 39 | 21 | 5 | 13 | 52 |
| 19 | 78 | 55 | 67 | 2 | 74 | 53 | 64 | 4 | 64 | 43 | 54 | 12 | 53 | 34 | 44 | 21 | 33 | 18 | 26 | 39 | 21 | 4 | 13 | 52 |
| 20 | 78 | 55 | 67 | 2 | 74 | 52 | 63 | 4 | 64 | 42 | 53 | 12 | 52 | 33 | 43 | 22 | 32 | 17 | 25 | 40 | 21 | 4 | 13 | 53 |
| 21 | 78 | 55 | 67 | 2 | 73 | 52 | 63 | 4 | 63 | 42 | 53 | 12 | 52 | 33 | 43 | 22 | 32 | 17 | 25 | 40 | 21 | 4 | 13 | 53 |
| 22 | 78 | 55 | 67 | 1 | 73 | 51 | 62 | 5 | 63 | 42 | 53 | 12 | 51 | 32 | 42 | 23 | 32 | 16 | 24 | 41 | 21 | 3 | 12 | 53 |
| 23 | 78 | 55 | 67 | 1 | 72 | 51 | 62 | 5 | 63 | 42 | 53 | 12 | 50 | 31 | 41 | 24 | 31 | 16 | 24 | 41 | 20 | 3 | 12 | 53 |
| 24 | 79 | 55 | 67 | 1 | 72 | 50 | 61 | 5 | 63 | 42 | 53 | 13 | 50 | 31 | 41 | 24 | 31 | 15 | 23 | 42 | 20 | 3 | 12 | 53 |
| 25 | 79 | 55 | 67 | 1 | 71 | 50 | 61 | 6 | 63 | 41 | 52 | 13 | 49 | 31 | 40 | 25 | 30 | 15 | 23 | 42 | 20 | 2 | 11 | 54 |
| 26 | 79 | 56 | 68 | 1 | 71 | 50 | 61 | 6 | 63 | 41 | 52 | 13 | 48 | 30 | 39 | 26 | 30 | 14 | 22 | 43 | 20 | 2 | 11 | 54 |
| 27 | 79 | 56 | 68 | 1 | 71 | 50 | 61 | 6 | 62 | 41 | 52 | 14 | 48 | 29 | 39 | 26 | 29 | 14 | 22 | 43 | 20 | 2 | 11 | 54 |
| 28 | 79 | 56 | 68 | 1 | 70 | 49 | 60 | 7 | 62 | 41 | 52 | 14 | 47 | 29 | 38 | 27 | 29 | 13 | 21 | 44 | 19 | 2 | 11 | 54 |
| 29 | 79 | 56 | 68 | 0 | 70 | 49 | 60 | 7 | 62 | 41 | 52 | 14 | 46 | 28 | 37 | 28 | 28 | 13 | 21 | 44 | 19 | 2 | 11 | 54 |
| 30 | 79 | 56 | 68 | 0 | 69 | 49 | 59 | 8 | 62 | 40 | 51 | 14 | 45 | 28 | 37 | 28 | 28 | 12 | 20 | 45 | 19 | 1 | 10 | 55 |
| 31 | 79 | 56 | 68 | 0 | 69 | 48 | 59 | 8 | | | | | 45 | 27 | 36 | 29 | | | | | 19 | 1 | 10 | 55 |

Appendix Table 1. Daily temperature and heating degree day normals at International Falls, 1931-1960 (33).

| DAY | JANUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | FEBRUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | MARCH TEMPERATURE MAX | MIN | AVG | DEG DAY | APRIL TEMPERATURE MAX | MIN | AVG | DEG DAY | MAY TEMPERATURE MAX | MIN | AVG | DEG DAY | JUNE TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | - 6 | 5 | 60 | 15 | - 8 | 4 | 62 | 25 | 0 | 13 | 53 | 39 | 17 | 28 | 37 | 57 | 34 | 46 | 20 | 69 | 43 | 56 | 9 |
| 2 | 15 | - 6 | 5 | 60 | 15 | - 8 | 4 | 62 | 25 | 1 | 13 | 52 | 40 | 18 | 29 | 36 | 58 | 34 | 46 | 19 | 69 | 44 | 57 | 9 |
| 3 | 15 | - 7 | 4 | 61 | 16 | - 8 | 4 | 61 | 25 | 2 | 14 | 52 | 40 | 19 | 30 | 35 | 58 | 34 | 46 | 19 | 69 | 44 | 57 | 8 |
| 4 | 15 | - 7 | 4 | 61 | 16 | - 8 | 4 | 61 | 26 | 2 | 14 | 51 | 41 | 19 | 30 | 35 | 59 | 34 | 47 | 18 | 70 | 44 | 57 | 8 |
| 5 | 15 | - 7 | 4 | 61 | 16 | - 8 | 4 | 61 | 26 | 2 | 14 | 51 | 42 | 20 | 31 | 34 | 59 | 35 | 47 | 18 | 70 | 45 | 58 | 8 |
| 6 | 14 | - 7 | 4 | 61 | 16 | - 8 | 4 | 61 | 27 | 3 | 15 | 50 | 42 | 21 | 32 | 33 | 60 | 35 | 48 | 18 | 70 | 45 | 58 | 8 |
| 7 | 14 | - 7 | 4 | 61 | 17 | - 7 | 5 | 60 | 27 | 3 | 15 | 50 | 43 | 22 | 33 | 33 | 60 | 35 | 48 | 17 | 70 | 45 | 58 | 7 |
| 8 | 14 | - 8 | 3 | 62 | 17 | - 7 | 5 | 60 | 27 | 3 | 15 | 50 | 44 | 22 | 33 | 32 | 60 | 36 | 48 | 17 | 71 | 46 | 59 | 7 |
| 9 | 14 | - 8 | 3 | 62 | 17 | - 7 | 5 | 60 | 28 | 4 | 16 | 49 | 44 | 23 | 34 | 31 | 61 | 36 | 49 | 17 | 71 | 46 | 59 | 7 |
| 10 | 14 | - 8 | 3 | 62 | 17 | - 7 | 5 | 60 | 28 | 4 | 16 | 49 | 45 | 24 | 35 | 31 | 61 | 36 | 49 | 16 | 71 | 46 | 59 | 7 |
| 11 | 14 | - 8 | 3 | 62 | 18 | - 6 | 6 | 59 | 29 | 5 | 17 | 48 | 46 | 24 | 35 | 30 | 61 | 37 | 49 | 16 | 71 | 46 | 59 | 6 |
| 12 | 14 | - 8 | 3 | 62 | 18 | - 6 | 6 | 59 | 29 | 5 | 17 | 48 | 47 | 25 | 36 | 29 | 62 | 37 | 50 | 16 | 72 | 47 | 60 | 6 |
| 13 | 14 | - 8 | 3 | 62 | 19 | - 6 | 7 | 59 | 29 | 6 | 18 | 47 | 47 | 26 | 37 | 29 | 62 | 37 | 50 | 15 | 72 | 47 | 60 | 6 |
| 14 | 14 | - 8 | 3 | 62 | 19 | - 6 | 7 | 59 | 30 | 7 | 19 | 47 | 48 | 26 | 37 | 28 | 63 | 37 | 50 | 15 | 72 | 47 | 60 | 6 |
| 15 | 14 | - 8 | 3 | 62 | 19 | - 5 | 7 | 58 | 30 | 7 | 19 | 46 | 49 | 26 | 38 | 27 | 63 | 38 | 51 | 15 | 72 | 48 | 60 | 6 |
| 16 | 14 | - 9 | 3 | 62 | 20 | - 5 | 8 | 58 | 31 | 7 | 19 | 46 | 49 | 27 | 38 | 27 | 64 | 38 | 51 | 14 | 72 | 48 | 60 | 5 |
| 17 | 14 | - 9 | 3 | 62 | 20 | - 5 | 8 | 57 | 31 | 8 | 20 | 45 | 50 | 28 | 39 | 26 | 64 | 38 | 51 | 14 | 73 | 48 | 61 | 5 |
| 18 | 14 | - 9 | 3 | 62 | 20 | - 4 | 8 | 57 | 31 | 9 | 20 | 45 | 50 | 28 | 39 | 26 | 64 | 39 | 52 | 14 | 73 | 48 | 61 | 5 |
| 19 | 14 | - 9 | 3 | 63 | 21 | - 4 | 9 | 57 | 32 | 9 | 21 | 44 | 51 | 29 | 40 | 25 | 64 | 39 | 52 | 13 | 73 | 49 | 61 | 5 |
| 20 | 14 | - 9 | 3 | 63 | 21 | - 4 | 9 | 56 | 33 | 10 | 22 | 44 | 52 | 29 | 41 | 25 | 65 | 39 | 52 | 13 | 73 | 49 | 61 | 5 |
| 21 | 14 | - 9 | 3 | 63 | 21 | - 3 | 9 | 56 | 33 | 10 | 22 | 43 | 52 | 30 | 41 | 24 | 65 | 40 | 53 | 13 | 73 | 49 | 61 | 5 |
| 22 | 14 | - 9 | 3 | 63 | 22 | - 3 | 10 | 55 | 33 | 11 | 22 | 43 | 53 | 30 | 42 | 23 | 66 | 40 | 53 | 12 | 74 | 49 | 62 | 4 |
| 23 | 14 | - 9 | 3 | 63 | 22 | - 2 | 10 | 55 | 34 | 12 | 23 | 42 | 53 | 31 | 42 | 23 | 66 | 40 | 53 | 12 | 74 | 49 | 62 | 4 |
| 24 | 14 | - 9 | 3 | 63 | 22 | - 2 | 10 | 54 | 35 | 12 | 24 | 42 | 54 | 31 | 43 | 22 | 66 | 40 | 53 | 11 | 74 | 50 | 62 | 4 |
| 25 | 14 | - 9 | 3 | 62 | 23 | - 1 | 11 | 54 | 35 | 13 | 24 | 41 | 54 | 32 | 43 | 22 | 67 | 41 | 54 | 11 | 74 | 50 | 62 | 4 |
| 26 | 14 | - 9 | 3 | 62 | 23 | - 1 | 11 | 54 | 35 | 13 | 24 | 41 | 55 | 32 | 44 | 22 | 67 | 41 | 54 | 11 | 74 | 50 | 62 | 4 |
| 27 | 14 | - 9 | 3 | 62 | 24 | - 1 | 12 | 53 | 36 | 14 | 25 | 40 | 55 | 32 | 44 | 21 | 68 | 42 | 55 | 10 | 75 | 50 | 63 | 4 |
| 28 | 14 | - 8 | 3 | 62 | 24 | 0 | 12 | 53 | 36 | 14 | 25 | 40 | 56 | 33 | 45 | 21 | 68 | 42 | 55 | 10 | 75 | 50 | 63 | 4 |
| 29 | 15 | - 8 | 4 | 62 | Feb. 29 values same as Feb. 28 | | | | 37 | 15 | 26 | 39 | 56 | 33 | 45 | 21 | 68 | 42 | 55 | 10 | 75 | 51 | 63 | 4 |
| 30 | 15 | - 8 | 4 | 62 | | | | | 38 | 16 | 27 | 38 | 57 | 33 | 45 | 20 | 68 | 43 | 56 | 10 | 75 | 51 | 63 | 4 |
| 31 | 15 | - 8 | 4 | 62 | | | | | 38 | 17 | 28 | 38 | | | | | 68 | 43 | 56 | 9 | | | | |

| DAY | JULY TEMPERATURE MAX | MIN | AVG | DEG DAY | AUGUST TEMPERATURE MAX | MIN | AVG | DEG DAY | SEPTEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | OCTOBER TEMPERATURE MAX | MIN | AVG | DEG DAY | NOVEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | DECEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 75 | 51 | 63 | 4 | 79 | 53 | 66 | 2 | 69 | 46 | 58 | 8 | 61 | 37 | 49 | 16 | 41 | 24 | 33 | 33 | 24 | 7 | 16 | 50 |
| 2 | 76 | 51 | 64 | 4 | 79 | 53 | 66 | 2 | 68 | 46 | 57 | 8 | 60 | 37 | 49 | 16 | 41 | 24 | 33 | 33 | 23 | 6 | 15 | 50 |
| 3 | 76 | 51 | 64 | 4 | 79 | 53 | 66 | 2 | 68 | 45 | 57 | 8 | 60 | 37 | 49 | 17 | 39 | 24 | 32 | 34 | 23 | 6 | 15 | 51 |
| 4 | 76 | 52 | 64 | 4 | 79 | 53 | 66 | 2 | 67 | 45 | 56 | 9 | 60 | 36 | 48 | 17 | 39 | 23 | 31 | 34 | 22 | 5 | 14 | 51 |
| 5 | 77 | 52 | 65 | 3 | 79 | 53 | 66 | 2 | 67 | 44 | 56 | 9 | 59 | 36 | 48 | 17 | 38 | 22 | 30 | 35 | 22 | 4 | 13 | 52 |
| 6 | 77 | 52 | 65 | 3 | 79 | 53 | 66 | 2 | 67 | 44 | 56 | 9 | 59 | 36 | 48 | 18 | 38 | 22 | 30 | 35 | 22 | 4 | 13 | 52 |
| 7 | 77 | 52 | 65 | 3 | 79 | 53 | 66 | 2 | 67 | 44 | 56 | 10 | 59 | 35 | 47 | 18 | 37 | 21 | 29 | 36 | 21 | 4 | 13 | 52 |
| 8 | 77 | 52 | 65 | 3 | 78 | 53 | 66 | 2 | 66 | 44 | 55 | 10 | 58 | 35 | 47 | 18 | 36 | 21 | 29 | 37 | 21 | 3 | 12 | 53 |
| 9 | 78 | 52 | 65 | 3 | 78 | 53 | 66 | 2 | 66 | 43 | 55 | 10 | 58 | 35 | 47 | 19 | 35 | 20 | 28 | 38 | 21 | 3 | 12 | 53 |
| 10 | 78 | 52 | 65 | 3 | 78 | 53 | 66 | 2 | 66 | 43 | 55 | 11 | 57 | 34 | 46 | 19 | 34 | 19 | 27 | 38 | 20 | 2 | 11 | 54 |
| 11 | 78 | 53 | 66 | 3 | 78 | 53 | 66 | 2 | 65 | 43 | 54 | 11 | 57 | 34 | 46 | 20 | 34 | 19 | 27 | 39 | 20 | 1 | 11 | 54 |
| 12 | 78 | 53 | 66 | 3 | 77 | 52 | 65 | 2 | 65 | 42 | 54 | 11 | 56 | 34 | 45 | 20 | 33 | 18 | 26 | 39 | 20 | 1 | 11 | 55 |
| 13 | 78 | 53 | 66 | 3 | 77 | 52 | 65 | 2 | 65 | 42 | 54 | 12 | 55 | 33 | 44 | 20 | 32 | 18 | 25 | 40 | 19 | 1 | 10 | 55 |
| 14 | 79 | 53 | 66 | 2 | 76 | 52 | 64 | 3 | 64 | 42 | 53 | 12 | 55 | 33 | 44 | 21 | 32 | 17 | 25 | 40 | 19 | 0 | 10 | 55 |
| 15 | 79 | 53 | 66 | 2 | 76 | 52 | 64 | 3 | 64 | 41 | 53 | 12 | 54 | 32 | 43 | 21 | 31 | 17 | 24 | 41 | 19 | 0 | 10 | 56 |
| 16 | 79 | 53 | 66 | 2 | 76 | 52 | 64 | 3 | 64 | 41 | 53 | 12 | 54 | 32 | 43 | 22 | 30 | 16 | 23 | 42 | 19 | - 1 | 9 | 56 |
| 17 | 79 | 53 | 66 | 2 | 75 | 51 | 63 | 3 | 64 | 40 | 52 | 13 | 53 | 32 | 43 | 23 | 30 | 15 | 23 | 42 | 19 | - 1 | 9 | 56 |
| 18 | 79 | 53 | 66 | 2 | 75 | 51 | 63 | 3 | 64 | 40 | 52 | 13 | 52 | 31 | 42 | 23 | 29 | 15 | 22 | 43 | 18 | - 2 | 8 | 56 |
| 19 | 79 | 53 | 66 | 2 | 74 | 51 | 63 | 4 | 64 | 40 | 52 | 13 | 52 | 31 | 42 | 24 | 29 | 14 | 22 | 44 | 18 | - 2 | 8 | 57 |
| 20 | 79 | 53 | 66 | 2 | 74 | 51 | 63 | 4 | 63 | 40 | 52 | 13 | 51 | 30 | 41 | 24 | 28 | 14 | 21 | 44 | 18 | - 2 | 8 | 57 |
| 21 | 79 | 53 | 66 | 2 | 74 | 50 | 62 | 4 | 63 | 40 | 52 | 14 | 50 | 30 | 40 | 25 | 28 | 13 | 21 | 45 | 18 | - 3 | 8 | 57 |
| 22 | 80 | 53 | 67 | 1 | 73 | 50 | 62 | 5 | 63 | 39 | 51 | 14 | 49 | 30 | 40 | 25 | 27 | 12 | 20 | 45 | 17 | - 3 | 7 | 58 |
| 23 | 80 | 53 | 67 | 1 | 73 | 50 | 62 | 5 | 63 | 39 | 51 | 14 | 49 | 29 | 39 | 26 | 27 | 12 | 20 | 46 | 17 | - 3 | 7 | 58 |
| 24 | 80 | 54 | 67 | 1 | 72 | 49 | 61 | 5 | 62 | 39 | 51 | 14 | 48 | 29 | 39 | 27 | 26 | 11 | 19 | 46 | 17 | - 4 | 7 | 58 |
| 25 | 80 | 54 | 67 | 1 | 72 | 49 | 61 | 5 | 62 | 39 | 51 | 15 | 47 | 28 | 38 | 27 | 26 | 11 | 19 | 47 | 17 | - 4 | 7 | 59 |
| 26 | 80 | 54 | 67 | 1 | 71 | 49 | 60 | 5 | 62 | 38 | 50 | 15 | 47 | 28 | 38 | 28 | 25 | 10 | 18 | 47 | 16 | - 5 | 6 | 59 |
| 27 | 80 | 54 | 67 | 1 | 71 | 48 | 60 | 6 | 61 | 38 | 50 | 15 | 46 | 27 | 37 | 28 | 25 | 10 | 18 | 48 | 16 | - 5 | 6 | 60 |
| 28 | 80 | 54 | 67 | 1 | 71 | 48 | 60 | 6 | 61 | 37 | 49 | 16 | 45 | 27 | 36 | 29 | 25 | 9 | 17 | 48 | 16 | - 5 | 6 | 60 |
| 29 | 80 | 54 | 67 | 1 | 70 | 48 | 59 | 7 | 61 | 37 | 49 | 16 | 44 | 26 | 35 | 30 | 24 | 8 | 16 | 48 | 16 | - 5 | 6 | 60 |
| 30 | 79 | 54 | 67 | 2 | 70 | 47 | 59 | 7 | 61 | 37 | 49 | 16 | 43 | 25 | 34 | 31 | 24 | 8 | 16 | 49 | 16 | - 5 | 6 | 60 |
| 31 | 79 | 53 | 66 | 2 | 69 | 46 | 58 | 8 | | | | | 42 | 25 | 34 | 32 | | | | | 16 | - 5 | 6 | 60 |

Appendix Table 1. Daily temperature and heating degree day normals at Minneapolis - St. Paul, 1931-1960 (33).

| DAY | JANUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | FEBRUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | MARCH TEMPERATURE MAX | MIN | AVG | DEG DAY | APRIL TEMPERATURE MAX | MIN | AVG | DEG DAY | MAY TEMPERATURE MAX | MIN | AVG | DEG DAY | JUNE TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 23 | 3 | 13 | 52 | 23 | 2 | 13 | 52 | 30 | 10 | 20 | 45 | 47 | 26 | 37 | 29 | 64 | 40 | 52 | 14 | 74 | 51 | 63 | 5 |
| 2 | 23 | 3 | 13 | 52 | 24 | 2 | 13 | 52 | 31 | 11 | 21 | 44 | 47 | 26 | 37 | 28 | 64 | 40 | 52 | 14 | 75 | 51 | 63 | 5 |
| 3 | 23 | 3 | 13 | 52 | 24 | 2 | 13 | 52 | 31 | 11 | 21 | 44 | 48 | 27 | 38 | 27 | 64 | 41 | 53 | 13 | 75 | 52 | 64 | 4 |
| 4 | 23 | 3 | 13 | 52 | 24 | 2 | 13 | 52 | 31 | 11 | 21 | 44 | 49 | 27 | 38 | 27 | 65 | 41 | 53 | 13 | 75 | 52 | 64 | 4 |
| 5 | 23 | 3 | 13 | 52 | 24 | 2 | 13 | 52 | 32 | 12 | 22 | 43 | 50 | 28 | 39 | 26 | 65 | 41 | 53 | 13 | 75 | 52 | 64 | 4 |
| 6 | 23 | 3 | 13 | 52 | 24 | 2 | 13 | 52 | 32 | 12 | 22 | 43 | 51 | 28 | 40 | 26 | 66 | 42 | 54 | 12 | 76 | 53 | 65 | 4 |
| 7 | 22 | 3 | 13 | 52 | 24 | 3 | 14 | 51 | 32 | 13 | 23 | 43 | 51 | 29 | 40 | 25 | 66 | 42 | 54 | 12 | 76 | 53 | 65 | 4 |
| 8 | 22 | 3 | 13 | 52 | 25 | 3 | 14 | 51 | 33 | 13 | 23 | 42 | 52 | 29 | 41 | 25 | 66 | 42 | 54 | 12 | 76 | 53 | 65 | 3 |
| 9 | 22 | 2 | 12 | 53 | 25 | 3 | 14 | 51 | 33 | 14 | 24 | 42 | 52 | 30 | 41 | 24 | 67 | 43 | 55 | 11 | 77 | 54 | 66 | 3 |
| 10 | 22 | 2 | 12 | 53 | 25 | 3 | 14 | 51 | 34 | 14 | 24 | 41 | 53 | 30 | 42 | 23 | 67 | 43 | 55 | 11 | 77 | 54 | 66 | 3 |
| 11 | 22 | 2 | 12 | 53 | 25 | 3 | 14 | 51 | 34 | 15 | 25 | 41 | 54 | 31 | 43 | 22 | 67 | 44 | 56 | 11 | 77 | 54 | 66 | 3 |
| 12 | 22 | 2 | 12 | 53 | 25 | 4 | 15 | 50 | 35 | 15 | 25 | 40 | 54 | 31 | 43 | 22 | 68 | 44 | 56 | 10 | 77 | 55 | 66 | 3 |
| 13 | 22 | 2 | 12 | 53 | 26 | 4 | 15 | 50 | 35 | 16 | 26 | 40 | 55 | 32 | 44 | 21 | 68 | 44 | 56 | 10 | 78 | 55 | 67 | 2 |
| 14 | 22 | 2 | 12 | 53 | 26 | 4 | 15 | 50 | 36 | 17 | 27 | 39 | 55 | 32 | 44 | 21 | 68 | 45 | 57 | 10 | 78 | 55 | 67 | 2 |
| 15 | 22 | 2 | 12 | 53 | 26 | 5 | 16 | 49 | 36 | 17 | 27 | 38 | 56 | 33 | 45 | 20 | 69 | 45 | 57 | 9 | 78 | 56 | 67 | 2 |
| 16 | 22 | 2 | 12 | 53 | 26 | 5 | 16 | 49 | 37 | 18 | 28 | 38 | 56 | 33 | 45 | 20 | 69 | 45 | 57 | 9 | 78 | 56 | 67 | 2 |
| 17 | 22 | 2 | 12 | 53 | 27 | 5 | 16 | 49 | 37 | 18 | 28 | 37 | 57 | 34 | 46 | 19 | 69 | 46 | 58 | 9 | 78 | 56 | 67 | 2 |
| 18 | 22 | 2 | 12 | 53 | 27 | 6 | 17 | 49 | 38 | 19 | 29 | 36 | 57 | 34 | 46 | 19 | 70 | 46 | 58 | 8 | 79 | 56 | 68 | 2 |
| 19 | 22 | 2 | 12 | 53 | 27 | 6 | 17 | 48 | 38 | 19 | 29 | 36 | 58 | 35 | 47 | 19 | 70 | 46 | 58 | 8 | 79 | 57 | 68 | 2 |
| 20 | 22 | 2 | 12 | 53 | 27 | 6 | 17 | 48 | 39 | 20 | 30 | 35 | 58 | 35 | 47 | 18 | 70 | 47 | 59 | 8 | 79 | 57 | 68 | 2 |
| 21 | 22 | 2 | 12 | 53 | 28 | 7 | 18 | 48 | 39 | 20 | 30 | 35 | 59 | 35 | 47 | 18 | 71 | 47 | 59 | 8 | 79 | 57 | 68 | 2 |
| 22 | 22 | 2 | 12 | 53 | 28 | 7 | 18 | 47 | 40 | 21 | 31 | 34 | 59 | 36 | 48 | 18 | 71 | 48 | 60 | 7 | 80 | 57 | 69 | 2 |
| 23 | 22 | 2 | 12 | 53 | 28 | 8 | 18 | 47 | 40 | 21 | 31 | 34 | 60 | 36 | 48 | 17 | 72 | 48 | 60 | 7 | 80 | 58 | 69 | 2 |
| 24 | 22 | 2 | 12 | 53 | 29 | 8 | 19 | 47 | 41 | 22 | 32 | 33 | 60 | 37 | 49 | 17 | 72 | 48 | 60 | 7 | 80 | 58 | 69 | 2 |
| 25 | 22 | 2 | 12 | 53 | 29 | 9 | 19 | 46 | 42 | 22 | 32 | 33 | 61 | 37 | 49 | 16 | 72 | 49 | 61 | 7 | 80 | 58 | 69 | 2 |
| 26 | 22 | 2 | 12 | 53 | 29 | 9 | 19 | 46 | 43 | 23 | 33 | 32 | 61 | 38 | 50 | 16 | 73 | 49 | 61 | 6 | 81 | 58 | 70 | 2 |
| 27 | 23 | 2 | 13 | 53 | 30 | 9 | 20 | 45 | 43 | 23 | 33 | 32 | 62 | 38 | 50 | 15 | 73 | 49 | 61 | 6 | 81 | 59 | 70 | 2 |
| 28 | 23 | 2 | 13 | 52 | 30 | 10 | 20 | 45 | 44 | 24 | 34 | 31 | 62 | 38 | 50 | 15 | 73 | 50 | 62 | 6 | 81 | 59 | 70 | 2 |
| 29 | 23 | 2 | 13 | 52 | | | | | 45 | 24 | 35 | 31 | 63 | 39 | 51 | 14 | 74 | 50 | 62 | 6 | 81 | 59 | 70 | 2 |
| 30 | 23 | 2 | 13 | 52 | FEB. 29 VALUES | | | | 45 | 25 | 35 | 30 | 63 | 39 | 51 | 14 | 74 | 50 | 62 | 6 | 82 | 59 | 71 | 2 |
| 31 | 23 | 2 | 13 | 52 | SAME AS FEB. 28 | | | | 46 | 25 | 36 | 30 | | | | | 74 | 51 | 63 | 5 | | | | |

| DAY | JULY TEMPERATURE MAX | MIN | AVG | DEG DAY | AUGUST TEMPERATURE MAX | MIN | AVG | DEG DAY | SEPTEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | OCTOBER TEMPERATURE MAX | MIN | AVG | DEG DAY | NOVEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | DECEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 82 | 59 | 71 | 2 | 84 | 61 | 73 | 0 | 77 | 54 | 66 | 3 | 67 | 43 | 55 | 11 | 52 | 29 | 41 | 24 | 32 | 14 | 23 | 42 |
| 2 | 82 | 60 | 71 | 1 | 84 | 61 | 73 | 0 | 77 | 54 | 66 | 3 | 67 | 43 | 55 | 11 | 51 | 29 | 40 | 25 | 31 | 14 | 23 | 42 |
| 3 | 82 | 60 | 71 | 1 | 84 | 61 | 73 | 0 | 76 | 53 | 65 | 3 | 66 | 42 | 54 | 11 | 50 | 28 | 39 | 26 | 31 | 13 | 22 | 43 |
| 4 | 82 | 60 | 71 | 1 | 84 | 61 | 73 | 0 | 76 | 53 | 65 | 4 | 66 | 42 | 54 | 11 | 49 | 28 | 39 | 26 | 31 | 13 | 22 | 43 |
| 5 | 83 | 60 | 72 | 1 | 84 | 61 | 73 | 0 | 76 | 52 | 64 | 4 | 66 | 42 | 54 | 11 | 48 | 27 | 38 | 27 | 30 | 12 | 21 | 44 |
| 6 | 83 | 60 | 72 | 1 | 83 | 61 | 72 | 0 | 75 | 52 | 64 | 4 | 65 | 41 | 53 | 12 | 47 | 27 | 37 | 28 | 30 | 12 | 21 | 44 |
| 7 | 83 | 60 | 72 | 1 | 83 | 61 | 72 | 0 | 75 | 52 | 64 | 4 | 65 | 41 | 53 | 12 | 47 | 26 | 37 | 29 | 30 | 12 | 21 | 44 |
| 8 | 83 | 60 | 72 | 1 | 83 | 60 | 72 | 0 | 75 | 51 | 63 | 4 | 65 | 41 | 53 | 12 | 46 | 26 | 36 | 29 | 29 | 11 | 20 | 45 |
| 9 | 83 | 60 | 72 | 1 | 83 | 60 | 72 | 0 | 74 | 51 | 63 | 5 | 64 | 40 | 52 | 13 | 45 | 25 | 35 | 30 | 29 | 11 | 20 | 45 |
| 10 | 83 | 61 | 72 | 1 | 83 | 60 | 72 | 0 | 74 | 50 | 62 | 5 | 64 | 40 | 52 | 13 | 44 | 25 | 35 | 30 | 29 | 10 | 20 | 45 |
| 11 | 84 | 61 | 73 | 1 | 83 | 60 | 72 | 0 | 74 | 50 | 62 | 5 | 63 | 39 | 51 | 14 | 43 | 24 | 34 | 31 | 29 | 10 | 20 | 46 |
| 12 | 84 | 61 | 73 | 1 | 82 | 60 | 71 | 0 | 73 | 50 | 62 | 5 | 63 | 39 | 51 | 14 | 42 | 24 | 33 | 32 | 28 | 10 | 19 | 46 |
| 13 | 84 | 61 | 73 | 1 | 82 | 60 | 71 | 1 | 73 | 49 | 61 | 5 | 62 | 39 | 51 | 15 | 42 | 23 | 33 | 32 | 28 | 9 | 19 | 46 |
| 14 | 84 | 61 | 73 | 1 | 82 | 59 | 71 | 1 | 73 | 49 | 61 | 5 | 62 | 38 | 50 | 15 | 41 | 23 | 32 | 33 | 28 | 9 | 19 | 47 |
| 15 | 84 | 61 | 73 | 1 | 82 | 59 | 71 | 1 | 72 | 49 | 61 | 6 | 61 | 38 | 50 | 16 | 40 | 22 | 31 | 34 | 27 | 9 | 18 | 47 |
| 16 | 84 | 61 | 73 | 1 | 82 | 59 | 71 | 1 | 72 | 48 | 60 | 6 | 61 | 38 | 50 | 16 | 39 | 22 | 31 | 34 | 27 | 8 | 18 | 47 |
| 17 | 84 | 61 | 73 | 1 | 81 | 59 | 70 | 1 | 72 | 48 | 60 | 6 | 60 | 37 | 49 | 17 | 39 | 21 | 30 | 35 | 27 | 8 | 18 | 47 |
| 18 | 84 | 61 | 73 | 1 | 81 | 59 | 70 | 1 | 71 | 47 | 59 | 7 | 60 | 37 | 49 | 17 | 38 | 20 | 29 | 36 | 27 | 8 | 18 | 48 |
| 19 | 84 | 61 | 73 | 1 | 81 | 58 | 70 | 1 | 71 | 47 | 59 | 7 | 59 | 36 | 48 | 18 | 37 | 20 | 29 | 36 | 26 | 8 | 17 | 48 |
| 20 | 85 | 61 | 73 | 1 | 81 | 58 | 70 | 1 | 71 | 47 | 59 | 7 | 59 | 36 | 48 | 18 | 37 | 19 | 28 | 37 | 26 | 7 | 17 | 48 |
| 21 | 85 | 61 | 73 | 1 | 80 | 58 | 69 | 1 | 70 | 46 | 58 | 8 | 58 | 35 | 47 | 18 | 36 | 19 | 28 | 38 | 26 | 7 | 17 | 48 |
| 22 | 85 | 61 | 73 | 0 | 80 | 57 | 69 | 1 | 70 | 46 | 58 | 8 | 58 | 35 | 47 | 19 | 35 | 18 | 27 | 38 | 26 | 7 | 17 | 49 |
| 23 | 85 | 61 | 73 | 0 | 80 | 57 | 69 | 2 | 70 | 46 | 58 | 8 | 57 | 34 | 46 | 19 | 35 | 18 | 27 | 39 | 25 | 6 | 16 | 49 |
| 24 | 85 | 61 | 73 | 0 | 79 | 57 | 68 | 2 | 69 | 45 | 57 | 9 | 57 | 34 | 46 | 20 | 34 | 17 | 26 | 39 | 25 | 6 | 16 | 49 |
| 25 | 85 | 61 | 73 | 0 | 79 | 57 | 68 | 2 | 69 | 45 | 57 | 9 | 56 | 33 | 45 | 20 | 34 | 17 | 26 | 40 | 25 | 6 | 16 | 49 |
| 26 | 85 | 61 | 73 | 0 | 79 | 56 | 68 | 2 | 69 | 45 | 57 | 9 | 56 | 33 | 45 | 21 | 33 | 16 | 25 | 40 | 25 | 6 | 16 | 50 |
| 27 | 85 | 61 | 73 | 0 | 79 | 56 | 68 | 2 | 68 | 44 | 56 | 10 | 55 | 32 | 44 | 21 | 33 | 16 | 25 | 41 | 25 | 5 | 15 | 50 |
| 28 | 85 | 61 | 73 | 0 | 78 | 56 | 67 | 2 | 68 | 44 | 56 | 10 | 55 | 32 | 44 | 22 | 33 | 15 | 24 | 41 | 24 | 5 | 15 | 50 |
| 29 | 85 | 61 | 73 | 0 | 78 | 55 | 67 | 3 | 68 | 44 | 56 | 10 | 54 | 31 | 43 | 22 | 32 | 15 | 24 | 42 | 24 | 5 | 15 | 51 |
| 30 | 84 | 61 | 73 | 0 | 78 | 55 | 67 | 3 | 67 | 43 | 55 | 10 | 54 | 31 | 43 | 23 | 32 | 14 | 23 | 42 | 24 | 4 | 14 | 51 |
| 31 | 84 | 61 | 73 | 0 | 77 | 54 | 66 | 3 | | | | | 53 | 30 | 42 | 23 | | | | | 24 | 4 | 14 | 51 |

Appendix Table 1. Daily temperature and heating degree day normals at Rochester, 1931-1960 (33).

| | JANUARY | | | | FEBRUARY | | | | MARCH | | | | APRIL | | | | MAY | | | | JUNE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY |
| 1 | 24 | 6 | 15 | 50 | 23 | 4 | 14 | 51 | 31 | 12 | 22 | 43 | 45 | 26 | 36 | 29 | 63 | 40 | 52 | 14 | 74 | 51 | 63 | 5 |
| 2 | 24 | 6 | 15 | 50 | 23 | 4 | 14 | 51 | 31 | 12 | 22 | 43 | 46 | 26 | 36 | 29 | 63 | 41 | 52 | 14 | 74 | 51 | 63 | 5 |
| 3 | 24 | 6 | 15 | 50 | 23 | 4 | 14 | 51 | 31 | 13 | 22 | 43 | 47 | 27 | 37 | 28 | 64 | 41 | 53 | 13 | 75 | 52 | 64 | 5 |
| 4 | 23 | 6 | 15 | 51 | 24 | 4 | 14 | 51 | 32 | 13 | 23 | 42 | 48 | 28 | 38 | 28 | 64 | 41 | 53 | 13 | 75 | 52 | 64 | 5 |
| 5 | 23 | 5 | 14 | 51 | 24 | 4 | 14 | 51 | 32 | 14 | 23 | 42 | 49 | 28 | 39 | 27 | 65 | 41 | 53 | 13 | 75 | 53 | 64 | 5 |
| 6 | 23 | 5 | 14 | 51 | 24 | 4 | 14 | 51 | 32 | 15 | 24 | 41 | 49 | 29 | 39 | 26 | 65 | 41 | 53 | 12 | 76 | 53 | 65 | 4 |
| 7 | 23 | 5 | 14 | 51 | 24 | 4 | 14 | 51 | 33 | 15 | 24 | 41 | 50 | 29 | 40 | 25 | 65 | 42 | 54 | 12 | 76 | 54 | 65 | 4 |
| 8 | 23 | 5 | 14 | 51 | 24 | 4 | 14 | 51 | 33 | 16 | 25 | 40 | 50 | 30 | 40 | 25 | 66 | 42 | 54 | 12 | 76 | 54 | 65 | 4 |
| 9 | 23 | 5 | 14 | 51 | 25 | 4 | 15 | 51 | 34 | 16 | 25 | 40 | 51 | 30 | 41 | 24 | 66 | 43 | 55 | 11 | 76 | 54 | 65 | 4 |
| 10 | 23 | 5 | 14 | 51 | 25 | 5 | 15 | 50 | 34 | 16 | 25 | 40 | 51 | 31 | 41 | 24 | 66 | 43 | 55 | 11 | 77 | 55 | 66 | 4 |
| 11 | 23 | 4 | 14 | 51 | 25 | 5 | 15 | 50 | 34 | 17 | 26 | 39 | 52 | 31 | 42 | 23 | 67 | 43 | 55 | 11 | 77 | 55 | 66 | 3 |
| 12 | 23 | 4 | 14 | 51 | 25 | 5 | 15 | 50 | 35 | 17 | 26 | 39 | 52 | 32 | 42 | 23 | 67 | 44 | 56 | 11 | 77 | 55 | 66 | 3 |
| 13 | 23 | 4 | 14 | 51 | 25 | 5 | 15 | 50 | 35 | 18 | 27 | 38 | 53 | 32 | 43 | 22 | 67 | 44 | 56 | 11 | 78 | 56 | 67 | 3 |
| 14 | 23 | 4 | 14 | 51 | 26 | 6 | 16 | 49 | 35 | 18 | 27 | 38 | 54 | 32 | 43 | 22 | 67 | 44 | 56 | 11 | 78 | 56 | 67 | 3 |
| 15 | 23 | 4 | 14 | 51 | 26 | 6 | 16 | 49 | 36 | 18 | 27 | 38 | 55 | 32 | 44 | 21 | 68 | 45 | 57 | 10 | 78 | 56 | 67 | 3 |
| 16 | 23 | 4 | 14 | 52 | 26 | 6 | 16 | 49 | 36 | 19 | 28 | 38 | 56 | 33 | 45 | 20 | 68 | 45 | 57 | 10 | 78 | 56 | 67 | 3 |
| 17 | 23 | 4 | 14 | 52 | 26 | 6 | 16 | 49 | 37 | 19 | 28 | 37 | 57 | 34 | 46 | 19 | 69 | 45 | 57 | 10 | 79 | 57 | 68 | 3 |
| 18 | 22 | 4 | 13 | 52 | 27 | 7 | 17 | 48 | 37 | 20 | 29 | 37 | 57 | 34 | 46 | 19 | 69 | 45 | 57 | 9 | 79 | 57 | 68 | 3 |
| 19 | 22 | 4 | 13 | 52 | 27 | 7 | 17 | 48 | 38 | 20 | 29 | 36 | 58 | 35 | 47 | 18 | 69 | 46 | 58 | 9 | 79 | 57 | 68 | 2 |
| 20 | 22 | 4 | 13 | 52 | 27 | 7 | 17 | 48 | 38 | 21 | 30 | 36 | 58 | 35 | 47 | 18 | 70 | 46 | 58 | 8 | 79 | 57 | 68 | 2 |
| 21 | 22 | 4 | 13 | 52 | 28 | 7 | 18 | 47 | 39 | 21 | 30 | 35 | 59 | 36 | 48 | 18 | 70 | 47 | 59 | 8 | 79 | 58 | 69 | 2 |
| 22 | 23 | 3 | 13 | 52 | 28 | 8 | 18 | 47 | 39 | 22 | 31 | 35 | 60 | 36 | 48 | 17 | 71 | 47 | 59 | 8 | 80 | 58 | 69 | 2 |
| 23 | 23 | 3 | 13 | 52 | 28 | 8 | 18 | 47 | 40 | 22 | 31 | 34 | 60 | 36 | 48 | 17 | 71 | 47 | 59 | 8 | 80 | 58 | 69 | 2 |
| 24 | 23 | 3 | 13 | 52 | 29 | 9 | 19 | 46 | 40 | 23 | 32 | 34 | 60 | 37 | 49 | 17 | 71 | 48 | 60 | 7 | 80 | 58 | 69 | 2 |
| 25 | 23 | 3 | 13 | 52 | 29 | 9 | 19 | 46 | 41 | 23 | 32 | 33 | 61 | 37 | 49 | 16 | 72 | 48 | 60 | 7 | 80 | 58 | 69 | 2 |
| 26 | 23 | 3 | 13 | 52 | 29 | 10 | 20 | 45 | 41 | 23 | 32 | 33 | 61 | 37 | 49 | 16 | 72 | 48 | 60 | 7 | 80 | 59 | 70 | 2 |
| 27 | 23 | 3 | 13 | 52 | 30 | 10 | 20 | 45 | 42 | 24 | 33 | 32 | 62 | 37 | 50 | 16 | 72 | 48 | 60 | 7 | 81 | 59 | 70 | 2 |
| 28 | 23 | 3 | 13 | 52 | 30 | 11 | 21 | 44 | 42 | 24 | 33 | 32 | 62 | 38 | 50 | 15 | 72 | 49 | 61 | 6 | 81 | 59 | 70 | 2 |
| 29 | 23 | 3 | 13 | 52 | | | | | 43 | 24 | 34 | 31 | 63 | 39 | 51 | 14 | 73 | 50 | 62 | 6 | 81 | 59 | 70 | 2 |
| 30 | 23 | 3 | 13 | 52 | FEB. 29 VALUES | | | | 44 | 25 | 35 | 30 | 63 | 39 | 51 | 14 | 73 | 50 | 62 | 6 | 81 | 59 | 70 | 2 |
| 31 | 23 | 4 | 14 | 51 | SAME AS FEB. 28 | | | | 45 | 25 | 35 | 30 | | | | | 74 | 50 | 62 | 6 | | | | |

| | JULY | | | | AUGUST | | | | SEPTEMBER | | | | OCTOBER | | | | NOVEMBER | | | | DECEMBER | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY | TEMPERATURE MAX | MIN | AVG | DEG DAY |
| 1 | 81 | 59 | 70 | 2 | 85 | 60 | 73 | 0 | 76 | 54 | 65 | 4 | 69 | 44 | 57 | 10 | 50 | 31 | 41 | 25 | 32 | 15 | 24 | 42 |
| 2 | 82 | 59 | 71 | 2 | 85 | 60 | 73 | 0 | 76 | 54 | 65 | 4 | 69 | 44 | 57 | 10 | 49 | 30 | 40 | 25 | 32 | 14 | 23 | 42 |
| 3 | 82 | 59 | 71 | 2 | 85 | 60 | 73 | 0 | 76 | 53 | 65 | 4 | 68 | 43 | 56 | 10 | 48 | 30 | 39 | 26 | 31 | 14 | 23 | 42 |
| 4 | 82 | 60 | 71 | 2 | 85 | 60 | 73 | 0 | 75 | 53 | 64 | 4 | 68 | 43 | 56 | 10 | 47 | 29 | 38 | 27 | 31 | 13 | 22 | 43 |
| 5 | 83 | 60 | 72 | 2 | 85 | 60 | 73 | 0 | 75 | 52 | 64 | 4 | 68 | 43 | 56 | 10 | 46 | 28 | 37 | 28 | 30 | 13 | 22 | 43 |
| 6 | 83 | 60 | 72 | 1 | 85 | 60 | 73 | 0 | 75 | 52 | 64 | 4 | 67 | 42 | 55 | 11 | 45 | 28 | 37 | 29 | 30 | 12 | 21 | 44 |
| 7 | 83 | 60 | 72 | 1 | 84 | 59 | 72 | 0 | 74 | 52 | 63 | 5 | 67 | 42 | 55 | 11 | 45 | 27 | 36 | 29 | 29 | 12 | 21 | 44 |
| 8 | 83 | 60 | 72 | 1 | 84 | 59 | 72 | 0 | 74 | 51 | 63 | 5 | 66 | 42 | 54 | 11 | 44 | 27 | 36 | 30 | 29 | 12 | 21 | 44 |
| 9 | 83 | 60 | 72 | 1 | 84 | 59 | 72 | 0 | 74 | 51 | 63 | 5 | 66 | 41 | 54 | 12 | 44 | 26 | 35 | 30 | 29 | 12 | 21 | 45 |
| 10 | 83 | 60 | 72 | 1 | 84 | 59 | 72 | 0 | 74 | 51 | 63 | 5 | 65 | 41 | 53 | 12 | 43 | 26 | 35 | 31 | 28 | 11 | 20 | 45 |
| 11 | 84 | 60 | 72 | 1 | 83 | 59 | 71 | 0 | 73 | 50 | 62 | 5 | 65 | 40 | 53 | 13 | 42 | 25 | 34 | 31 | 28 | 11 | 20 | 45 |
| 12 | 84 | 60 | 72 | 1 | 83 | 59 | 71 | 0 | 73 | 50 | 62 | 5 | 64 | 40 | 52 | 13 | 41 | 25 | 33 | 32 | 28 | 10 | 19 | 46 |
| 13 | 84 | 60 | 72 | 1 | 83 | 59 | 71 | 0 | 73 | 50 | 62 | 5 | 64 | 40 | 52 | 13 | 41 | 24 | 33 | 32 | 28 | 10 | 19 | 46 |
| 14 | 84 | 60 | 72 | 1 | 83 | 59 | 71 | 1 | 73 | 50 | 62 | 6 | 63 | 39 | 51 | 14 | 41 | 24 | 33 | 33 | 27 | 10 | 19 | 46 |
| 15 | 84 | 61 | 73 | 1 | 82 | 58 | 70 | 1 | 72 | 49 | 61 | 6 | 63 | 39 | 51 | 14 | 40 | 23 | 32 | 33 | 27 | 9 | 18 | 47 |
| 16 | 84 | 61 | 73 | 1 | 82 | 58 | 70 | 1 | 72 | 49 | 61 | 6 | 62 | 39 | 51 | 15 | 39 | 23 | 31 | 34 | 27 | 9 | 18 | 47 |
| 17 | 84 | 61 | 73 | 1 | 82 | 58 | 70 | 1 | 72 | 48 | 60 | 6 | 61 | 38 | 50 | 15 | 38 | 22 | 30 | 35 | 27 | 9 | 18 | 47 |
| 18 | 85 | 61 | 73 | 1 | 81 | 58 | 70 | 1 | 72 | 48 | 60 | 6 | 61 | 38 | 50 | 15 | 38 | 22 | 30 | 35 | 26 | 9 | 18 | 47 |
| 19 | 85 | 61 | 73 | 1 | 81 | 58 | 70 | 1 | 71 | 48 | 60 | 7 | 60 | 38 | 49 | 16 | 38 | 21 | 30 | 36 | 26 | 9 | 18 | 48 |
| 20 | 85 | 61 | 73 | 1 | 81 | 57 | 69 | 1 | 71 | 48 | 60 | 7 | 59 | 37 | 48 | 17 | 37 | 21 | 29 | 36 | 26 | 8 | 17 | 48 |
| 21 | 85 | 61 | 73 | 0 | 80 | 57 | 69 | 2 | 71 | 47 | 59 | 7 | 59 | 37 | 48 | 17 | 36 | 20 | 28 | 37 | 26 | 8 | 17 | 48 |
| 22 | 85 | 61 | 73 | 0 | 80 | 57 | 69 | 2 | 71 | 47 | 59 | 7 | 58 | 36 | 47 | 18 | 36 | 20 | 28 | 37 | 26 | 8 | 17 | 48 |
| 23 | 85 | 61 | 73 | 0 | 80 | 57 | 69 | 2 | 70 | 47 | 59 | 8 | 58 | 36 | 47 | 18 | 36 | 19 | 28 | 38 | 25 | 8 | 17 | 48 |
| 24 | 85 | 61 | 73 | 0 | 79 | 56 | 68 | 2 | 70 | 47 | 59 | 8 | 57 | 35 | 46 | 19 | 35 | 19 | 27 | 38 | 25 | 8 | 17 | 48 |
| 25 | 85 | 61 | 73 | 0 | 79 | 56 | 68 | 2 | 70 | 46 | 58 | 8 | 56 | 35 | 46 | 19 | 34 | 18 | 26 | 38 | 25 | 7 | 16 | 49 |
| 26 | 85 | 61 | 73 | 0 | 79 | 56 | 68 | 2 | 69 | 46 | 58 | 8 | 55 | 34 | 45 | 20 | 34 | 18 | 26 | 39 | 25 | 7 | 16 | 49 |
| 27 | 85 | 61 | 73 | 0 | 78 | 55 | 67 | 3 | 69 | 45 | 57 | 9 | 54 | 34 | 44 | 21 | 34 | 17 | 26 | 39 | 25 | 7 | 16 | 49 |
| 28 | 85 | 61 | 73 | 0 | 78 | 55 | 67 | 3 | 69 | 45 | 57 | 9 | 54 | 33 | 44 | 21 | 33 | 17 | 25 | 40 | 25 | 7 | 16 | 49 |
| 29 | 85 | 61 | 73 | 0 | 78 | 55 | 67 | 3 | 69 | 45 | 57 | 9 | 53 | 33 | 43 | 22 | 32 | 16 | 24 | 41 | 24 | 7 | 16 | 49 |
| 30 | 85 | 61 | 73 | 0 | 77 | 54 | 66 | 3 | 69 | 44 | 57 | 10 | 52 | 32 | 42 | 23 | 32 | 16 | 24 | 41 | 24 | 7 | 16 | 50 |
| 31 | 85 | 61 | 73 | 0 | 77 | 54 | 66 | 3 | | | | | 51 | 31 | 41 | 24 | | | | | 24 | 7 | 16 | 50 |

Appendix Table 1. Daily temperature and heating degree day normals at St. Cloud, 1931-1960 (33).

| DAY | JANUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | FEBRUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | MARCH TEMPERATURE MAX | MIN | AVG | DEG DAY | APRIL TEMPERATURE MAX | MIN | AVG | DEG DAY | MAY TEMPERATURE MAX | MIN | AVG | DEG DAY | JUNE TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 22 | 3 | 13 | 53 | 21 | - 1 | 10 | 55 | 29 | 9 | 19 | 46 | 44 | 24 | 34 | 31 | 62 | 39 | 51 | 15 | 73 | 49 | 61 | 6 |
| 2 | 22 | 2 | 12 | 53 | 21 | - 1 | 10 | 55 | 29 | 10 | 20 | 45 | 44 | 25 | 35 | 30 | 62 | 39 | 51 | 15 | 73 | 50 | 62 | 6 |
| 3 | 21 | 2 | 12 | 53 | 21 | - 1 | 10 | 55 | 30 | 10 | 20 | 45 | 45 | 26 | 36 | 30 | 63 | 39 | 51 | 14 | 74 | 50 | 62 | 5 |
| 4 | 21 | 2 | 12 | 53 | 22 | - 1 | 11 | 55 | 30 | 10 | 20 | 45 | 46 | 26 | 36 | 29 | 63 | 39 | 51 | 14 | 74 | 51 | 63 | 5 |
| 5 | 21 | 2 | 12 | 54 | 22 | - 1 | 11 | 55 | 31 | 10 | 21 | 44 | 47 | 26 | 37 | 28 | 63 | 40 | 52 | 14 | 74 | 51 | 63 | 5 |
| 6 | 21 | 1 | 11 | 54 | 22 | - 1 | 11 | 55 | 31 | 11 | 21 | 44 | 47 | 27 | 37 | 28 | 64 | 40 | 52 | 14 | 74 | 52 | 63 | 5 |
| 7 | 21 | 1 | 11 | 54 | 22 | - 1 | 11 | 54 | 31 | 12 | 22 | 43 | 48 | 28 | 38 | 27 | 64 | 41 | 53 | 13 | 75 | 52 | 64 | 4 |
| 8 | 21 | 1 | 11 | 54 | 22 | 0 | 11 | 54 | 32 | 12 | 22 | 43 | 49 | 28 | 39 | 26 | 65 | 41 | 53 | 13 | 75 | 52 | 64 | 4 |
| 9 | 20 | 1 | 11 | 54 | 23 | 0 | 12 | 54 | 32 | 12 | 22 | 42 | 50 | 29 | 40 | 26 | 65 | 41 | 53 | 13 | 75 | 52 | 64 | 4 |
| 10 | 20 | 1 | 11 | 54 | 23 | 0 | 12 | 53 | 33 | 13 | 23 | 42 | 50 | 29 | 40 | 25 | 65 | 42 | 54 | 12 | 75 | 52 | 64 | 4 |
| 11 | 20 | 0 | 10 | 55 | 23 | 1 | 12 | 53 | 33 | 14 | 24 | 42 | 51 | 30 | 41 | 25 | 66 | 42 | 54 | 12 | 76 | 53 | 65 | 4 |
| 12 | 20 | 0 | 10 | 55 | 23 | 1 | 12 | 53 | 33 | 14 | 24 | 41 | 52 | 30 | 41 | 24 | 66 | 42 | 54 | 12 | 76 | 53 | 65 | 4 |
| 13 | 20 | 0 | 10 | 55 | 24 | 1 | 13 | 52 | 34 | 14 | 24 | 41 | 53 | 31 | 42 | 23 | 66 | 42 | 54 | 12 | 76 | 53 | 65 | 4 |
| 14 | 20 | 0 | 10 | 55 | 24 | 2 | 13 | 52 | 34 | 14 | 24 | 40 | 53 | 31 | 42 | 22 | 66 | 43 | 55 | 11 | 76 | 54 | 65 | 3 |
| 15 | 20 | - 1 | 10 | 55 | 24 | 2 | 13 | 52 | 35 | 15 | 25 | 40 | 54 | 32 | 43 | 22 | 67 | 43 | 55 | 11 | 77 | 54 | 66 | 3 |
| 16 | 20 | - 1 | 10 | 55 | 24 | 3 | 14 | 51 | 35 | 16 | 26 | 40 | 54 | 33 | 44 | 21 | 67 | 44 | 56 | 10 | 77 | 54 | 66 | 3 |
| 17 | 20 | - 1 | 10 | 55 | 25 | 3 | 14 | 51 | 35 | 16 | 26 | 39 | 55 | 33 | 44 | 21 | 68 | 44 | 56 | 10 | 77 | 55 | 66 | 3 |
| 18 | 20 | - 1 | 10 | 55 | 25 | 3 | 14 | 51 | 36 | 16 | 26 | 39 | 56 | 33 | 45 | 20 | 68 | 44 | 56 | 10 | 77 | 55 | 66 | 3 |
| 19 | 20 | - 1 | 10 | 56 | 25 | 4 | 15 | 50 | 36 | 17 | 27 | 38 | 57 | 34 | 46 | 20 | 69 | 45 | 57 | 9 | 77 | 55 | 66 | 3 |
| 20 | 20 | - 1 | 10 | 56 | 26 | 4 | 15 | 50 | 37 | 18 | 28 | 38 | 57 | 34 | 46 | 19 | 69 | 45 | 57 | 9 | 78 | 55 | 67 | 3 |
| 21 | 20 | - 1 | 10 | 56 | 26 | 5 | 16 | 50 | 37 | 18 | 28 | 37 | 57 | 35 | 46 | 19 | 69 | 46 | 58 | 9 | 78 | 55 | 67 | 3 |
| 22 | 20 | - 1 | 10 | 56 | 26 | 5 | 16 | 49 | 38 | 18 | 28 | 37 | 58 | 35 | 47 | 18 | 70 | 46 | 58 | 8 | 78 | 56 | 67 | 3 |
| 23 | 20 | - 2 | 9 | 56 | 27 | 6 | 17 | 49 | 38 | 19 | 29 | 36 | 59 | 36 | 48 | 18 | 70 | 46 | 58 | 8 | 78 | 56 | 67 | 3 |
| 24 | 20 | - 2 | 9 | 56 | 27 | 6 | 17 | 48 | 39 | 20 | 30 | 36 | 59 | 36 | 48 | 18 | 70 | 46 | 58 | 8 | 78 | 56 | 67 | 3 |
| 25 | 20 | - 2 | 9 | 56 | 28 | 7 | 18 | 48 | 39 | 20 | 30 | 35 | 59 | 37 | 48 | 17 | 70 | 47 | 59 | 8 | 79 | 56 | 68 | 2 |
| 26 | 20 | - 2 | 9 | 56 | 28 | 7 | 18 | 47 | 40 | 20 | 30 | 35 | 60 | 37 | 49 | 17 | 71 | 47 | 59 | 8 | 79 | 56 | 68 | 2 |
| 27 | 20 | - 2 | 9 | 56 | 28 | 8 | 18 | 47 | 40 | 21 | 31 | 35 | 61 | 37 | 49 | 16 | 71 | 48 | 60 | 7 | 79 | 57 | 68 | 2 |
| 28 | 21 | - 2 | 10 | 56 | 29 | 8 | 19 | 47 | 41 | 22 | 32 | 34 | 61 | 38 | 50 | 16 | 72 | 48 | 60 | 7 | 79 | 57 | 68 | 2 |
| 29 | 21 | - 2 | 10 | 56 | Feb. 29 values | | | | 41 | 22 | 32 | 34 | 61 | 38 | 50 | 15 | 72 | 48 | 60 | 7 | 80 | 57 | 69 | 2 |
| 30 | 21 | - 1 | 10 | 55 | same as Feb. 28 | | | | 42 | 23 | 33 | 33 | 62 | 38 | 50 | 15 | 72 | 49 | 61 | 7 | 80 | 57 | 69 | 2 |
| 31 | 21 | - 1 | 10 | 55 | | | | | 43 | 23 | 33 | 32 | | | | | 73 | 49 | 61 | 6 | | | | |

| DAY | JULY TEMPERATURE MAX | MIN | AVG | DEG DAY | AUGUST TEMPERATURE MAX | MIN | AVG | DEG DAY | SEPTEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | OCTOBER TEMPERATURE MAX | MIN | AVG | DEG DAY | NOVEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | DECEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 80 | 57 | 69 | 2 | 84 | 59 | 72 | 0 | 74 | 52 | 63 | 5 | 67 | 41 | 54 | 11 | 47 | 28 | 38 | 27 | 31 | 13 | 22 | 43 |
| 2 | 81 | 58 | 70 | 2 | 84 | 59 | 72 | 0 | 74 | 52 | 63 | 5 | 67 | 41 | 54 | 11 | 47 | 28 | 38 | 28 | 30 | 12 | 21 | 44 |
| 3 | 81 | 58 | 70 | 2 | 84 | 59 | 72 | 0 | 74 | 52 | 63 | 5 | 66 | 41 | 54 | 12 | 46 | 28 | 37 | 28 | 30 | 12 | 21 | 44 |
| 4 | 81 | 58 | 70 | 2 | 84 | 59 | 72 | 0 | 73 | 51 | 62 | 5 | 66 | 41 | 54 | 12 | 45 | 27 | 36 | 29 | 29 | 11 | 20 | 45 |
| 5 | 81 | 58 | 70 | 2 | 84 | 59 | 72 | 0 | 73 | 50 | 62 | 5 | 66 | 40 | 53 | 12 | 44 | 26 | 35 | 30 | 29 | 11 | 20 | 45 |
| 6 | 81 | 58 | 70 | 2 | 84 | 59 | 72 | 0 | 73 | 50 | 62 | 5 | 65 | 40 | 53 | 12 | 43 | 26 | 35 | 30 | 28 | 11 | 20 | 45 |
| 7 | 82 | 58 | 70 | 2 | 84 | 59 | 72 | 0 | 73 | 50 | 62 | 6 | 65 | 39 | 52 | 13 | 43 | 25 | 34 | 31 | 28 | 10 | 19 | 46 |
| 8 | 82 | 59 | 71 | 1 | 83 | 59 | 71 | 0 | 72 | 49 | 61 | 6 | 64 | 39 | 52 | 13 | 42 | 25 | 34 | 31 | 28 | 10 | 19 | 46 |
| 9 | 82 | 59 | 71 | 1 | 83 | 59 | 71 | 0 | 72 | 49 | 61 | 6 | 64 | 38 | 51 | 14 | 41 | 24 | 33 | 32 | 28 | 9 | 19 | 46 |
| 10 | 82 | 59 | 71 | 1 | 83 | 58 | 71 | 0 | 72 | 49 | 61 | 6 | 63 | 38 | 51 | 14 | 41 | 24 | 33 | 33 | 27 | 9 | 18 | 47 |
| 11 | 83 | 59 | 71 | 1 | 83 | 58 | 71 | 0 | 72 | 48 | 60 | 7 | 63 | 38 | 51 | 15 | 40 | 23 | 32 | 33 | 27 | 9 | 18 | 47 |
| 12 | 83 | 59 | 71 | 1 | 82 | 58 | 70 | 1 | 71 | 48 | 60 | 7 | 62 | 37 | 50 | 15 | 40 | 22 | 31 | 34 | 27 | 8 | 18 | 47 |
| 13 | 83 | 59 | 71 | 1 | 82 | 58 | 70 | 1 | 71 | 48 | 60 | 7 | 61 | 37 | 49 | 16 | 39 | 22 | 31 | 34 | 26 | 8 | 17 | 48 |
| 14 | 83 | 59 | 71 | 1 | 82 | 58 | 70 | 1 | 71 | 48 | 60 | 7 | 61 | 37 | 49 | 16 | 38 | 21 | 30 | 35 | 26 | 8 | 17 | 48 |
| 15 | 83 | 59 | 71 | 1 | 81 | 57 | 69 | 1 | 71 | 47 | 59 | 7 | 60 | 36 | 48 | 16 | 38 | 21 | 30 | 36 | 26 | 7 | 17 | 48 |
| 16 | 84 | 59 | 72 | 1 | 81 | 57 | 69 | 1 | 71 | 47 | 59 | 7 | 60 | 36 | 48 | 17 | 38 | 21 | 30 | 36 | 25 | 7 | 16 | 49 |
| 17 | 84 | 59 | 72 | 1 | 81 | 57 | 69 | 1 | 70 | 46 | 58 | 8 | 59 | 35 | 47 | 18 | 37 | 20 | 29 | 37 | 25 | 7 | 16 | 49 |
| 18 | 84 | 59 | 72 | 1 | 80 | 57 | 69 | 2 | 70 | 46 | 58 | 8 | 58 | 35 | 47 | 19 | 36 | 19 | 28 | 37 | 25 | 7 | 16 | 49 |
| 19 | 84 | 59 | 72 | 1 | 80 | 56 | 68 | 2 | 70 | 46 | 58 | 8 | 57 | 34 | 46 | 19 | 36 | 19 | 28 | 38 | 25 | 6 | 16 | 49 |
| 20 | 84 | 59 | 72 | 1 | 79 | 56 | 68 | 2 | 70 | 45 | 58 | 8 | 57 | 34 | 46 | 20 | 35 | 18 | 27 | 38 | 24 | 6 | 15 | 50 |
| 21 | 84 | 59 | 72 | 1 | 79 | 56 | 68 | 2 | 69 | 45 | 57 | 9 | 56 | 34 | 45 | 20 | 35 | 18 | 27 | 39 | 24 | 6 | 15 | 50 |
| 22 | 84 | 59 | 72 | 0 | 79 | 56 | 68 | 2 | 69 | 44 | 57 | 9 | 55 | 33 | 44 | 20 | 34 | 17 | 26 | 39 | 24 | 6 | 15 | 50 |
| 23 | 84 | 59 | 72 | 0 | 78 | 55 | 67 | 3 | 69 | 44 | 57 | 9 | 55 | 33 | 44 | 21 | 34 | 17 | 26 | 40 | 24 | 5 | 15 | 50 |
| 24 | 84 | 60 | 72 | 0 | 78 | 55 | 67 | 3 | 69 | 44 | 57 | 9 | 54 | 32 | 43 | 22 | 33 | 16 | 25 | 40 | 23 | 5 | 14 | 51 |
| 25 | 84 | 60 | 72 | 0 | 77 | 55 | 66 | 3 | 69 | 44 | 57 | 9 | 53 | 32 | 43 | 22 | 33 | 16 | 25 | 41 | 23 | 5 | 14 | 51 |
| 26 | 85 | 60 | 73 | 0 | 77 | 54 | 66 | 3 | 68 | 43 | 56 | 10 | 52 | 32 | 42 | 23 | 32 | 15 | 24 | 41 | 23 | 4 | 14 | 52 |
| 27 | 85 | 60 | 73 | 0 | 77 | 54 | 66 | 3 | 68 | 43 | 56 | 10 | 52 | 31 | 42 | 24 | 32 | 15 | 24 | 42 | 23 | 4 | 14 | 52 |
| 28 | 85 | 60 | 73 | 0 | 76 | 54 | 65 | 4 | 68 | 42 | 55 | 10 | 51 | 30 | 41 | 24 | 32 | 15 | 24 | 42 | 22 | 4 | 13 | 52 |
| 29 | 84 | 60 | 72 | 0 | 76 | 53 | 65 | 4 | 67 | 42 | 55 | 11 | 50 | 30 | 40 | 25 | 32 | 14 | 23 | 42 | 22 | 4 | 13 | 52 |
| 30 | 84 | 59 | 72 | 0 | 76 | 53 | 65 | 4 | 67 | 42 | 55 | 11 | 49 | 29 | 39 | 26 | 31 | 13 | 22 | 42 | 22 | 4 | 13 | 52 |
| 31 | 84 | 59 | 72 | 0 | 75 | 52 | 64 | 4 | | | | | 48 | 29 | 39 | 27 | | | | | 22 | 3 | 13 | 53 |

Appendix Table 1. Daily temperature and heating degree day normals at Fargo, North Dakota, 1931-1960 (33).

| DAY | JANUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | FEBRUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | MARCH TEMPERATURE MAX | MIN | AVG | DEG DAY | APRIL TEMPERATURE MAX | MIN | AVG | DEG DAY | MAY TEMPERATURE MAX | MIN | AVG | DEG DAY | JUNE TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 0 | 10 | 55 | 16 | -4 | 6 | 59 | 27 | 7 | 17 | 48 | 42 | 23 | 33 | 32 | 63 | 38 | 51 | 15 | 72 | 48 | 60 | 7 |
| 2 | 20 | 0 | 10 | 55 | 16 | -3 | 7 | 59 | 27 | 8 | 18 | 48 | 43 | 24 | 34 | 32 | 63 | 39 | 51 | 15 | 72 | 49 | 61 | 6 |
| 3 | 20 | 0 | 10 | 55 | 16 | -3 | 7 | 58 | 28 | 8 | 18 | 47 | 44 | 25 | 35 | 31 | 64 | 39 | 52 | 14 | 72 | 49 | 61 | 6 |
| 4 | 19 | -1 | 9 | 56 | 16 | -3 | 7 | 58 | 28 | 9 | 19 | 46 | 44 | 25 | 35 | 30 | 64 | 39 | 52 | 14 | 72 | 50 | 61 | 6 |
| 5 | 19 | -1 | 9 | 56 | 17 | -3 | 7 | 58 | 29 | 9 | 19 | 46 | 45 | 26 | 36 | 30 | 65 | 39 | 52 | 14 | 73 | 50 | 62 | 6 |
| 6 | 19 | -1 | 9 | 56 | 17 | -2 | 8 | 58 | 29 | 10 | 20 | 46 | 46 | 26 | 36 | 29 | 65 | 40 | 53 | 13 | 73 | 50 | 62 | 5 |
| 7 | 19 | -2 | 9 | 56 | 17 | -2 | 8 | 57 | 29 | 10 | 20 | 45 | 46 | 27 | 37 | 28 | 65 | 40 | 53 | 13 | 73 | 51 | 62 | 5 |
| 8 | 18 | -2 | 8 | 57 | 18 | -2 | 8 | 57 | 30 | 11 | 21 | 45 | 47 | 28 | 38 | 27 | 66 | 40 | 53 | 13 | 74 | 51 | 63 | 5 |
| 9 | 18 | -2 | 8 | 57 | 18 | -1 | 9 | 57 | 30 | 11 | 21 | 44 | 48 | 28 | 38 | 27 | 66 | 41 | 54 | 12 | 74 | 51 | 63 | 5 |
| 10 | 18 | -2 | 8 | 57 | 18 | -1 | 9 | 56 | 31 | 12 | 22 | 44 | 49 | 29 | 39 | 26 | 67 | 41 | 54 | 12 | 74 | 52 | 63 | 4 |
| 11 | 18 | -2 | 8 | 57 | 19 | -1 | 9 | 56 | 31 | 12 | 22 | 44 | 49 | 29 | 39 | 26 | 67 | 41 | 54 | 12 | 75 | 52 | 64 | 4 |
| 12 | 18 | -3 | 8 | 57 | 19 | 0 | 10 | 56 | 32 | 13 | 23 | 43 | 50 | 30 | 40 | 25 | 67 | 42 | 55 | 11 | 75 | 52 | 64 | 4 |
| 13 | 17 | -3 | 7 | 58 | 20 | 0 | 10 | 55 | 32 | 14 | 23 | 42 | 51 | 30 | 41 | 24 | 67 | 42 | 55 | 11 | 75 | 53 | 64 | 4 |
| 14 | 17 | -3 | 7 | 58 | 20 | 0 | 10 | 55 | 32 | 14 | 23 | 42 | 52 | 31 | 42 | 23 | 68 | 42 | 55 | 11 | 76 | 53 | 65 | 3 |
| 15 | 17 | -3 | 7 | 58 | 21 | 1 | 11 | 54 | 33 | 15 | 24 | 41 | 53 | 32 | 43 | 22 | 68 | 43 | 56 | 11 | 76 | 53 | 65 | 3 |
| 16 | 17 | -3 | 7 | 58 | 21 | 1 | 11 | 54 | 33 | 15 | 24 | 41 | 53 | 32 | 43 | 22 | 68 | 43 | 56 | 11 | 76 | 54 | 65 | 3 |
| 17 | 17 | -3 | 7 | 58 | 21 | 2 | 12 | 54 | 34 | 16 | 25 | 40 | 54 | 32 | 43 | 21 | 68 | 43 | 56 | 11 | 77 | 54 | 66 | 3 |
| 18 | 16 | -4 | 6 | 58 | 22 | 2 | 12 | 53 | 34 | 16 | 25 | 40 | 55 | 33 | 44 | 21 | 69 | 44 | 57 | 10 | 77 | 54 | 66 | 3 |
| 19 | 16 | -4 | 6 | 59 | 22 | 2 | 12 | 53 | 34 | 17 | 26 | 39 | 56 | 33 | 45 | 20 | 69 | 44 | 57 | 10 | 77 | 55 | 66 | 2 |
| 20 | 16 | -4 | 6 | 59 | 23 | 3 | 13 | 52 | 35 | 17 | 26 | 39 | 56 | 34 | 45 | 20 | 69 | 44 | 57 | 10 | 78 | 55 | 67 | 2 |
| 21 | 16 | -4 | 6 | 59 | 23 | 3 | 13 | 52 | 35 | 18 | 27 | 38 | 57 | 34 | 46 | 19 | 69 | 45 | 57 | 9 | 78 | 55 | 67 | 2 |
| 22 | 16 | -4 | 6 | 59 | 24 | 4 | 14 | 51 | 36 | 18 | 27 | 38 | 58 | 35 | 47 | 19 | 69 | 45 | 57 | 9 | 79 | 55 | 67 | 2 |
| 23 | 16 | -4 | 6 | 59 | 24 | 4 | 14 | 51 | 36 | 19 | 28 | 37 | 58 | 35 | 47 | 18 | 70 | 45 | 58 | 9 | 79 | 56 | 68 | 2 |
| 24 | 16 | -4 | 6 | 59 | 25 | 5 | 15 | 50 | 37 | 19 | 28 | 37 | 59 | 36 | 48 | 18 | 70 | 46 | 58 | 8 | 79 | 56 | 68 | 1 |
| 25 | 16 | -4 | 6 | 59 | 25 | 5 | 15 | 50 | 37 | 20 | 29 | 36 | 60 | 36 | 48 | 18 | 70 | 46 | 58 | 8 | 80 | 56 | 68 | 1 |
| 26 | 16 | -4 | 6 | 59 | 25 | 6 | 16 | 49 | 38 | 20 | 29 | 36 | 60 | 37 | 49 | 17 | 70 | 46 | 58 | 8 | 80 | 56 | 68 | 1 |
| 27 | 16 | -4 | 6 | 59 | 26 | 6 | 16 | 49 | 38 | 21 | 30 | 35 | 61 | 37 | 49 | 17 | 71 | 47 | 59 | 8 | 80 | 57 | 69 | 1 |
| 28 | 16 | -4 | 6 | 59 | 26 | 7 | 17 | 49 | 39 | 21 | 30 | 35 | 61 | 37 | 49 | 16 | 71 | 47 | 59 | 8 | 80 | 57 | 69 | 1 |
| 29 | 16 | -4 | 6 | 59 | | | | | 40 | 22 | 31 | 34 | 62 | 38 | 50 | 16 | 71 | 47 | 59 | 8 | 81 | 57 | 69 | 1 |
| 30 | 16 | -4 | 6 | 59 | FEB. 29 VALUES | | | | 41 | 22 | 32 | 33 | 62 | 38 | 50 | 16 | 71 | 48 | 60 | 7 | 81 | 57 | 69 | 1 |
| 31 | 16 | -4 | 6 | 59 | SAME AS FEB. 28 | | | | 42 | 23 | 33 | 33 | | | | | 72 | 48 | 60 | 7 | | | | |

| DAY | JULY TEMPERATURE MAX | MIN | AVG | DEG DAY | AUGUST TEMPERATURE MAX | MIN | AVG | DEG DAY | SEPTEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | OCTOBER TEMPERATURE MAX | MIN | AVG | DEG DAY | NOVEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | DECEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 82 | 58 | 70 | 1 | 84 | 59 | 72 | 0 | 77 | 52 | 65 | 3 | 65 | 40 | 53 | 13 | 48 | 27 | 38 | 27 | 28 | 10 | 19 | 46 |
| 2 | 82 | 58 | 70 | 1 | 84 | 59 | 72 | 0 | 77 | 52 | 65 | 3 | 65 | 40 | 53 | 13 | 47 | 27 | 37 | 28 | 27 | 10 | 19 | 47 |
| 3 | 82 | 58 | 70 | 1 | 84 | 59 | 72 | 0 | 76 | 51 | 64 | 4 | 64 | 40 | 52 | 13 | 47 | 26 | 37 | 29 | 27 | 9 | 18 | 47 |
| 4 | 83 | 58 | 71 | 1 | 84 | 59 | 72 | 0 | 76 | 51 | 64 | 4 | 64 | 39 | 52 | 13 | 46 | 26 | 36 | 29 | 27 | 9 | 18 | 47 |
| 5 | 83 | 58 | 71 | 1 | 84 | 59 | 72 | 1 | 75 | 51 | 63 | 4 | 63 | 39 | 51 | 14 | 45 | 25 | 35 | 30 | 26 | 8 | 17 | 48 |
| 6 | 83 | 58 | 71 | 1 | 84 | 59 | 72 | 1 | 75 | 50 | 63 | 5 | 63 | 39 | 51 | 14 | 44 | 25 | 35 | 31 | 26 | 8 | 17 | 48 |
| 7 | 83 | 59 | 71 | 1 | 84 | 59 | 72 | 1 | 75 | 50 | 63 | 5 | 63 | 38 | 51 | 14 | 43 | 24 | 34 | 31 | 26 | 7 | 17 | 48 |
| 8 | 83 | 59 | 71 | 1 | 84 | 59 | 72 | 1 | 74 | 50 | 62 | 5 | 62 | 38 | 50 | 15 | 43 | 23 | 33 | 32 | 26 | 7 | 17 | 49 |
| 9 | 84 | 59 | 72 | 1 | 84 | 59 | 72 | 1 | 74 | 49 | 62 | 5 | 62 | 38 | 50 | 15 | 42 | 23 | 33 | 33 | 25 | 7 | 16 | 49 |
| 10 | 84 | 59 | 72 | 1 | 83 | 59 | 71 | 1 | 73 | 49 | 61 | 5 | 61 | 37 | 49 | 15 | 41 | 22 | 32 | 33 | 25 | 6 | 16 | 49 |
| 11 | 84 | 59 | 72 | 1 | 83 | 58 | 71 | 1 | 73 | 48 | 61 | 6 | 61 | 37 | 49 | 16 | 40 | 22 | 31 | 34 | 25 | 6 | 16 | 49 |
| 12 | 84 | 59 | 72 | 1 | 83 | 58 | 71 | 1 | 72 | 48 | 60 | 6 | 61 | 37 | 49 | 16 | 39 | 21 | 30 | 35 | 25 | 6 | 16 | 50 |
| 13 | 84 | 59 | 72 | 1 | 83 | 58 | 71 | 1 | 72 | 48 | 60 | 6 | 60 | 36 | 48 | 16 | 39 | 20 | 30 | 36 | 24 | 5 | 15 | 50 |
| 14 | 84 | 59 | 72 | 1 | 83 | 58 | 71 | 1 | 71 | 47 | 59 | 7 | 60 | 36 | 48 | 17 | 38 | 19 | 29 | 36 | 24 | 5 | 15 | 50 |
| 15 | 84 | 59 | 72 | 1 | 83 | 58 | 71 | 1 | 71 | 47 | 59 | 7 | 59 | 36 | 48 | 17 | 37 | 19 | 28 | 37 | 24 | 5 | 15 | 51 |
| 16 | 84 | 59 | 72 | 1 | 82 | 57 | 70 | 1 | 71 | 46 | 59 | 7 | 59 | 35 | 47 | 18 | 36 | 18 | 27 | 38 | 24 | 4 | 14 | 51 |
| 17 | 84 | 59 | 72 | 1 | 82 | 57 | 70 | 1 | 70 | 46 | 58 | 8 | 58 | 35 | 47 | 18 | 36 | 18 | 27 | 38 | 24 | 4 | 14 | 51 |
| 18 | 84 | 59 | 72 | 1 | 82 | 57 | 70 | 1 | 70 | 46 | 58 | 8 | 58 | 35 | 47 | 19 | 35 | 17 | 26 | 39 | 23 | 4 | 14 | 51 |
| 19 | 84 | 59 | 72 | 1 | 82 | 57 | 70 | 1 | 70 | 45 | 58 | 8 | 57 | 34 | 46 | 19 | 34 | 16 | 25 | 40 | 23 | 4 | 14 | 52 |
| 20 | 84 | 59 | 72 | 1 | 81 | 57 | 69 | 1 | 69 | 45 | 57 | 8 | 56 | 34 | 45 | 20 | 33 | 16 | 25 | 40 | 23 | 3 | 13 | 52 |
| 21 | 84 | 59 | 72 | 1 | 81 | 56 | 69 | 1 | 69 | 44 | 57 | 9 | 56 | 33 | 45 | 21 | 33 | 15 | 24 | 41 | 23 | 3 | 13 | 52 |
| 22 | 84 | 59 | 72 | 1 | 81 | 56 | 69 | 1 | 68 | 44 | 56 | 9 | 55 | 33 | 44 | 21 | 32 | 15 | 24 | 41 | 22 | 3 | 13 | 52 |
| 23 | 85 | 60 | 73 | 1 | 81 | 56 | 69 | 1 | 68 | 43 | 56 | 10 | 55 | 32 | 44 | 22 | 32 | 14 | 23 | 42 | 22 | 3 | 13 | 52 |
| 24 | 85 | 60 | 73 | 1 | 80 | 56 | 68 | 1 | 67 | 43 | 55 | 10 | 54 | 32 | 43 | 22 | 31 | 14 | 23 | 42 | 22 | 2 | 12 | 53 |
| 25 | 85 | 60 | 73 | 1 | 80 | 55 | 68 | 2 | 67 | 43 | 55 | 10 | 53 | 32 | 43 | 23 | 31 | 13 | 22 | 43 | 22 | 2 | 12 | 53 |
| 26 | 85 | 60 | 73 | 1 | 80 | 55 | 68 | 2 | 67 | 42 | 55 | 11 | 53 | 31 | 42 | 23 | 30 | 13 | 22 | 43 | 22 | 2 | 12 | 53 |
| 27 | 84 | 60 | 72 | 1 | 79 | 54 | 67 | 2 | 67 | 42 | 55 | 11 | 52 | 31 | 42 | 24 | 30 | 12 | 21 | 44 | 21 | 2 | 12 | 53 |
| 28 | 84 | 59 | 72 | 1 | 79 | 54 | 67 | 2 | 66 | 42 | 54 | 11 | 51 | 30 | 41 | 25 | 29 | 12 | 21 | 44 | 21 | 1 | 11 | 54 |
| 29 | 84 | 59 | 72 | 0 | 78 | 54 | 66 | 3 | 65 | 41 | 53 | 12 | 50 | 30 | 40 | 25 | 29 | 11 | 20 | 45 | 21 | 1 | 11 | 54 |
| 30 | 84 | 59 | 72 | 0 | 78 | 53 | 66 | 3 | 65 | 41 | 53 | 12 | 49 | 29 | 39 | 26 | 28 | 11 | 20 | 46 | 21 | 1 | 11 | 54 |
| 31 | 84 | 59 | 72 | 0 | 78 | 53 | 66 | 3 | | | | | 48 | 28 | 38 | 27 | | | | | 21 | 1 | 11 | 54 |

Appendix Table 1. Daily temperature and heating degree day normals at Sioux Falls, South Dakota, 1931-1960 (33).

| DAY | JANUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | FEBRUARY TEMPERATURE MAX | MIN | AVG | DEG DAY | MARCH TEMPERATURE MAX | MIN | AVG | DEG DAY | APRIL TEMPERATURE MAX | MIN | AVG | DEG DAY | MAY TEMPERATURE MAX | MIN | AVG | DEG DAY | JUNE TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 27 | 8 | 18 | 48 | 25 | 5 | 15 | 50 | 34 | 15 | 25 | 41 | 47 | 28 | 38 | 27 | 66 | 42 | 54 | 12 | 74 | 52 | 63 | 6 |
| 2 | 27 | 8 | 18 | 48 | 25 | 5 | 15 | 50 | 34 | 15 | 25 | 41 | 48 | 28 | 38 | 26 | 66 | 42 | 54 | 12 | 75 | 52 | 64 | 5 |
| 3 | 27 | 7 | 17 | 48 | 26 | 5 | 16 | 49 | 35 | 16 | 26 | 40 | 49 | 29 | 39 | 26 | 67 | 42 | 55 | 12 | 75 | 53 | 64 | 5 |
| 4 | 27 | 7 | 17 | 48 | 26 | 6 | 16 | 49 | 35 | 16 | 26 | 40 | 49 | 29 | 39 | 25 | 67 | 43 | 55 | 11 | 75 | 53 | 64 | 5 |
| 5 | 27 | 7 | 17 | 48 | 26 | 6 | 16 | 49 | 35 | 17 | 26 | 39 | 50 | 30 | 40 | 25 | 67 | 43 | 55 | 11 | 76 | 53 | 65 | 4 |
| 6 | 26 | 7 | 17 | 48 | 26 | 6 | 16 | 49 | 36 | 17 | 27 | 39 | 51 | 30 | 41 | 24 | 68 | 43 | 56 | 11 | 76 | 54 | 65 | 4 |
| 7 | 26 | 6 | 16 | 49 | 27 | 6 | 17 | 48 | 36 | 17 | 27 | 39 | 51 | 31 | 41 | 24 | 68 | 44 | 56 | 10 | 76 | 54 | 65 | 4 |
| 8 | 26 | 6 | 16 | 49 | 27 | 7 | 17 | 48 | 36 | 18 | 27 | 38 | 52 | 31 | 42 | 23 | 68 | 44 | 56 | 10 | 77 | 54 | 66 | 4 |
| 9 | 26 | 6 | 16 | 49 | 27 | 7 | 17 | 48 | 37 | 18 | 28 | 38 | 53 | 32 | 43 | 23 | 69 | 44 | 57 | 10 | 77 | 55 | 66 | 4 |
| 10 | 26 | 6 | 16 | 49 | 27 | 7 | 17 | 48 | 37 | 18 | 28 | 38 | 54 | 32 | 43 | 22 | 69 | 45 | 57 | 9 | 77 | 55 | 66 | 3 |
| 11 | 26 | 6 | 16 | 49 | 28 | 8 | 18 | 47 | 37 | 19 | 28 | 37 | 54 | 33 | 44 | 21 | 69 | 45 | 57 | 9 | 78 | 56 | 67 | 3 |
| 12 | 25 | 5 | 15 | 50 | 28 | 8 | 18 | 47 | 38 | 19 | 29 | 37 | 55 | 33 | 44 | 20 | 69 | 45 | 57 | 9 | 78 | 56 | 67 | 3 |
| 13 | 25 | 5 | 15 | 50 | 28 | 8 | 18 | 47 | 38 | 20 | 29 | 36 | 56 | 34 | 45 | 20 | 69 | 45 | 57 | 9 | 78 | 56 | 67 | 3 |
| 14 | 25 | 5 | 15 | 50 | 29 | 9 | 19 | 46 | 38 | 20 | 29 | 36 | 56 | 34 | 45 | 19 | 70 | 46 | 58 | 9 | 79 | 57 | 68 | 3 |
| 15 | 25 | 5 | 15 | 50 | 29 | 9 | 19 | 46 | 39 | 20 | 30 | 35 | 57 | 35 | 46 | 19 | 70 | 46 | 58 | 9 | 79 | 57 | 68 | 2 |
| 16 | 25 | 5 | 15 | 50 | 29 | 9 | 19 | 46 | 39 | 21 | 30 | 35 | 58 | 35 | 47 | 19 | 70 | 46 | 58 | 9 | 80 | 57 | 69 | 2 |
| 17 | 24 | 5 | 15 | 50 | 30 | 10 | 20 | 45 | 39 | 21 | 30 | 35 | 58 | 35 | 47 | 18 | 70 | 47 | 59 | 8 | 80 | 57 | 69 | 2 |
| 18 | 24 | 4 | 14 | 51 | 30 | 10 | 20 | 45 | 40 | 21 | 31 | 34 | 59 | 36 | 48 | 18 | 71 | 47 | 59 | 8 | 80 | 58 | 69 | 2 |
| 19 | 24 | 4 | 14 | 51 | 31 | 10 | 21 | 44 | 40 | 22 | 31 | 34 | 60 | 36 | 48 | 17 | 71 | 47 | 59 | 8 | 81 | 58 | 70 | 2 |
| 20 | 24 | 4 | 14 | 51 | 31 | 11 | 21 | 44 | 41 | 22 | 32 | 33 | 60 | 37 | 49 | 16 | 71 | 48 | 60 | 8 | 81 | 58 | 70 | 2 |
| 21 | 24 | 4 | 14 | 51 | 31 | 11 | 21 | 44 | 41 | 23 | 32 | 33 | 61 | 37 | 49 | 16 | 71 | 48 | 60 | 8 | 82 | 59 | 71 | 1 |
| 22 | 24 | 4 | 14 | 51 | 32 | 12 | 22 | 43 | 41 | 23 | 32 | 33 | 61 | 38 | 50 | 16 | 71 | 48 | 60 | 8 | 82 | 59 | 71 | 1 |
| 23 | 24 | 4 | 14 | 51 | 32 | 12 | 22 | 43 | 42 | 23 | 33 | 32 | 62 | 38 | 50 | 15 | 72 | 49 | 61 | 7 | 82 | 59 | 71 | 1 |
| 24 | 24 | 4 | 14 | 51 | 32 | 12 | 22 | 43 | 42 | 24 | 33 | 32 | 63 | 39 | 51 | 15 | 72 | 49 | 61 | 7 | 83 | 59 | 71 | 1 |
| 25 | 24 | 4 | 14 | 51 | 33 | 13 | 23 | 42 | 43 | 24 | 34 | 31 | 63 | 39 | 51 | 14 | 72 | 49 | 61 | 7 | 83 | 60 | 72 | 1 |
| 26 | 24 | 4 | 14 | 51 | 33 | 13 | 23 | 42 | 43 | 25 | 34 | 31 | 64 | 39 | 52 | 14 | 72 | 50 | 61 | 7 | 83 | 60 | 72 | 1 |
| 27 | 24 | 4 | 14 | 51 | 33 | 14 | 24 | 42 | 44 | 25 | 35 | 30 | 64 | 40 | 52 | 13 | 73 | 50 | 62 | 7 | 83 | 60 | 72 | 1 |
| 28 | 24 | 4 | 14 | 51 | 34 | 14 | 24 | 41 | 45 | 26 | 36 | 30 | 65 | 40 | 53 | 13 | 73 | 50 | 62 | 7 | 84 | 60 | 72 | 1 |
| 29 | 25 | 4 | 15 | 50 | Feb. 29 values | | | | 45 | 26 | 36 | 29 | 65 | 41 | 53 | 13 | 73 | 51 | 62 | 6 | 84 | 61 | 73 | 1 |
| 30 | 25 | 5 | 15 | 50 | same as Feb. 28 | | | | 46 | 27 | 37 | 28 | 65 | 41 | 53 | 12 | 74 | 51 | 63 | 6 | 84 | 61 | 73 | 1 |
| 31 | 25 | 5 | 15 | 50 | | | | | 46 | 27 | 37 | 28 | | | | | 74 | 52 | 63 | 6 | | | | |

| DAY | JULY TEMPERATURE MAX | MIN | AVG | DEG DAY | AUGUST TEMPERATURE MAX | MIN | AVG | DEG DAY | SEPTEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | OCTOBER TEMPERATURE MAX | MIN | AVG | DEG DAY | NOVEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY | DECEMBER TEMPERATURE MAX | MIN | AVG | DEG DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 85 | 61 | 73 | 1 | 86 | 63 | 75 | 0 | 79 | 55 | 67 | 2 | 68 | 44 | 56 | 10 | 52 | 31 | 42 | 24 | 34 | 16 | 25 | 40 |
| 2 | 85 | 61 | 73 | 1 | 86 | 63 | 75 | 0 | 79 | 55 | 67 | 2 | 68 | 44 | 56 | 10 | 51 | 30 | 41 | 24 | 33 | 16 | 25 | 40 |
| 3 | 85 | 61 | 73 | 1 | 86 | 63 | 75 | 0 | 78 | 55 | 67 | 3 | 68 | 44 | 56 | 10 | 51 | 29 | 40 | 25 | 33 | 15 | 24 | 41 |
| 4 | 85 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 78 | 54 | 66 | 3 | 67 | 43 | 55 | 10 | 50 | 28 | 39 | 25 | 33 | 15 | 24 | 41 |
| 5 | 85 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 78 | 54 | 66 | 3 | 67 | 43 | 55 | 11 | 49 | 28 | 39 | 26 | 32 | 15 | 24 | 41 |
| 6 | 86 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 77 | 54 | 66 | 3 | 67 | 43 | 55 | 11 | 49 | 27 | 38 | 26 | 32 | 14 | 23 | 42 |
| 7 | 86 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 77 | 53 | 65 | 4 | 66 | 42 | 54 | 11 | 48 | 27 | 38 | 27 | 32 | 14 | 23 | 42 |
| 8 | 86 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 76 | 53 | 65 | 4 | 66 | 42 | 54 | 11 | 47 | 26 | 37 | 28 | 32 | 14 | 23 | 42 |
| 9 | 86 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 76 | 53 | 65 | 4 | 65 | 42 | 54 | 11 | 46 | 26 | 36 | 29 | 31 | 14 | 23 | 42 |
| 10 | 86 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 76 | 52 | 64 | 4 | 65 | 41 | 53 | 12 | 46 | 25 | 36 | 29 | 31 | 13 | 22 | 43 |
| 11 | 86 | 62 | 74 | 1 | 85 | 62 | 74 | 0 | 75 | 52 | 64 | 4 | 65 | 41 | 53 | 12 | 45 | 25 | 35 | 30 | 31 | 13 | 22 | 43 |
| 12 | 86 | 62 | 74 | 1 | 84 | 62 | 73 | 1 | 75 | 51 | 63 | 5 | 64 | 41 | 53 | 12 | 44 | 24 | 34 | 31 | 31 | 13 | 22 | 43 |
| 13 | 86 | 63 | 75 | 1 | 84 | 61 | 73 | 1 | 74 | 51 | 63 | 5 | 64 | 40 | 52 | 13 | 44 | 24 | 34 | 31 | 31 | 13 | 22 | 43 |
| 14 | 86 | 63 | 75 | 1 | 84 | 61 | 73 | 1 | 74 | 51 | 63 | 5 | 63 | 40 | 52 | 14 | 43 | 23 | 33 | 31 | 31 | 12 | 22 | 43 |
| 15 | 87 | 63 | 75 | 1 | 84 | 61 | 73 | 1 | 74 | 50 | 62 | 5 | 63 | 40 | 52 | 14 | 42 | 23 | 33 | 32 | 30 | 12 | 21 | 44 |
| 16 | 87 | 63 | 75 | 1 | 84 | 61 | 73 | 1 | 73 | 50 | 62 | 6 | 62 | 39 | 51 | 14 | 42 | 22 | 32 | 33 | 30 | 12 | 21 | 44 |
| 17 | 87 | 63 | 75 | 1 | 83 | 61 | 72 | 1 | 73 | 49 | 61 | 6 | 62 | 39 | 51 | 15 | 41 | 22 | 32 | 34 | 30 | 12 | 21 | 44 |
| 18 | 87 | 63 | 75 | 1 | 83 | 60 | 72 | 1 | 72 | 49 | 61 | 6 | 61 | 38 | 50 | 15 | 40 | 21 | 31 | 35 | 30 | 11 | 21 | 44 |
| 19 | 87 | 63 | 75 | 1 | 83 | 60 | 72 | 1 | 72 | 49 | 61 | 6 | 61 | 38 | 50 | 16 | 40 | 21 | 31 | 35 | 30 | 11 | 21 | 45 |
| 20 | 87 | 63 | 75 | 0 | 83 | 60 | 72 | 1 | 72 | 48 | 60 | 7 | 60 | 37 | 49 | 16 | 39 | 20 | 30 | 36 | 30 | 11 | 21 | 45 |
| 21 | 86 | 63 | 75 | 0 | 82 | 59 | 71 | 1 | 71 | 48 | 60 | 7 | 60 | 37 | 49 | 17 | 39 | 20 | 30 | 36 | 29 | 11 | 20 | 45 |
| 22 | 86 | 63 | 75 | 0 | 82 | 59 | 71 | 1 | 71 | 48 | 60 | 7 | 59 | 36 | 48 | 17 | 38 | 19 | 29 | 37 | 29 | 10 | 20 | 45 |
| 23 | 86 | 63 | 75 | 0 | 82 | 59 | 71 | 1 | 71 | 47 | 59 | 8 | 59 | 36 | 48 | 18 | 38 | 19 | 29 | 37 | 29 | 10 | 20 | 46 |
| 24 | 86 | 63 | 75 | 0 | 82 | 59 | 71 | 1 | 70 | 47 | 59 | 8 | 58 | 35 | 47 | 18 | 37 | 18 | 28 | 38 | 29 | 10 | 20 | 46 |
| 25 | 86 | 63 | 75 | 0 | 81 | 58 | 70 | 1 | 70 | 46 | 58 | 8 | 58 | 35 | 47 | 19 | 37 | 18 | 28 | 38 | 29 | 10 | 20 | 46 |
| 26 | 86 | 63 | 75 | 0 | 81 | 58 | 70 | 1 | 70 | 46 | 58 | 8 | 57 | 34 | 46 | 19 | 36 | 18 | 27 | 38 | 29 | 9 | 19 | 46 |
| 27 | 86 | 63 | 75 | 0 | 81 | 58 | 70 | 2 | 69 | 46 | 58 | 8 | 57 | 34 | 46 | 20 | 36 | 17 | 27 | 39 | 28 | 9 | 19 | 47 |
| 28 | 86 | 63 | 75 | 0 | 81 | 57 | 69 | 2 | 69 | 45 | 57 | 9 | 56 | 33 | 45 | 20 | 35 | 17 | 26 | 39 | 28 | 9 | 19 | 47 |
| 29 | 86 | 63 | 75 | 0 | 80 | 57 | 69 | 2 | 69 | 45 | 57 | 9 | 55 | 32 | 44 | 21 | 35 | 17 | 26 | 39 | 28 | 9 | 19 | 47 |
| 30 | 86 | 63 | 75 | 0 | 80 | 57 | 69 | 2 | 68 | 45 | 57 | 9 | 54 | 32 | 43 | 22 | 34 | 16 | 25 | 40 | 28 | 9 | 19 | 47 |
| 31 | 86 | 63 | 75 | 0 | 80 | 56 | 68 | 2 | | | | | 53 | 31 | 42 | 23 | | | | | 28 | 8 | 18 | 47 |

Appendix Table 2. Monthly temperature summary

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **ADA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 52 | 65 | 78 | 91 | 107 | 104 | 111 | 102 | 101 | 95 | 74 | 60 | -- | -- | 111 | 164 |
| Average maximum..... | 17.1 | 19.8 | 33.3 | 53.3 | 68.9 | 77.0 | 83.8 | 81.3 | 71.4 | 57.6 | 35.7 | 22.4 | 51.8 | -- | | |
| Effective day temperature... | 11.9 | 14.3 | 27.8 | 47.6 | 62.3 | 70.8 | 77.3 | 74.9 | 64.9 | 51.6 | 31.2 | 17.7 | 46.3 | -- | | |
| Normal..... | 6.3 | 10.4 | 23.9 | 42.2 | 55.9 | 64.9 | 71.0 | 69.0 | 58.6 | 46.3 | 27.2 | 13.5 | 40.8 | -- | | |
| Effective night temperature. | 1.6 | 3.5 | 18.4 | 36.4 | 49.1 | 58.5 | 64.5 | 62.0 | 52.1 | 39.7 | 22.1 | 8.1 | 35.4 | -- | | |
| Average minimum..... | -3.6 | -2.0 | 13.4 | 30.7 | 42.5 | 52.3 | 58.0 | 55.6 | 45.6 | 33.7 | 17.6 | 3.4 | 29.9 | -- | | |
| Extreme minimum..... | -43 | -53 | -39 | -12 | 12 | 26 | 35 | 31 | 16 | -10 | -35 | -42 | -- | -- | -53 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 165 | 493 | 747 | 961 | 899 | 558 | 254 | -- | -- | -- | 4077 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 39 | 239 | 447 | 651 | 589 | 276 | 87 | -- | -- | -- | 2328 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/17-8/3)..... | | | | | | | | | | | | | | 2365 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/3-10/23)..... | | | | | | | | | | | | | | 1995 | | |
| Heating degree days, $T_b$ = 65° | 1820 | 1529 | 1274 | 684 | 316 | 96 | 28 | 37 | 225 | 580 | 1134 | 1597 | -- | 9320 | | |
| **ALBERT LEA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 64 | 62 | 84 | 94 | 104 | 104 | 106 | 101 | 103 | 91 | 77 | 63 | -- | -- | 106 | 147 |
| Average maximum..... | 24.8 | 27.8 | 39.2 | 56.3 | 69.3 | 78.7 | 84.8 | 81.9 | 73.9 | 62.1 | 42.0 | 29.0 | 55.8 | -- | | |
| Effective day temperature... | 20.4 | 23.3 | 34.9 | 51.2 | 64.0 | 73.6 | 79.3 | 76.6 | 68.3 | 56.6 | 37.7 | 24.9 | 50.9 | -- | | |
| Normal..... | 15.9 | 19.2 | 30.0 | 46.1 | 58.7 | 68.6 | 73.6 | 71.4 | 62.4 | 51.1 | 33.4 | 21.0 | 46.0 | -- | | |
| Effective night temperature. | 11.7 | 14.4 | 26.3 | 40.8 | 53.5 | 63.5 | 68.5 | 65.8 | 57.1 | 45.6 | 29.1 | 16.6 | 41.1 | -- | | |
| Average minimum..... | 7.3 | 9.9 | 22.0 | 35.7 | 48.2 | 58.4 | 63.0 | 60.5 | 51.5 | 40.1 | 24.8 | 12.5 | 36.2 | -- | | |
| Extreme minimum..... | -41 | -32 | -29 | 4 | 23 | 34 | 42 | 35 | 22 | -6 | -19 | -27 | -- | -- | -41 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 231 | 580 | 858 | 1042 | 973 | 672 | 366 | -- | -- | -- | 4722 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 66 | 316 | 558 | 732 | 663 | 381 | 146 | -- | -- | -- | 2862 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (3/31-9/2)..... | | | | | | | | | | | | | | 3729 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/14-11/8)..... | | | | | | | | | | | | | | 2659 | | |
| Heating degree days, $T_b$ = 65° | 1522 | 1282 | 1085 | 567 | 264 | 75 | 16 | 25 | 153 | 446 | 948 | 1364 | -- | 7747 | | |
| **ARTICHOKE LAKE** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 57 | 59 | 80 | 93 | 108 | 106 | 109 | 105 | 106 | 93 | 83 | 69 | -- | -- | 109 | 148 |
| Average maximum..... | 21.5 | 25.2 | 37.1 | 55.5 | 69.6 | 78.5 | 84.9 | 82.4 | 73.5 | 61.1 | 39.6 | 26.4 | 54.6 | -- | | |
| Effective day temperature... | 16.4 | 19.9 | 32.3 | 49.8 | 63.5 | 72.6 | 78.7 | 76.2 | 67.2 | 55.0 | 34.9 | 21.7 | 49.0 | -- | | |
| Normal..... | 12.1 | 15.1 | 27.2 | 44.2 | 57.4 | 66.7 | 72.6 | 70.4 | 60.9 | 49.2 | 30.5 | 17.6 | 43.6 | -- | | |
| Effective night temperature. | 6.0 | 9.5 | 22.6 | 38.5 | 51.3 | 60.8 | 66.3 | 63.9 | 54.7 | 42.8 | 25.4 | 12.3 | 37.9 | -- | | |
| Average minimum..... | 0.9 | 4.2 | 17.8 | 32.8 | 45.2 | 54.9 | 60.1 | 57.7 | 48.4 | 36.7 | 20.7 | 7.6 | 32.3 | -- | | |
| Extreme minimum..... | -37 | -39 | -32 | -4 | 16 | 29 | 39 | 31 | 17 | 3 | -20 | -31 | -- | -- | -39 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 195 | 539 | 801 | 1011 | 942 | 627 | 322 | -- | -- | -- | 4437 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 57 | 205 | 501 | 701 | 632 | 339 | 130 | -- | -- | -- | 2645 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/12-8/25)..... | | | | | | | | | | | | | | 3233 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/23-10/28)..... | | | | | | | | | | | | | | 2369 | | |
| Heating degree days, $T_b$ = 65° | 1671 | 1397 | 1172 | 624 | 288 | 87 | 25 | 31 | 180 | 496 | 1035 | 1489 | -- | 8475 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **BABBITT** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 47 | 58 | 79 | 84 | 91 | 96 | 103 | 95 | 96 | 83 | 65 | 55 | -- | -- | 103 | 144 |
| Average maximum..... | 16.6 | 19.7 | 31.1 | 47.7 | 63.6 | 71.6 | 77.6 | 74.6 | 65.0 | 52.7 | 32.0 | 20.5 | 47.7 | -- | | |
| Effective day temperature... | 12.1 | 14.8 | 26.4 | 42.7 | 57.9 | 66.4 | 72.4 | 69.7 | 60.2 | 48.2 | 28.6 | 16.5 | 43.0 | -- | | |
| Normal..... | 7.5 | 10.9 | 22.2 | 38.4 | 52.3 | 61.6 | 67.2 | 64.8 | 55.0 | 44.2 | 25.6 | 12.5 | 38.5 | -- | | |
| Effective night temperature. | 3.2 | 5.1 | 16.8 | 32.6 | 46.5 | 55.9 | 62.1 | 59.7 | 50.6 | 39.3 | 21.9 | 8.4 | 33.5 | -- | | |
| Average minimum..... | -1.3 | 0.2 | 12.1 | 27.6 | 40.6 | 50.7 | 56.9 | 54.8 | 45.8 | 34.8 | 18.5 | 4.4 | 28.8 | -- | | |
| Extreme minimum..... | -41 | -38 | -28 | -12 | 17 | 28 | 38 | 31 | 22 | 5 | -24 | -36 | -- | -- | -41 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 99 | 381 | 648 | 843 | 769 | 450 | 198 | -- | -- | -- | 3388 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 12 | 115 | 348 | 533 | 459 | 180 | 47 | -- | -- | -- | 1694 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/20-7/15)..... | | | | | | | | | | | | | | 1467 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/29-10/28)..... | | | | | | | | | | | | | | 1572 | | |
| Heating degree days, $T_b$ = 65° | 1783 | 1515 | 1327 | 798 | 394 | 132 | 47 | 87 | 309 | 645 | 1182 | 1628 | -- | 9847 | | |
| **BAUDETTE** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 50 | 50 | 76 | 91 | 96 | 102 | 103 | 97 | 94 | 84 | 68 | 54 | -- | -- | 103 | 152 |
| Average maximum..... | 15.2 | 20.0 | 32.8 | 50.8 | 66.2 | 74.5 | 80.9 | 77.5 | 67.8 | 55.1 | 33.5 | 20.3 | 49.6 | -- | | |
| Effective day temperature... | 9.6 | 13.8 | 26.8 | 44.9 | 59.7 | 68.3 | 74.5 | 71.3 | 61.7 | 49.6 | 29.4 | 15.4 | 44.3 | -- | | |
| Normal..... | 3.8 | 7.8 | 20.4 | 39.1 | 52.9 | 62.0 | 67.8 | 65.2 | 55.2 | 44.4 | 25.7 | 10.6 | 37.9 | -- | | |
| Effective night temperature. | -1.6 | 1.5 | 14.7 | 33.2 | 46.6 | 56.0 | 61.7 | 59.0 | 49.7 | 38.6 | 21.2 | 5.8 | 33.7 | -- | | |
| Average minimum..... | -7.2 | -4.7 | 8.7 | 27.3 | 40.1 | 49.8 | 55.3 | 52.8 | 43.6 | 33.1 | 17.1 | 0.9 | 28.4 | -- | | |
| Extreme minimum..... | -49 | -47 | -37 | -14 | 14 | 27 | 34 | 28 | 17 | -3 | -26 | -45 | -- | -- | -49 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 105 | 400 | 660 | 862 | 781 | 456 | 205 | -- | -- | -- | 3469 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 12 | 146 | 360 | 552 | 471 | 189 | 59 | -- | -- | -- | 1789 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/20-7/19)..... | | | | | | | | | | | | | | 1626 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/6-10/23)..... | | | | | | | | | | | | | | 1554 | | |
| Heating degree days, $T_b$ = 65° | 1897 | 1602 | 1383 | 777 | 381 | 132 | 40 | 74 | 300 | 639 | 1179 | 1686 | -- | 10090 | | |
| **BEARDSLEY** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 60 | 66 | 83 | 95 | 106 | 109 | 114 | 110 | 111 | 94 | 78 | 73 | -- | -- | 114 | 155 |
| Average maximum..... | 23.0 | 26.6 | 38.6 | 56.7 | 70.9 | 79.6 | 86.8 | 84.5 | 75.1 | 62.3 | 40.9 | 28.4 | 56.1 | -- | | |
| Effective day temperature... | 17.5 | 21.1 | 33.4 | 50.7 | 64.3 | 73.3 | 82.1 | 77.8 | 68.2 | 55.7 | 35.8 | 22.4 | 50.1 | -- | | |
| Normal..... | 11.9 | 15.9 | 28.0 | 44.7 | 57.6 | 66.9 | 73.1 | 71.2 | 61.2 | 49.4 | 30.9 | 18.5 | 44.1 | -- | | |
| Effective night temperature. | 6.5 | 10.2 | 23.1 | 38.7 | 51.1 | 60.9 | 66.5 | 64.2 | 54.5 | 42.6 | 25.6 | 14.4 | 38.1 | -- | | |
| Average minimum..... | 1.0 | 4.7 | 17.9 | 32.7 | 44.5 | 54.6 | 59.8 | 57.5 | 47.6 | 36.0 | 20.5 | 8.4 | 32.1 | -- | | |
| Extreme minimum..... | -37 | -41 | -35 | -3 | 5 | 28 | 34 | 23 | 13 | 1 | -20 | -36 | -- | -- | -41 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 201 | 546 | 807 | 1026 | 967 | 636 | 325 | -- | -- | -- | 4508 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 63 | 288 | 507 | 716 | 657 | 345 | 127 | -- | -- | -- | 2703 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/11-8/23)..... | | | | | | | | | | | | | | 3230 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/28-10/23)..... | | | | | | | | | | | | | | 2352 | | |
| Heating degree days, $T_b$ = 65° | 1646 | 1375 | 1147 | 609 | 282 | 87 | 19 | 25 | 177 | 490 | 1023 | 1442 | -- | 8322 | | |

Appendix Table 1. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **BEMIDJI** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 57 | 60 | 84 | 91 | 100 | 101 | 107 | 101 | 103 | 88 | 80 | 62 | -- | -- | 107 | 157 |
| Average maximum..... | 16.7 | 21.0 | 33.5 | 50.5 | 65.5 | 74.0 | 81.2 | 77.8 | 67.7 | 55.1 | 34.1 | 21.4 | 49.9 | -- | | |
| Effective day temperature... | 11.1 | 14.6 | 27.4 | 44.5 | 59.0 | 68.1 | 74.9 | 71.9 | 61.7 | 49.4 | 29.7 | 16.1 | 44.5 | -- | | |
| Normal..... | 4.7 | 8.4 | 20.6 | 38.5 | 52.4 | 62.0 | 68.2 | 65.7 | 55.2 | 44.0 | 25.5 | 11.1 | 38.0 | -- | | |
| Effective night temperature. | -0.1 | 1.8 | 15.2 | 32.4 | 46.2 | 56.1 | 62.1 | 59.2 | 49.7 | 38.0 | 21.0 | 5.7 | 33.6 | -- | | |
| Average minimum..... | -5.7 | -4.6 | 9.1 | 26.4 | 39.7 | 50.2 | 55.8 | 53.3 | 43.7 | 32.3 | 16.6 | 0.4 | 28.2 | -- | | |
| Extreme minimum..... | -50 | -48 | -44 | -13 | 15 | 26 | 37 | 30 | 18 | -1 | -30 | -45 | -- | -- | -50 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 105 | 384 | 660 | 874 | 797 | 456 | 201 | -- | -- | -- | 3477 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 21 | 149 | 360 | 564 | 487 | 192 | 59 | -- | -- | -- | 1832 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/25-7/18)..... | | | | | | | | | | | | | | 1589 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/9-10/19)..... | | | | | | | | | | | | | | 1385 | | |
| Heating degree days, $T_b$ = 65° | 1869 | 1585 | 1376 | 795 | 397 | 138 | 43 | 74 | 303 | 651 | 1185 | 1671 | -- | 10082 | | |
| **BIG FALLS** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 54 | 62 | 83 | 92 | 97 | 105 | 106 | 98 | 98 | 88 | 69 | 59 | -- | -- | 106 | 159 |
| Average maximum..... | 17.6 | 22.7 | 35.7 | 52.4 | 67.0 | 75.7 | 81.3 | 78.1 | 67.8 | 55.8 | 34.4 | 21.8 | 50.9 | -- | | |
| Effective day temperature... | 11.5 | 15.6 | 28.8 | 45.8 | 59.8 | 68.9 | 74.4 | 71.3 | 61.5 | 49.9 | 30.0 | 16.4 | 45.0 | -- | | |
| Normal..... | 5.2 | 9.1 | 21.7 | 39.4 | 52.5 | 62.1 | 67.5 | 64.9 | 54.8 | 44.3 | 26.1 | 11.1 | 38.2 | -- | | |
| Effective night temperature. | -0.9 | 1.6 | 15.1 | 32.7 | 45.5 | 55.4 | 60.5 | 57.8 | 48.8 | 37.9 | 21.3 | 5.6 | 33.4 | -- | | |
| Average minimum..... | -7.0 | -5.5 | 8.2 | 26.1 | 38.3 | 48.6 | 53.6 | 51.0 | 42.5 | 32.0 | 16.9 | 0.2 | 27.5 | -- | | |
| Extreme minimum..... | -52 | -53 | -42 | -19 | 15 | 27 | 34 | 25 | 18 | -12 | -27 | -51 | -- | -- | -53 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 114 | 387 | 663 | 853 | 772 | 444 | 201 | -- | -- | -- | 3434 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 18 | 127 | 363 | 543 | 462 | 180 | 59 | -- | -- | -- | 1752 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/24-7/14)..... | | | | | | | | | | | | | | 1526 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/14-10/14)..... | | | | | | | | | | | | | | 1415 | | |
| Heating degree days, $T_b$ = 65° | 1854 | 1565 | 1342 | 768 | 388 | 126 | 47 | 81 | 312 | 642 | 1167 | 1671 | -- | 9963 | | |
| **BIRD ISLAND** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 59 | 65 | 85 | 93 | 106 | 103 | 106 | 104 | 104 | 91 | 75 | 67 | -- | -- | 106 | 144 |
| Average maximum..... | 22.8 | 26.6 | 38.2 | 56.2 | 70.2 | 78.5 | 84.5 | 81.5 | 73.0 | 61.0 | 40.5 | 27.4 | 55.0 | -- | | |
| Effective day temperature... | 17.9 | 21.6 | 33.6 | 50.7 | 64.3 | 72.9 | 78.6 | 75.8 | 67.1 | 54.1 | 35.9 | 22.9 | 49.5 | -- | | |
| Normal..... | 13.0 | 17.0 | 28.9 | 45.6 | 58.6 | 67.7 | 72.9 | 70.5 | 61.4 | 49.9 | 31.6 | 19.0 | 44.7 | -- | | |
| Effective night temperature. | 8.2 | 11.7 | 24.5 | 39.9 | 52.4 | 61.8 | 66.9 | 64.5 | 55.5 | 43.3 | 26.6 | 14.0 | 39.3 | -- | | |
| Average minimum..... | 3.3 | 6.7 | 19.9 | 34.4 | 46.5 | 56.2 | 61.0 | 58.8 | 49.6 | 37.4 | 22.0 | 9.5 | 33.8 | -- | | |
| Extreme minimum..... | -38 | -33 | -28 | 0 | 19 | 31 | 38 | 33 | 17 | 3 | -18 | -30 | -- | -- | -38 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 225 | 577 | 831 | 1020 | 945 | 642 | 335 | -- | -- | -- | 4575 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 69 | 313 | 531 | 710 | 635 | 351 | 127 | -- | -- | -- | 2736 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/5-9/2)..... | | | | | | | | | | | | | | 3610 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/20-10/29)..... | | | | | | | | | | | | | | 2463 | | |
| Heating degree days, $T_b$ = 65° | 1612 | 1344 | 1119 | 582 | 257 | 78 | 22 | 28 | 174 | 474 | 1002 | 1426 | -- | 8118 | | |

Appendix Table 1. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **BRAINERD** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 55 | 60 | 80 | 90 | 101 | 99 | 106 | 102 | 103 | 88 | 69 | 61 | -- | -- | 106 | 148 |
| Average maximum..... | 20.0 | 24.2 | 35.6 | 53.4 | 67.2 | 75.7 | 81.6 | 78.3 | 69.3 | 57.4 | 37.0 | 24.5 | 52.0 | -- | | |
| Effective day temperature... | 14.8 | 18.5 | 30.4 | 47.7 | 61.2 | 70.1 | 75.9 | 72.8 | 63.6 | 51.9 | 32.8 | 19.8 | 46.7 | -- | | |
| Normal..... | 8.3 | 12.8 | 24.8 | 42.0 | 55.0 | 64.5 | 70.1 | 67.6 | 57.8 | 46.6 | 28.8 | 15.3 | 41.1 | -- | | |
| Effective night temperature. | 4.4 | 7.0 | 20.0 | 36.3 | 49.1 | 58.8 | 64.3 | 61.7 | 52.4 | 40.8 | 24.3 | 10.6 | 35.9 | -- | | |
| Average minimum..... | -0.8 | 1.3 | 14.8 | 30.6 | 43.1 | 53.2 | 58.6 | 56.2 | 46.7 | 35.3 | 20.1 | 5.9 | 30.6 | -- | | |
| Extreme minimum..... | -42 | -41 | -35 | -2 | 19 | 21 | 33 | 31 | 19 | 3 | -21 | -39 | -- | -- | -42 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 159 | 465 | 735 | 933 | 856 | 534 | 263 | -- | -- | -- | 3945 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 42 | 198 | 435 | 623 | 546 | 258 | 96 | -- | -- | -- | 2198 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-8/16)..... | | | | | | | | | | | | | | 2670 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/26-10/28)..... | | | | | | | | | | | | | | 1983 | | |
| Heating degree days, $T_b$ = 65° | 1758 | 1462 | 1246 | 690 | 329 | 105 | 34 | 53 | 243 | 570 | 1086 | 1541 | -- | 9117 | | |
| **CHASKA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 60 | 60 | 79 | 92 | 108 | 105 | 109 | 105 | 104 | 91 | 76 | 63 | -- | -- | 109 | 152 |
| Average maximum..... | 23.8 | 27.6 | 39.1 | 57.2 | 71.3 | 80.5 | 86.9 | 84.1 | 75.1 | 62.6 | 41.6 | 28.2 | 56.5 | -- | | |
| Effective day temperature... | 18.7 | 22.3 | 33.2 | 51.3 | 65.0 | 74.4 | 80.4 | 77.6 | 68.6 | 56.4 | 37.3 | 23.7 | 40.8 | -- | | |
| Normal..... | 13.7 | 17.4 | 29.1 | 45.9 | 58.8 | 68.4 | 73.6 | 71.5 | 62.1 | 50.5 | 32.7 | 19.7 | 45.3 | -- | | |
| Effective night temperature. | 8.7 | 11.6 | 24.5 | 39.7 | 52.2 | 62.1 | 67.2 | 64.8 | 55.7 | 44.0 | 27.6 | 14.7 | 39.8 | -- | | |
| Average minimum..... | 3.6 | 6.3 | 19.6 | 33.8 | 45.9 | 56.0 | 60.7 | 58.3 | 49.2 | 37.8 | 23.3 | 10.2 | 33.7 | -- | | |
| Extreme minimum..... | -43 | -37 | -34 | 4 | 17 | 31 | 42 | 34 | 22 | 6 | -19 | -31 | -- | -- | -43 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 234 | 583 | 852 | 1042 | 977 | 663 | 381 | -- | -- | -- | 4732 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 75 | 313 | 552 | 732 | 667 | 369 | 139 | -- | -- | -- | 2847 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/2-9/9)..... | | | | | | | | | | | | | | 3879 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/15-11/4)..... | | | | | | | | | | | | | | 2630 | | |
| Heating degree days, $T_b$ = 65° | 1590 | 1333 | 1113 | 573 | 248 | 69 | 9 | 19 | 162 | 456 | 969 | 1404 | | 7945 | | |
| **CLOQUET** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 52 | 53 | 79 | 88 | 94 | 98 | 105 | 98 | 96 | 86 | 69 | 57 | -- | -- | 105 | 148 |
| Average maximum..... | 19.9 | 23.2 | 34.3 | 51.2 | 65.9 | 74.5 | 81.1 | 77.6 | 68.1 | 55.7 | 35.8 | 23.9 | 50.9 | -- | | |
| Effective day temperature... | 14.8 | 17.5 | 28.8 | 45.1 | 58.7 | 67.6 | 73.0 | 71.1 | 61.9 | 50.1 | 31.7 | 19.4 | 45.1 | -- | | |
| Normal..... | 9.4 | 12.2 | 23.2 | 39.4 | 51.4 | 60.7 | 66.7 | 64.8 | 55.5 | 44.7 | 27.9 | 15.0 | 39.2 | -- | | |
| Effective night temperature. | 4.5 | 6.2 | 17.9 | 33.1 | 44.3 | 53.8 | 60.0 | 58.2 | 49.6 | 38.9 | 23.7 | 10.2 | 33.4 | -- | | |
| Average minimum..... | -0.6 | 0.5 | 12.4 | 27.0 | 37.1 | 46.9 | 52.9 | 51.7 | 43.4 | 33.3 | 19.6 | 5.7 | 27.6 | -- | | |
| Extreme minimum..... | -43 | -41 | -35 | -7 | 14 | 24 | 30 | 26 | 19 | 0 | -24 | -37 | -- | -- | -43 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 117 | 353 | 621 | 828 | 769 | 465 | 214 | -- | -- | -- | 3367 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 21 | 109 | 321 | 518 | 459 | 201 | 62 | -- | -- | -- | 1691 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/26-7/4)..... | | | | | | | | | | | | | | 1100 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/17-10/18)..... | | | | | | | | | | | | | | 1361 | | |
| Heating degree days, $T_b$ = 65° | 1724 | 1478 | 1296 | 768 | 422 | 159 | 59 | 93 | 294 | 629 | 1113 | 1550 | -- | 9585 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **CROOKSTON** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 57 | 63 | 78 | 92 | 101 | 101 | 106 | 100 | 99 | 85 | 69 | 56 | -- | -- | 106 | 157 |
| Average maximum..... | 15.0 | 19.0 | 32.8 | 52.1 | 67.8 | 75.6 | 83.1 | 80.4 | 69.7 | 57.1 | 35.1 | 21.2 | 50.7 | -- | | |
| Effective day temperature... | 10.9 | 13.9 | 28.0 | 46.6 | 61.3 | 69.7 | 76.7 | 74.1 | 63.6 | 51.4 | 30.8 | 16.7 | 45.5 | -- | | |
| Normal..... | 5.2 | 9.2 | 23.1 | 41.1 | 54.9 | 63.8 | 70.2 | 68.2 | 57.3 | 45.9 | 26.8 | 12.5 | 39.9 | -- | | |
| Effective night temperature. | 0.3 | 3.5 | 18.5 | 35.5 | 48.5 | 57.8 | 64.0 | 61.6 | 51.4 | 39.8 | 22.4 | 7.5 | 35.0 | -- | | |
| Average minimum..... | -4.6 | -1.6 | 13.7 | 30.0 | 42.0 | 51.9 | 57.6 | 55.3 | 45.3 | 34.1 | 18.1 | 3.0 | 29.8 | -- | | |
| Extreme minimum..... | -44 | -51 | -39 | -9 | 14 | 29 | 38 | 32 | 11 | -2 | -30 | -38 | -- | -- | -51 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 138 | 462 | 714 | 936 | 874 | 519 | 242 | -- | -- | -- | 3885 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 30 | 214 | 414 | 626 | 564 | 243 | 81 | -- | -- | -- | 2172 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/18-8/5)..... | | | | | | | | | | | | | | 2313 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/29-10/21)..... | | | | | | | | | | | | | | 1920 | | |
| Heating degree days, $T_b$ = 65° | 1854 | 1562 | 1299 | 717 | 341 | 111 | 31 | 43 | 252 | 592 | 1146 | 1628 | -- | 9576 | | |
| **DETROIT LAKES** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 55 | 59 | 78 | 87 | 99 | 100 | 107 | 100 | 100 | 88 | 70 | 60 | -- | -- | 107 | 160 |
| Average maximum..... | 16.6 | 19.9 | 32.8 | 51.1 | 66.1 | 75.0 | 82.0 | 78.9 | 69.0 | 56.9 | 35.3 | 21.7 | 50.4 | -- | | |
| Effective day temperature... | 10.9 | 14.0 | 27.6 | 45.6 | 60.1 | 69.5 | 76.2 | 73.2 | 64.3 | 51.2 | 30.8 | 16.8 | 45.3 | -- | | |
| Normal..... | 5.0 | 8.4 | 21.9 | 40.0 | 53.8 | 63.4 | 69.5 | 67.3 | 56.7 | 45.2 | 26.5 | 12.3 | 39.2 | -- | | |
| Effective night temperature. | -0.4 | 2.3 | 17.2 | 34.6 | 48.2 | 58.5 | 64.5 | 61.9 | 51.8 | 39.6 | 21.9 | 7.1 | 35.1 | -- | | |
| Average minimum..... | -6.1 | -3.6 | 12.0 | 29.1 | 42.2 | 53.0 | 58.7 | 56.2 | 46.1 | 33.9 | 17.4 | 2.2 | 30.0 | -- | | |
| Extreme minimum..... | -51 | -53 | -43 | -12 | 16 | 28 | 35 | 31 | 15 | -10 | -35 | -48 | -- | -- | -53 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 120 | 428 | 702 | 915 | 846 | 501 | 233 | -- | -- | -- | 3745 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 21 | 189 | 402 | 605 | 536 | 231 | 74 | -- | -- | -- | 2058 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-7/27)..... | | | | | | | | | | | | | | 1998 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/4-10/23)..... | | | | | | | | | | | | | | 1786 | | |
| Heating degree days, $T_b$ = 65° | 1860 | 1585 | 1336 | 750 | 369 | 123 | 40 | 59 | 270 | 614 | 1155 | 1634 | -- | 9795 | | |
| **DULUTH (AIRPORT)** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 52 | 53 | 78 | 88 | 87 | 92 | 97 | 97 | 89 | 86 | 68 | 55 | -- | -- | 97 | 132 |
| Average maximum..... | 17.9 | 21.4 | 31.1 | 47.1 | 60.6 | 70.3 | 77.1 | 74.6 | 64.7 | 53.5 | 34.1 | 22.3 | 47.9 | -- | | |
| Effective day temperature... | 13.3 | 16.3 | 26.4 | 42.3 | 55.1 | 64.8 | 71.6 | 69.4 | 59.7 | 48.8 | 30.4 | 18.2 | 43.0 | -- | | |
| Normal..... | 8.7 | 11.3 | 21.8 | 37.5 | 49.7 | 59.3 | 66.0 | 64.3 | 54.7 | 44.1 | 26.8 | 14.0 | 38.2 | -- | | |
| Effective night temperature. | 4.0 | 6.2 | 17.1 | 32.7 | 44.2 | 53.8 | 60.4 | 59.1 | 49.7 | 39.3 | 23.2 | 9.8 | 33.3 | -- | | |
| Average minimum..... | -0.6 | 1.1 | 12.4 | 27.9 | 38.7 | 48.3 | 54.9 | 53.9 | 44.7 | 34.6 | 19.5 | 5.7 | 28.4 | -- | | |
| Extreme minimum..... | -35 | -29 | -28 | -5 | 20 | 30 | 39 | 37 | 22 | 9 | -17 | -33 | -- | -- | -35 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 93 | 301 | 579 | 806 | 753 | 441 | 195 | -- | -- | -- | 3168 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 15 | 77 | 282 | 496 | 443 | 177 | 56 | -- | -- | -- | 1546 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-7/19)..... | | | | | | | | | | | | | | 1429 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/31-11/3)..... | | | | | | | | | | | | | | 1456 | | |
| Heating degree days, $T_b$ = 65° | 1745 | 1504 | 1339 | 825 | 474 | 186 | 65 | 99 | 315 | 648 | 1146 | 1581 | -- | 9927 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **FAIRMONT** | | | | | | | | | | | | | | | | |
| Extreme maximum | 64 | 64 | 80 | 90 | 108 | 106 | 108 | 109 | 97 | 91 | 77 | 67 | -- | -- | 109 | 144 |
| Average maximum | 24.7 | 28.3 | 39.2 | 56.5 | 70.3 | 79.8 | 86.0 | 82.5 | 73.9 | 62.5 | 42.1 | 29.3 | 56.3 | -- | | |
| Effective day temperature | 20.0 | 23.4 | 34.7 | 51.2 | 64.6 | 74.2 | 80.1 | 76.8 | 68.1 | 56.8 | 37.6 | 24.9 | 51.0 | -- | | |
| Normal | 15.2 | 18.8 | 29.8 | 46.1 | 58.9 | 68.8 | 74.0 | 71.6 | 62.4 | 51.2 | 33.3 | 21.0 | 45.9 | -- | | |
| Effective night temperature | 10.4 | 13.7 | 25.7 | 40.5 | 53.1 | 63.1 | 68.2 | 65.3 | 56.5 | 45.2 | 28.4 | 16.1 | 40.6 | -- | | |
| Average minimum | 5.7 | 8.8 | 21.2 | 35.2 | 47.4 | 57.5 | 62.3 | 59.6 | 50.7 | 39.5 | 23.9 | 11.7 | 35.3 | -- | | |
| Extreme minimum | -35 | -33 | -30 | 2 | 22 | 29 | 40 | 34 | 18 | 0 | -19 | -26 | -- | -- | -35 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 231 | 586 | 864 | 1054 | 980 | 672 | 369 | -- | -- | -- | 4756 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 66 | 322 | 564 | 744 | 670 | 381 | 149 | -- | -- | -- | 2896 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/3-9/9) | | | | | | | | | | | | | | 3901 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/15-11/7) | | | | | | | | | | | | | | 2684 | | |
| Heating degree days, $T_b$ = 65° | 1544 | 1294 | 1091 | 567 | 257 | 72 | 19 | 25 | 156 | 440 | 951 | 1364 | -- | 7780 | | |
| **FARIBAULT** | | | | | | | | | | | | | | | | |
| Extreme maximum | 63 | 63 | 81 | 90 | 108 | 106 | 108 | 105 | 102 | 91 | 78 | 69 | -- | -- | 108 | 145 |
| Average maximum | 25.3 | 28.8 | 40.1 | 57.9 | 71.3 | 80.6 | 86.6 | 84.1 | 75.1 | 61.9 | 42.9 | 29.4 | 57.0 | -- | | |
| Effective day temperature | 20.6 | 23.9 | 35.4 | 52.3 | 65.4 | 74.6 | 80.5 | 78.1 | 69.2 | 56.4 | 38.5 | 25.2 | 51.7 | -- | | |
| Normal | 15.8 | 19.1 | 30.3 | 46.9 | 59.4 | 69.1 | 74.2 | 72.2 | 62.9 | 51.6 | 34.0 | 21.2 | 46.4 | -- | | |
| Effective night temperature | 11.2 | 13.9 | 26.0 | 41.0 | 53.5 | 63.3 | 68.3 | 66.2 | 57.3 | 45.6 | 29.6 | 16.7 | 41.0 | -- | | |
| Average minimum | 6.5 | 9.0 | 21.3 | 35.4 | 47.6 | 57.5 | 62.2 | 60.2 | 51.4 | 40.1 | 25.2 | 12.5 | 35.7 | -- | | |
| Extreme minimum | -37 | -34 | -30 | 5 | 21 | 33 | 41 | 34 | 23 | 4 | -14 | -30 | -- | -- | -37 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 252 | 601 | 873 | 1060 | 998 | 687 | 378 | -- | -- | -- | 4849 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 81 | 325 | 573 | 750 | 688 | 390 | 158 | -- | -- | -- | 2965 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/2-8/18) | | | | | | | | | | | | | | 3357 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/16-11/4) | | | | | | | | | | | | | | 2727 | | |
| Heating degree days, $T_b$ = 65° | 1525 | 1285 | 1076 | 543 | 239 | 66 | 9 | 19 | 144 | 428 | 930 | 1358 | -- | 7622 | | |
| **FARMINGTON** | | | | | | | | | | | | | | | | |
| Extreme maximum | 58 | 63 | 82 | 92 | 107 | 102 | 110 | 105 | 103 | 90 | 80 | 63 | -- | -- | 110 | 150 |
| Average maximum | 23.9 | 27.2 | 38.3 | 56.3 | 69.9 | 78.6 | 84.9 | 82.0 | 74.0 | 62.0 | 41.6 | 28.1 | 55.6 | -- | | |
| Effective day temperature | 18.9 | 22.0 | 23.6 | 50.8 | 64.0 | 72.9 | 79.0 | 76.3 | 67.9 | 56.0 | 37.0 | 23.6 | 50.2 | -- | | |
| Normal | 13.9 | 17.2 | 28.7 | 45.6 | 58.2 | 67.5 | 72.8 | 70.7 | 61.6 | 50.3 | 32.9 | 19.5 | 44.9 | -- | | |
| Effective night temperature | 8.9 | 11.5 | 24.0 | 39.7 | 52.2 | 61.7 | 67.0 | 64.7 | 55.8 | 44.1 | 27.7 | 14.5 | 39.3 | -- | | |
| Average minimum | 3.9 | 6.3 | 19.3 | 34.2 | 46.3 | 56.0 | 61.1 | 59.0 | 49.7 | 38.1 | 23.1 | 10.0 | 33.9 | -- | | |
| Extreme minimum | -40 | -34 | -30 | -1 | 21 | 26 | 41 | 36 | 20 | 2 | -18 | -31 | -- | -- | -40 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 225 | 564 | 825 | 1017 | 952 | 648 | 344 | -- | -- | -- | 4575 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 69 | 301 | 525 | 707 | 642 | 360 | 133 | -- | -- | -- | 2737 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/4-9/7) | | | | | | | | | | | | | | 3712 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/18-10/26) | | | | | | | | | | | | | | 2477 | | |
| Heating degree days, $T_b$ = 65° | 1584 | 1338 | 1125 | 582 | 260 | 84 | 19 | 28 | 165 | 462 | 963 | 1411 | -- | 8021 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **FERGUS FALLS** | | | | | | | | | | | | | | | | |
| Extreme maximum | 56 | 57 | 80 | 89 | 105 | 105 | 110 | 105 | 105 | 92 | 72 | 65 | -- | -- | 110 | 152 |
| Average maximum | 18.9 | 22.7 | 35.6 | 53.9 | 68.5 | 77.2 | 84.2 | 81.6 | 71.8 | 58.5 | 37.3 | 24.1 | 52.9 | -- | | |
| Effective day temperature | 14.1 | 17.8 | 31.1 | 48.6 | 62.7 | 71.7 | 78.3 | 75.9 | 66.0 | 53.1 | 33.1 | 20.7 | 47.7 | -- | | |
| Normal | 9.2 | 13.2 | 26.3 | 43.4 | 57.0 | 66.1 | 72.3 | 70.3 | 59.9 | 47.9 | 29.1 | 15.8 | 42.5 | -- | | |
| Effective night temperature | 4.4 | 8.0 | 21.9 | 37.9 | 51.0 | 60.6 | 66.7 | 64.3 | 54.4 | 42.2 | 24.6 | 11.0 | 37.3 | -- | | |
| Average minimum | -0.4 | 3.1 | 17.4 | 32.6 | 45.2 | 55.1 | 60.8 | 58.6 | 48.6 | 36.8 | 20.4 | 6.6 | 32.1 | -- | | |
| Extreme minimum | -39 | -42 | -31 | -1 | 20 | 29 | 40 | 34 | 20 | 2 | -23 | -35 | -- | -- | -42 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 186 | 527 | 783 | 1001 | 939 | 597 | 298 | -- | -- | -- | 4331 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 48 | 270 | 483 | 691 | 629 | 312 | 112 | -- | -- | -- | 2545 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/9-8/7) | | | | | | | | | | | | | | 2646 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/25-10/26) | | | | | | | | | | | | | | 2266 | | |
| Heating degree days, $T_b$ = 65° | 1730 | 1450 | 1200 | 648 | 291 | 87 | 22 | 28 | 198 | 536 | 1077 | 1525 | -- | 8792 | | |
| **FOSSTON** | | | | | | | | | | | | | | | | |
| Extreme maximum | 48 | 61 | 75 | 89 | 96 | 101 | 110 | 100 | 103 | 89 | 78 | 58 | -- | -- | 110 | 158 |
| Average maximum | 15.8 | 20.1 | 32.0 | 51.6 | 67.0 | 75.2 | 81.8 | 79.0 | 68.9 | 56.0 | 34.9 | 21.6 | 50.3 | -- | | |
| Effective day temperature | 10.7 | 14.5 | 26.9 | 46.2 | 60.9 | 69.3 | 75.7 | 73.0 | 63.1 | 50.6 | 30.6 | 16.9 | 45.2 | -- | | |
| Normal | 5.9 | 9.6 | 22.6 | 41.0 | 54.6 | 63.6 | 69.4 | 67.5 | 57.4 | 45.8 | 26.8 | 12.7 | 39.7 | -- | | |
| Effective night temperature | 0.3 | 3.3 | 16.9 | 35.5 | 48.5 | 57.6 | 63.5 | 61.0 | 51.5 | 39.8 | 22.2 | 7.5 | 34.8 | -- | | |
| Average minimum | -4.8 | -2.3 | 11.8 | 30.1 | 42.4 | 51.7 | 57.4 | 55.0 | 45.7 | 34.4 | 17.9 | 2.8 | 29.7 | -- | | |
| Extreme minimum | -44 | -48 | -35 | -12 | 11 | 27 | 36 | 28 | 19 | -4 | -23 | -42 | -- | -- | -48 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 141 | 453 | 708 | 911 | 853 | 522 | 245 | -- | -- | -- | 3833 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 30 | 195 | 408 | 601 | 543 | 246 | 84 | -- | -- | -- | 2107 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/20-7/29) | | | | | | | | | | | | | | 2065 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/3-10/21) | | | | | | | | | | | | | | 1825 | | |
| Heating degree days, $T_b$ = 65° | 1832 | 1551 | 1314 | 720 | 341 | 111 | 34 | 53 | 249 | 595 | 1146 | 1621 | -- | 9567 | | |
| **GRAND MARAIS** | | | | | | | | | | | | | | | | |
| Extreme maximum | 58 | 51 | 63 | 74 | 85 | 91 | 94 | 100 | 90 | 79 | 64 | 55 | -- | -- | 100 | 134 |
| Average maximum | 24.4 | 25.4 | 33.2 | 44.5 | 55.0 | 61.9 | 69.2 | 69.8 | 62.2 | 52.0 | 37.7 | 28.6 | 47.0 | -- | | |
| Effective day temperature | 19.8 | 20.7 | 29.1 | 40.4 | 50.2 | 56.8 | 63.9 | 65.5 | 58.2 | 48.1 | 34.2 | 24.5 | 42.6 | -- | | |
| Normal | 14.6 | 16.3 | 24.9 | 37.3 | 45.9 | 52.9 | 59.4 | 61.9 | 54.2 | 44.4 | 30.9 | 19.8 | 38.5 | -- | | |
| Effective night temperature | 10.6 | 11.5 | 21.0 | 32.3 | 40.7 | 46.8 | 53.2 | 57.0 | 50.2 | 40.1 | 27.2 | 16.2 | 33.9 | -- | | |
| Average minimum | 6.0 | 6.8 | 16.9 | 28.2 | 35.9 | 41.7 | 47.9 | 52.7 | 46.2 | 36.2 | 23.7 | 12.1 | 29.5 | -- | | |
| Extreme minimum | -34 | -34 | -28 | -5 | 17 | 25 | 28 | 33 | 23 | 6 | -13 | -34 | -- | -- | -34 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 84 | 205 | 387 | 601 | 679 | 426 | 205 | -- | -- | -- | 2587 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 6 | 34 | 126 | 291 | 369 | 162 | 56 | -- | -- | -- | 1044 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-7/22) | | | | | | | | | | | | | | 1068 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/4-11/2) | | | | | | | | | | | | | | 991 | | |
| Heating degree days, $T_b$ = 65° | 1562 | 1364 | 1243 | 831 | 592 | 363 | 189 | 140 | 330 | 639 | 1023 | 1401 | -- | 9677 | | |

Appendix Table 2. Monthly temperature summary. (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **GRAND MEADOW** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 57 | 60 | 84 | 89 | 107 | 105 | 107 | 102 | 100 | 91 | 78 | 61 | -- | -- | 107 | 146 |
| Average maximum..... | 24.1 | 26.8 | 37.8 | 55.0 | 68.4 | 77.8 | 84.0 | 81.3 | 72.2 | 60.7 | 41.0 | 28.1 | 54.8 | -- | | |
| Effective day temperature... | 19.1 | 21.7 | 33.0 | 49.5 | 62.7 | 72.2 | 77.9 | 75.4 | 66.3 | 54.8 | 36.4 | 23.6 | 49.4 | -- | | |
| Normal..... | 13.9 | 16.8 | 27.7 | 44.1 | 56.9 | 66.4 | 71.4 | 69.4 | 60.1 | 48.9 | 31.8 | 19.3 | 43.9 | -- | | |
| Effective night temperature. | 9.2 | 11 5 | 23.5 | 38.3 | 51.2 | 61.9 | 65.9 | 63.5 | 54.4 | 43.0 | 27.1 | 14.6 | 38.6 | -- | | |
| Average minimum..... | 4.2 | 6.4 | 18.7 | 32.8 | 45.5 | 55.4 | 59.8 | 57.6 | 48.5 | 37.1 | 22.5 | 10.1 | 33.2 | -- | | |
| Extreme minimum..... | -39 | -36 | -31 | 3 | 20 | 32 | 37 | 33 | 22 | -5 | -22 | -30 | -- | -- | -39 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 186 | 530 | 792 | 973 | 911 | 603 | 310 | -- | -- | -- | 4305 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 51 | 270 | 492 | 663 | 601 | 318 | 118 | -- | -- | -- | 2513 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/7-8/29)..... | | | | | | | | | | | | | | 3296 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/19-10/31)..... | | | | | | | | | | | | | | 2292 | | |
| Heating degree days, $T_b$ = 65° | 1584 | 1350 | 1156 | 627 | 295 | 99 | 31 | 37 | 198 | 505 | 996 | 1417 | -- | 8295 | | |
| **GRAND RAPIDS** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 51 | 61 | 80 | 89 | 101 | 99 | 104 | 99 | 99 | 84 | 69 | 59 | -- | -- | 104 | 155 |
| Average maximum..... | 18.8 | 23.1 | 34.8 | 52.0 | 66.3 | 74.9 | 80.7 | 77.5 | 68.2 | 55.9 | 35.1 | 23.0 | 50.9 | -- | | |
| Effective day temperature... | 13.6 | 16.9 | 28.9 | 45.8 | 59.5 | 68.4 | 74.1 | 71.2 | 62.0 | 50.1 | 30.9 | 18.1 | 45.2 | -- | | |
| Normal..... | 7.8 | 11.3 | 22.9 | 39.9 | 52.7 | 62.0 | 67.4 | 65.1 | 55.6 | 44.8 | 27.1 | 13.4 | 39.2 | -- | | |
| Effective night temperature. | 2.4 | 4.6 | 17.1 | 33.5 | 46.0 | 55.6 | 61.0 | 58.6 | 49.7 | 38.6 | 22.4 | 8.1 | 33.7 | -- | | |
| Average minimum..... | -3.1 | -1.6 | 11.2 | 27.3 | 39.2 | 49.1 | 54.4 | 52.3 | 43.5 | 32.8 | 18.2 | 3.2 | 28.0 | -- | | |
| Extreme minimum..... | -51 | -45 | -39 | -10 | 11 | 24 | 33 | 27 | 15 | -10 | -25 | -45 | -- | -- | -51 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 120 | 394 | 660 | 849 | 778 | 468 | 211 | -- | -- | -- | 3480 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 0 | 136 | 360 | 539 | 468 | 198 | 62 | -- | -- | -- | 1763 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/24-7/7)..... | | | | | | | | | | | | | | 1280 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/9-10/12)..... | | | | | | | | | | | | | | 1491 | | |
| Heating degree days, $T_b$ = 65° | 1773 | 1504 | 1305 | 753 | 388 | 132 | 50 | 84 | 291 | 626 | 1137 | 1600 | -- | 9643 | | |
| **GULL LAKE DAM** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 55 | 59 | 87 | 89 | 104 | 100 | 107 | 105 | 103 | 89 | 70 | 62 | -- | -- | 107 | 154 |
| Average maximum..... | 20.5 | 24.6 | 36.3 | 53.6 | 67.8 | 77.1 | 82.7 | 79.4 | 70.3 | 58.4 | 37.8 | 25.1 | 52.8 | -- | | |
| Effective day temperature... | 15.2 | 18.8 | 30.8 | 47.6 | 61.5 | 71.0 | 76.6 | 73.6 | 64.4 | 52.7 | 33.5 | 20.4 | 47.2 | -- | | |
| Normal..... | 9.9 | 13.5 | 25.0 | 41.7 | 55.2 | 64.8 | 70.5 | 68.1 | 58.4 | 47.3 | 29.6 | 16.1 | 41.7 | -- | | |
| Effective night temperature. | 4.7 | 7.2 | 19.7 | 35.5 | 48.7 | 58.7 | 64.5 | 62.0 | 52.7 | 41.3 | 25.1 | 11.2 | 36.0 | -- | | |
| Average minimum..... | -0.6 | 1.4 | 14.2 | 29.5 | 42.4 | 52.6 | 58.4 | 56.2 | 46.8 | 35.6 | 20.8 | 6.5 | 30.4 | -- | | |
| Extreme minimum..... | -47 | -42 | -34 | -3 | 19 | 30 | 39 | 35 | 21 | 4 | -20 | -38 | -- | -- | -47 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 156 | 471 | 744 | 945 | 871 | 552 | 279 | -- | -- | -- | 4018 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 39 | 211 | 444 | 635 | 561 | 276 | 96 | -- | -- | -- | 2262 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/15-8/16)..... | | | | | | | | | | | | | | 2692 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/26-10/27)..... | | | | | | | | | | | | | | 2037 | | |
| Heating degree days, $T_b$ = 65° | 1708 | 1442 | 1240 | 699 | 322 | 99 | 31 | 47 | 225 | 549 | 1062 | 1516 | -- | 8940 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **HALLOCK** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 50 | 61 | 77 | 96 | 105 | 103 | 109 | 102 | 100 | 90 | 72 | 53 | -- | -- | 109 | 160 |
| Average maximum..... | 12.5 | 16.5 | 30.5 | 51.3 | 68.0 | 75.4 | 82.6 | 80.2 | 69.4 | 55.3 | 32.9 | 18.7 | 49.4 | -- | | |
| Effective day temperature... | 7.2 | 16.2 | 25.3 | 45.5 | 61.0 | 69.0 | 75.8 | 73.5 | 62.9 | 49.4 | 28.4 | 14.0 | 44.1 | -- | | |
| Normal..... | 2.1 | 6.3 | 20.1 | 39.7 | 53.9 | 62.8 | 68.9 | 67.0 | 56.1 | 44.1 | 24.4 | 9.8 | 37.9 | -- | | |
| Effective night temperature. | -3.3 | 0.5 | 14.8 | 33.8 | 47.0 | 56.3 | 62.2 | 60.0 | 49.9 | 37.4 | 19.4 | 4.6 | 33.6 | -- | | |
| Average minimum..... | -8.6 | -4.8 | 9.6 | 28.0 | 40.0 | 49.9 | 55.4 | 53.3 | 43.4 | 31.5 | 14.9 | -0.1 | 28.3 | -- | | |
| Extreme minimum..... | -48 | -51 | -42 | -13 | 11 | 26 | 34 | 28 | 13 | -7 | -32 | -41 | -- | -- | -51 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 117 | 431 | 684 | 896 | 837 | 483 | 205 | -- | -- | -- | 3653 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 18 | 192 | 384 | 586 | 527 | 213 | 59 | -- | -- | -- | 1979 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/25-7/15)..... | | | | | | | | | | | | | | 1571 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/8-10/17)..... | | | | | | | | | | | | | | 1650 | | |
| Heating degree days, $T_b$ = 65° | 1950 | 1644 | 1392 | 759 | 363 | 126 | 34 | 53 | 282 | 648 | 1218 | 1711 | -- | 10180 | | |
| **INTERNATIONAL FALLS** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 48 | 53 | 76 | 93 | 91 | 98 | 97 | 95 | 91 | 86 | 68 | 57 | -- | -- | 97 | 139 |
| Average maximum..... | 14.2 | 19.2 | 30.9 | 48.5 | 63.3 | 72.2 | 78.4 | 75.2 | 64.4 | 52.9 | 31.4 | 19.0 | 47.5 | -- | | |
| Effective day temperature... | 8.6 | 13.1 | 25.2 | 43.0 | 57.0 | 66.0 | 72.0 | 69.1 | 58.6 | 49.6 | 27.6 | 14.2 | 41.9 | -- | | |
| Normal..... | 3.1 | 7.1 | 19.4 | 37.4 | 50.7 | 59.9 | 65.6 | 63.1 | 52.9 | 42.4 | 23.8 | 9.4 | 36.2 | -- | | |
| Effective night temperature. | -2.5 | 1.1 | 13.6 | 31.8 | 44.4 | 53.7 | 59.2 | 57.1 | 47.1 | 37.1 | 20.0 | 4.6 | 30.6 | -- | | |
| Average minimum..... | -8.1 | -5.0 | 7.9 | 26.3 | 38.1 | 47.5 | 52.8 | 51.0 | 41.3 | 31.8 | 16.2 | -0.2 | 25.0 | -- | | |
| Extreme minimum..... | -41 | -38 | -38 | -14 | 18 | 29 | 38 | 32 | 20 | 7 | -27 | -41 | -- | -- | -41 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 87 | 332 | 597 | 794 | 716 | 387 | 161 | -- | -- | -- | 3074 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 6 | 99 | 297 | 484 | 406 | 135 | 37 | -- | -- | -- | 1464 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/20-7/23)..... | | | | | | | | | | | | | | 1549 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/4-10/22)..... | | | | | | | | | | | | | | 1317 | | |
| Heating degree days, $T_b$ = 65° | 1919 | 1621 | 1414 | 828 | 443 | 174 | 71 | 112 | 363 | 701 | 1236 | 1724 | -- | 10606 | | |
| **ITASCA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 62 | 62 | 81 | 89 | 98 | 100 | 105 | 101 | 99 | 89 | 69 | 59 | -- | -- | 105 | 156 |
| Average maximum..... | 18.6 | 22.8 | 34.8 | 51.7 | 65.7 | 74.4 | 80.8 | 77.2 | 67.7 | 55.9 | 35.2 | 23.0 | 50.7 | -- | | |
| Effective day temperature... | 12.6 | 16.7 | 27.5 | 45.3 | 58.9 | 68.0 | 74.3 | 71.0 | 61.6 | 50.0 | 30.6 | 17.7 | 45.0 | -- | | |
| Normal..... | 6.6 | 10.4 | 22.1 | 39.1 | 52.2 | 61.6 | 67.6 | 65.1 | 55.5 | 44.7 | 26.5 | 12.9 | 38.7 | -- | | |
| Effective night temperature. | 0.6 | 2.5 | 15.9 | 32.6 | 45.3 | 55.1 | 61.2 | 58.5 | 49.4 | 38.2 | 21.5 | 7.1 | 33.5 | -- | | |
| Average minimum..... | -5.4 | -3.6 | 9.6 | 26.2 | 38.5 | 48.7 | 54.7 | 52.3 | 43.3 | 32.3 | 16.9 | 1.8 | 27.8 | -- | | |
| Extreme minimum..... | -51 | -51 | -44 | -17 | 12 | 25 | 32 | 26 | 17 | -14 | -29 | -47 | -- | -- | -51 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 108 | 378 | 648 | 856 | 778 | 465 | 217 | -- | -- | -- | 3450 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 15 | 149 | 348 | 546 | 468 | 198 | 65 | -- | -- | -- | 1789 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/25-7/17)..... | | | | | | | | | | | | | | 1519 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/13-10/19)..... | | | | | | | | | | | | | | 1459 | | |
| Heating degree days, $T_b$ = 65° | 1810 | 1529 | 1330 | 777 | 409 | 147 | 53 | 84 | 294 | 629 | 1155 | 1615 | -- | 9832 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **LEECH LAKE DAM** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 53 | 61 | 81 | 89 | 102 | 98 | 104 | 99 | 101 | 85 | 71 | 57 | -- | -- | 104 | 163 |
| Average maximum..... | 18.7 | 23.1 | 34.9 | 51.6 | 66.1 | 74.7 | 80.7 | 77.6 | 68.5 | 56.1 | 35.2 | 23.0 | 50.9 | -- | | |
| Effective day temperature... | 13.2 | 17.0 | 29.1 | 45.7 | 59.7 | 68.7 | 74.6 | 70.7 | 62.6 | 50.6 | 31.2 | 18.1 | 45.4 | -- | | |
| Normal..... | 7.7 | 11.4 | 23.2 | 40.1 | 53.3 | 62.8 | 68.5 | 66.2 | 56.6 | 45.6 | 27.7 | 13.7 | 39.7 | -- | | |
| Effective night temperature. | 2.4 | 4.7 | 17.6 | 33.9 | 46.9 | 56.8 | 62.5 | 59.9 | 50.9 | 39.7 | 23.2 | 8.5 | 34.5 | -- | | |
| Average minimum..... | -3.1 | -1.4 | 11.8 | 28.0 | 40.5 | 50.8 | 56.4 | 54.0 | 45.0 | 34.2 | 19.2 | 3.6 | 29.0 | -- | | |
| Extreme minimum..... | -52 | -59 | -48 | -13 | 12 | 24 | 35 | 28 | 16 | 1 | -37 | -44 | -- | -- | -59 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 126 | 412 | 684 | 883 | 812 | 498 | 236 | -- | -- | -- | 3651 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 24 | 164 | 384 | 573 | 502 | 228 | 74 | -- | -- | -- | 1949 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/17-7/29)..... | | | | | | | | | | | | | | 1981 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/7-10/20)..... | | | | | | | | | | | | | | 1655 | | |
| Heating degree days, $T_b$ = 65° | 1776 | 1501 | 1296 | 747 | 369 | 123 | 37 | 65 | 267 | 601 | 1119 | 1590 | -- | 9491 | | |
| **LITTLE FALLS** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 59 | 59 | 83 | 87 | 103 | 102 | 106 | 104 | 105 | 91 | 72 | 64 | -- | -- | 106 | 152 |
| Average maximum..... | 20.5 | 24.4 | 36.6 | 54.7 | 68.9 | 77.9 | 84.3 | 80.9 | 71.5 | 59.2 | 38.3 | 25.1 | 53.5 | -- | | |
| Effective day temperature... | 15.4 | 19.0 | 31.5 | 48.9 | 62.6 | 71.8 | 78.0 | 74.8 | 65.4 | 53.3 | 33.9 | 20.6 | 47.9 | -- | | |
| Normal..... | 10.1 | 13.7 | 26.1 | 43.2 | 56.3 | 65.7 | 71.4 | 68.8 | 59.0 | 47.5 | 29.6 | 16.2 | 42.3 | -- | | |
| Effective night temperature. | 5.4 | 8.3 | 21.5 | 37.3 | 50.2 | 59.8 | 65.3 | 62.6 | 53.1 | 41.3 | 25.1 | 11.7 | 36.8 | -- | | |
| Average minimum..... | 0.3 | 2.9 | 16.4 | 31.5 | 43.9 | 53.7 | 59.0 | 56.5 | 47.0 | 35.4 | 20.7 | 7.2 | 31.2 | -- | | |
| Extreme minimum..... | -40 | -46 | -39 | 0 | 18 | 33 | 39 | 35 | 20 | 4 | -22 | -36 | -- | -- | -46 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 180 | 505 | 771 | 973 | 893 | 570 | 282 | -- | -- | -- | 4174 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 51 | 245 | 471 | 663 | 583 | 291 | 102 | -- | -- | -- | 2304 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-8/25)..... | | | | | | | | | | | | | | 3077 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/20-10/27)..... | | | | | | | | | | | | | | 2188 | | |
| Heating degree days, $T_b$ = 65° | 1702 | 1436 | 1206 | 654 | 304 | 96 | 25 | 40 | 219 | 543 | 1062 | 1513 | -- | 8800 | | |
| **MAHONING MINE** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 51 | 59 | 80 | 89 | 98 | 100 | 102 | 95 | 96 | 83 | 68 | 58 | -- | -- | 102 | 142 |
| Average maximum..... | 17.4 | 21.6 | 33.3 | 50.6 | 65.6 | 73.7 | 79.2 | 75.8 | 66.3 | 54.8 | 33.6 | 21.4 | 49.4 | -- | | |
| Effective day temperature... | 12.8 | 16.5 | 28.3 | 45.0 | 59.4 | 67.9 | 73.5 | 70.4 | 61.0 | 49.7 | 30.0 | 17.3 | 44.3 | -- | | |
| Normal..... | 8.2 | 12.0 | 23.3 | 39.8 | 53.3 | 62.4 | 67.9 | 65.4 | 55.6 | 45.2 | 26.8 | 13.5 | 39.5 | -- | | |
| Effective night temperature. | 3.6 | 6.4 | 18.2 | 33.9 | 47.0 | 56.4 | 62.2 | 59.5 | 50.4 | 39.6 | 22.7 | 9.2 | 34.2 | -- | | |
| Average minimum..... | -1.0 | 1.3 | 13.2 | 28.3 | 40.8 | 50.6 | 56.5 | 54.1 | 45.1 | 34.5 | 19.1 | 5.1 | 29.1 | -- | | |
| Extreme minimum..... | -40 | -37 | -28 | -6 | 16 | 28 | 37 | 28 | 22 | 6 | -22 | -34 | -- | -- | -40 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 120 | 412 | 672 | 865 | 787 | 468 | 220 | -- | -- | -- | 3544 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 24 | 139 | 372 | 555 | 477 | 198 | 65 | -- | -- | -- | 1830 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/17-7/19)..... | | | | | | | | | | | | | | 1669 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/27-10/29)..... | | | | | | | | | | | | | | 1683 | | |
| Heating degree days, $T_b$ = 65° | 1761 | 1484 | 1293 | 756 | 363 | 120 | 43 | 78 | 291 | 614 | 1146 | 1597 | -- | 9546 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **MAPLE PLAIN** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 55 | 60 | 81 | 96 | 112 | 106 | 110 | 106 | 102 | 89 | 77 | 61 | -- | -- | 112 | 149 |
| Average maximum..... | 21.9 | 25.2 | 36.9 | 54.6 | 69.0 | 78.2 | 84.4 | 81.0 | 71.7 | 59.5 | 39.4 | 26.1 | 54.0 | -- | | |
| Effective day temperature... | 17.3 | 20.4 | 32.4 | 49.5 | 63.3 | 72.8 | 78.7 | 75.6 | 66.3 | 54.4 | 35.3 | 22.0 | 49.0 | -- | | |
| Normal..... | 12.7 | 16.0 | 27.8 | 44.7 | 57.8 | 67.3 | 72.7 | 70.4 | 60.6 | 49.4 | 31.5 | 18.4 | 44.1 | -- | | |
| Effective night temperature. | 8.0 | 10.7 | 23.5 | 39.2 | 52.1 | 61.9 | 67.5 | 64.9 | 55.4 | 44.0 | 27.1 | 13.6 | 39.0 | -- | | |
| Average minimum..... | 3.4 | 5.9 | 19.0 | 34.1 | 46.4 | 56.5 | 61.8 | 59.5 | 50.0 | 38.9 | 23.0 | 9.5 | 34.0 | -- | | |
| Extreme minimum..... | -37 | -36 | -31 | -2 | 20 | 33 | 41 | 36 | 22 | 6 | -17 | -35 | -- | -- | -37 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 210 | 552 | 819 | 1014 | 942 | 618 | 322 | -- | -- | -- | 4477 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 66 | 288 | 519 | 704 | 632 | 330 | 124 | -- | -- | -- | 2663 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/5-9/8)..... | | | | | | | | | | | | | | 3673 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/18-11/2)..... | | | | | | | | | | | | | | 2439 | | |
| Heating degree days, $T_b$ = 65° | 1621 | 1372 | 1153 | 609 | 273 | 84 | 22 | 31 | 189 | 490 | 1005 | 1445 | -- | 8294 | | |
| **MEADOWLANDS** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 57 | 66 | 73 | 90 | 102 | 96 | 103 | 97 | 94 | 86 | 69 | 60 | -- | -- | 103 | 154 |
| Average maximum..... | 20.3 | 23.7 | 34.9 | 51.6 | 65.9 | 74.7 | 79.8 | 76.5 | 67.8 | 56.2 | 36.3 | 23.7 | 51.0 | -- | | |
| Effective day temperature... | 14.2 | 17.1 | 28.8 | 45.4 | 58.8 | 68.0 | 73.0 | 70.2 | 61.5 | 50.1 | 31.5 | 17.2 | 45.1 | -- | | |
| Normal..... | 7.8 | 10.9 | 22.5 | 39.4 | 51.8 | 61.3 | 66.4 | 64.4 | 55.1 | 44.4 | 27.1 | 13.2 | 38.7 | -- | | |
| Effective night temperature. | 1.9 | 4.0 | 16.6 | 32.9 | 44.5 | 54.5 | 59.5 | 57.5 | 48.7 | 37.7 | 21.9 | 7.2 | 33.1 | -- | | |
| Average minimum..... | -4.2 | -2.6 | 10.5 | 26.7 | 37.4 | 47.8 | 52.7 | 51.2 | 42.4 | 31.6 | 17.1 | 1.7 | 27.2 | -- | | |
| Extreme minimum..... | -51 | -51 | -41 | -11 | 11 | 22 | 29 | 26 | 15 | -9 | -25 | -44 | -- | -- | -51 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 117 | 366 | 639 | 818 | 756 | 453 | 205 | -- | -- | -- | 3354 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 21 | 112 | 339 | 508 | 446 | 186 | 59 | -- | -- | -- | 1671 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/22-7/4)..... | | | | | | | | | | | | | | 1145 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/17-10/10)..... | | | | | | | | | | | | | | 1315 | | |
| Heating degree days, $T_b$ = 65° | 1773 | 1515 | 1318 | 768 | 409 | 144 | 59 | 96 | 306 | 639 | 1137 | 1606 | -- | 9770 | | |
| **MILACA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 60 | 58 | 81 | 92 | 107 | 101 | 108 | 103 | 104 | 88 | 71 | 63 | -- | -- | 108 | 152 |
| Average maximum..... | 21.6 | 25.1 | 36.3 | 53.8 | 68.3 | 77.3 | 83.8 | 81.0 | 72.3 | 59.6 | 38.8 | 25.9 | 53.7 | -- | | |
| Effective day temperature... | 16.7 | 19.4 | 31.5 | 48.4 | 62.3 | 71.5 | 77.8 | 74.1 | 66.3 | 53.9 | 34.6 | 21.6 | 48.4 | -- | | |
| Normal..... | 11.6 | 15.0 | 26.8 | 43.4 | 56.2 | 65.7 | 71.4 | 69.2 | 59.6 | 48.2 | 30.4 | 17.6 | 42.9 | -- | | |
| Effective night temperature. | 7.0 | 10.1 | 21.9 | 37.5 | 50.3 | 60.0 | 65.8 | 63.2 | 54.4 | 42.7 | 26.1 | 12.9 | 37.6 | -- | | |
| Average minimum..... | 2.1 | 4.4 | 17.1 | 32.1 | 44.3 | 54.2 | 59.8 | 57.3 | 48.4 | 37.0 | 21.9 | 8.6 | 32.3 | -- | | |
| Extreme minimum..... | -44 | -41 | -32 | 2 | 16 | 24 | 39 | 32 | 20 | 7 | -26 | -32 | -- | -- | -44 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 183 | 502 | 771 | 973 | 905 | 588 | 295 | -- | -- | -- | 4217 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 51 | 236 | 471 | 663 | 595 | 303 | 105 | -- | -- | -- | 2424 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/9-8/25)..... | | | | | | | | | | | | | | 3109 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/22-10/28)..... | | | | | | | | | | | | | | 2199 | | |
| Heating degree days, $T_b$ = 65° | 1655 | 1400 | 1184 | 648 | 307 | 99 | 25 | 37 | 201 | 527 | 1038 | 1469 | -- | 8590 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **MILAN** | | | | | | | | | | | | | | | | |
| Extreme maximum | 61 | 64 | 85 | 95 | 106 | 106 | 113 | 104 | 108 | 95 | 78 | 73 | -- | -- | 113 | 155 |
| Average maximum | 23.1 | 26.6 | 38.3 | 56.1 | 70.4 | 79.3 | 86.2 | 83.4 | 74.4 | 62.1 | 40.6 | 27.6 | 55.7 | -- | | |
| Effective day temperature | 17.7 | 21.2 | 33.3 | 50.4 | 64.1 | 73.3 | 79.7 | 77.1 | 67.9 | 55.6 | 45.6 | 22.7 | 49.9 | -- | | |
| Normal | 11.7 | 15.9 | 28.0 | 44.6 | 57.7 | 67.2 | 72.9 | 70.7 | 61.0 | 49.2 | 30.8 | 18.1 | 44.0 | -- | | |
| Effective night temperature | 7.0 | 10.4 | 23.4 | 38.8 | 51.6 | 61.3 | 66.7 | 64.3 | 54.9 | 42.7 | 25.7 | 12.7 | 38.3 | -- | | |
| Average minimum | 1.7 | 5.0 | 18.4 | 33.1 | 45.3 | 55.3 | 60.2 | 58.0 | 48.4 | 36.2 | 20.7 | 7.8 | 32.5 | -- | | |
| Extreme minimum | -37 | -42 | -32 | -2 | 17 | 29 | 36 | 30 | 14 | -1 | -21 | -34 | -- | -- | -42 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 201 | 549 | 816 | 1020 | 952 | 630 | 325 | -- | -- | -- | 4493 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 57 | 295 | 516 | 710 | 642 | 342 | 118 | -- | -- | -- | 2680 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/7-9/1) | | | | | | | | | | | | | | 3519 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/25-10/27) | | | | | | | | | | | | | | 2375 | | |
| Heating degree days, $T_b$ = 65° | 1652 | 1375 | 1147 | 612 | 279 | 81 | 22 | 31 | 186 | 496 | 1026 | 1454 | -- | 8361 | | |
| **MINNEAPOLIS** | | | | | | | | | | | | | | | | |
| Extreme maximum | 58 | 64 | 83 | 92 | 106 | 104 | 108 | 103 | 104 | 90 | 77 | 63 | -- | -- | 108 | 142 |
| Average maximum | 22.2 | 26.3 | 37.4 | 56.0 | 69.6 | 78.7 | 84.7 | 81.8 | 72.1 | 59.8 | 39.7 | 27.0 | 54.6 | -- | | |
| Effective day temperature | 17.3 | 21.1 | 32.5 | 50.3 | 63.6 | 73.0 | 78.8 | 76.1 | 65.3 | 54.0 | 35.1 | 22.4 | 49.2 | -- | | |
| Normal | 12.4 | 15.9 | 27.6 | 44.7 | 57.6 | 67.3 | 73.0 | 70.5 | 60.5 | 48.3 | 30.5 | 17.8 | 43.8 | -- | | |
| Effective night temperature | 7.4 | 10.6 | 22.7 | 39.0 | 51.6 | 61.6 | 67.1 | 64.8 | 55.6 | 42.5 | 25.9 | 13.1 | 38.4 | -- | | |
| Average minimum | 2.5 | 5.4 | 17.8 | 33.3 | 45.6 | 55.9 | 61.2 | 59.1 | 48.8 | 36.7 | 21.3 | 8.5 | 33.0 | -- | | |
| Extreme minimum | -34 | -33 | -32 | 2 | 22 | 34 | 44 | 40 | 26 | 10 | -13 | -27 | -- | -- | -34 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 210 | 546 | 819 | 1023 | 945 | 615 | 298 | -- | -- | -- | 4456 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 66 | 282 | 519 | 713 | 635 | 327 | 109 | -- | -- | -- | 2651 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (3/31-9/13) | | | | | | | | | | | | | | 3809 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/9-11/9) | | | | | | | | | | | | | | 2512 | | |
| Heating degree days, $T_b$ = 65° | 1631 | 1375 | 1159 | 609 | 279 | 84 | 16 | 31 | 186 | 524 | 1035 | 1463 | -- | 8392 | | |
| **MONTEVIDEO** | | | | | | | | | | | | | | | | |
| Extreme maximum | 64 | 64 | 88 | 96 | 105 | 107 | 107 | 103 | 105 | 93 | 82 | 72 | -- | -- | 107 | 146 |
| Average maximum | 22.2 | 25.4 | 37.5 | 55.2 | 69.3 | 77.9 | 84.6 | 81.7 | 72.9 | 61.4 | 40.4 | 27.0 | 54.6 | -- | | |
| Effective day temperature | 17.4 | 20.6 | 32.9 | 49.9 | 63.7 | 72.6 | 78.9 | 76.2 | 67.1 | 55.5 | 35.9 | 22.7 | 49.4 | -- | | |
| Normal | 12.1 | 15.8 | 27.9 | 44.7 | 57.9 | 67.2 | 72.9 | 70.6 | 60.9 | 49.6 | 31.4 | 18.6 | 44.1 | -- | | |
| Effective night temperature | 7.7 | 10.9 | 23.6 | 39.4 | 52.4 | 62.2 | 67.7 | 65.0 | 55.5 | 43.5 | 26.7 | 13.9 | 39.1 | -- | | |
| Average minimum | 2.9 | 6.1 | 19.0 | 34.1 | 46.8 | 56.9 | 62.0 | 59.5 | 49.7 | 37.6 | 22.2 | 9.6 | 33.9 | -- | | |
| Extreme minimum | -38 | -39 | -25 | 2 | 16 | 31 | 40 | 34 | 14 | 4 | -23 | -33 | -- | -- | -39 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 204 | 555 | 816 | 1020 | 949 | 627 | 329 | -- | -- | -- | 4500 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 57 | 295 | 516 | 710 | 639 | 342 | 124 | -- | -- | -- | 2683 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/5-9/13) | | | | | | | | | | | | | | 3788 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/17-10/31) | | | | | | | | | | | | | | 2469 | | |
| Heating degree days, $T_b$ = 65° | 1640 | 1378 | 1150 | 609 | 273 | 81 | 22 | 28 | 183 | 484 | 1008 | 1438 | -- | 8294 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **MORA** | | | | | | | | | | | | | | | | |
| Extreme maximum | 54 | 58 | 78 | 90 | 107 | 101 | 108 | 101 | 105 | 88 | 70 | 59 | -- | -- | 108 | 156 |
| Average maximum | 21.0 | 24.7 | 35.8 | 53.7 | 67.9 | 77.1 | 83.5 | 80.5 | 70.9 | 58.4 | 38.0 | 25.4 | 53.1 | -- | | |
| Effective day temperature | 16.1 | 19.4 | 30.9 | 48.0 | 61.6 | 71.1 | 77.4 | 74.4 | 64.8 | 52.7 | 33.8 | 21.0 | 47.6 | -- | | |
| Normal | 11.2 | 14.6 | 26.1 | 42.8 | 55.7 | 65.3 | 71.2 | 68.8 | 58.8 | 47.5 | 30.0 | 17.1 | 42.4 | -- | | |
| Effective night temperature | 6.3 | 8.8 | 21.2 | 36.8 | 49.1 | 59.0 | 65.0 | 62.2 | 52.6 | 51.4 | 25.3 | 12.1 | 36.7 | -- | | |
| Average minimum | 1.4 | 3.5 | 16.3 | 31.1 | 42.8 | 53.0 | 58.9 | 56.1 | 46.5 | 35.7 | 21.1 | 7.7 | 31.2 | -- | | |
| Extreme minimum | -48 | -44 | -35 | 2 | 15 | 29 | 37 | 31 | 21 | 5 | -26 | -30 | -- | -- | -48 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 177 | 487 | 759 | 967 | 893 | 564 | 279 | -- | -- | -- | 4126 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 48 | 223 | 459 | 657 | 583 | 282 | 99 | -- | -- | -- | 2351 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/10-8/17) | | | | | | | | | | | | | | 2826 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/24-10/27) | | | | | | | | | | | | | | 2121 | | |
| Heating degree days, $T_b$ = 65° | 1668 | 1411 | 1206 | 666 | 313 | 96 | 22 | 40 | 219 | 543 | 1050 | 1485 | -- | 8719 | | |
| **MORRIS** | | | | | | | | | | | | | | | | |
| Extreme maximum | 59 | 60 | 83 | 92 | 106 | 104 | 109 | 104 | 106 | 93 | 76 | 69 | -- | -- | 109 | 150 |
| Average maximum | 21.1 | 24.9 | 37.0 | 54.1 | 68.6 | 77.6 | 84.3 | 81.8 | 72.4 | 61.5 | 40.1 | 26.1 | 54.1 | -- | | |
| Effective day temperature | 15.9 | 19.6 | 32.1 | 48.6 | 62.6 | 71.9 | 78.1 | 75.6 | 66.1 | 55.2 | 35.2 | 21.3 | 48.5 | -- | | |
| Normal | 10.3 | 14.3 | 26.9 | 43.1 | 56.5 | 66.1 | 71.7 | 69.7 | 59.7 | 48.8 | 30.3 | 16.7 | 42.8 | -- | | |
| Effective night temperature | 5.4 | 9.0 | 22.5 | 37.5 | 50.5 | 60.3 | 65.6 | 63.3 | 53.5 | 42.5 | 25.4 | 11.8 | 37.3 | -- | | |
| A erage minimum | 0.2 | 3.7 | 17.6 | 32.0 | 44.5 | 54.6 | 59.4 | 57.1 | 47.2 | 36.2 | 20.5 | 7.0 | 31.7 | -- | | |
| Extreme minimum | -40 | -41 | -30 | -2 | 18 | 27 | 38 | 31 | 20 | 1 | -27 | -34 | -- | -- | -41 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 177 | 511 | 783 | 983 | 921 | 591 | 313 | -- | -- | -- | 4279 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 45 | 260 | 483 | 673 | 611 | 306 | 121 | -- | -- | -- | 2499 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-8/19) | | | | | | | | | | | | | | 2948 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/23-10/27) | | | | | | | | | | | | | | 2249 | | |
| Heating degree days, $T_b$ = 65° | 1696 | 1420 | 1181 | 657 | 307 | 99 | 28 | 31 | 204 | 508 | 1041 | 1497 | -- | 8669 | | |
| **NEW LONDON** | | | | | | | | | | | | | | | | |
| Extreme maximum | 59 | 58 | 83 | 93 | 107 | 108 | 108 | 102 | 106 | 90 | 76 | 62 | -- | -- | 108 | 150 |
| Average maximum | 21.9 | 25.2 | 37.1 | 55.1 | 69.4 | 78.4 | 85.1 | 82.0 | 73.3 | 60.9 | 39.7 | 26.8 | 54.6 | -- | | |
| Effective day temperature | 16.7 | 19.9 | 32.3 | 49.6 | 63.5 | 72.7 | 79.1 | 76.2 | 67.3 | 55.0 | 35.1 | 22.2 | 49.1 | -- | | |
| Normal | 11.5 | 15.1 | 27.4 | 44.4 | 57.8 | 67.3 | 73.1 | 70.8 | 61.2 | 49.3 | 30.8 | 18.1 | 43.9 | -- | | |
| Effective night temperature | 6.4 | 9.4 | 22.7 | 38.7 | 51.5 | 61.5 | 67.1 | 64.5 | 55.2 | 43.1 | 25.9 | 13.1 | 38.3 | -- | | |
| Average minimum | 1.2 | 4.1 | 17.9 | 33.2 | 45.6 | 55.8 | 61.1 | 58.7 | 49.2 | 37.2 | 21.3 | 8.5 | 32.8 | -- | | |
| Extreme minimum | -42 | -40 | -34 | -2 | 16 | 28 | 42 | 35 | 21 | 6 | -20 | -32 | -- | -- | -42 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 198 | 552 | 819 | 1026 | 955 | 636 | 325 | -- | -- | -- | 4511 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 57 | 291 | 519 | 716 | 645 | 348 | 124 | -- | -- | -- | 2700 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/9-9/2) | | | | | | | | | | | | | | 3539 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/18-10/28) | | | | | | | | | | | | | | 2472 | | |
| Heating degree days, $T_b$ = 65° | 1659 | 1397 | 1166 | 618 | 273 | 81 | 16 | 28 | 177 | 493 | 1026 | 1454 | -- | 8388 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **NEW ULM** | | | | | | | | | | | | | | | | |
| Extreme maximum | 63 | 68 | 87 | 93 | 108 | 107 | 111 | 107 | 106 | 92 | 83 | 69 | -- | -- | 111 | 146 |
| Average maximum | 24.1 | 27.2 | 38.9 | 56.5 | 70.3 | 80.7 | 87.9 | 84.8 | 75.0 | 63.1 | 42.1 | 28.7 | 56.6 | -- | | |
| Effective day temperature | 18.8 | 21.9 | 34.0 | 50.8 | 64.3 | 74.7 | 81.3 | 78.3 | 68.5 | 56.5 | 36.9 | 23.8 | 50.8 | -- | | |
| Normal | 13.8 | 17.2 | 29.2 | 45.8 | 58.6 | 68.7 | 74.4 | 72.0 | 62.1 | 50.4 | 32.4 | 19.8 | 45.4 | -- | | |
| Effective night temperature | 8.2 | 11.2 | 24.0 | 39.5 | 52.4 | 62.6 | 68.1 | 65.3 | 55.7 | 43.4 | 26.6 | 14.1 | 39.3 | -- | | |
| Average minimum | 2.9 | 5.9 | 19.1 | 33.8 | 46.4 | 56.6 | 61.5 | 58.8 | 49.2 | 36.8 | 21.4 | 9.2 | 33.5 | -- | | |
| Extreme minimum | -35 | -35 | -28 | -3 | 19 | 31 | 40 | 33 | 21 | 1 | -13 | -27 | -- | -- | -35 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 228 | 577 | 861 | 1066 | 992 | 663 | 347 | -- | -- | -- | 4734 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 69 | 310 | 561 | 756 | 682 | 369 | 136 | -- | -- | -- | 2883 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/6-8/25) | | | | | | | | | | | | | | 3493 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/22-10/26) | | | | | | | | | | | | | | 2578 | | |
| Heating degree days, $T_b$ = 65° | 1587 | 1338 | 1110 | 576 | 267 | 72 | 12 | 19 | 165 | 459 | 978 | 1401 | -- | 7984 | | |
| **PARK RAPIDS** | | | | | | | | | | | | | | | | |
| Extreme maximum | 58 | 60 | 80 | 90 | 105 | 101 | 107 | 103 | 99 | 88 | 69 | 60 | -- | -- | 107 | 158 |
| Average maximum | 17.7 | 22.2 | 33.8 | 50.9 | 65.3 | 74.5 | 81.9 | 78.5 | 68.6 | 56.3 | 35.1 | 22.3 | 50.6 | -- | | |
| Effective day temperature | 11.6 | 15.7 | 27.9 | 45.0 | 59.2 | 68.7 | 75.6 | 72.4 | 62.4 | 50.2 | 30.5 | 17.0 | 45.1 | -- | | |
| Normal | 5.6 | 9.5 | 21.9 | 39.4 | 53.2 | 62.9 | 69.2 | 66.7 | 56.1 | 44.8 | 26.2 | 12.3 | 39.0 | -- | | |
| Effective night temperature | -0.4 | 2.9 | 16.2 | 33.3 | 46.9 | 57.1 | 63.2 | 60.4 | 50.1 | 38.2 | 21.2 | 6.4 | 34.2 | -- | | |
| Average minimum | -6.5 | -3.6 | 10.3 | 27.4 | 40.8 | 51.3 | 56.9 | 54.3 | 43.9 | 32.1 | 16.6 | 1.1 | 28.7 | -- | | |
| Extreme minimum | -47 | -51 | -38 | -8 | 15 | 27 | 38 | 28 | 18 | -3 | -32 | -44 | -- | -- | -51 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 117 | 409 | 687 | 905 | 828 | 483 | 220 | -- | -- | -- | 3649 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 21 | 171 | 387 | 595 | 518 | 216 | 68 | -- | -- | -- | 1976 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/19-7/29) | | | | | | | | | | | | | | 1989 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/1-10/24) | | | | | | | | | | | | | | 1766 | | |
| Heating degree days, $T_b$ = 65° | 1841 | 1554 | 1336 | 768 | 378 | 126 | 37 | 59 | 282 | 626 | 1164 | 1634 | -- | 9805 | | |
| **PINE RIVER DAM** | | | | | | | | | | | | | | | | |
| Extreme maximum | 52 | 56 | 82 | 93 | 103 | 100 | 104 | 100 | 99 | 88 | 69 | 66 | -- | -- | 104 | 157 |
| Average maximum | 19.9 | 23.6 | 35.0 | 52.1 | 66.3 | 75.0 | 81.1 | 77.5 | 68.2 | 57.0 | 36.8 | 24.4 | 51.4 | -- | | |
| Effective day temperature | 14.1 | 17.3 | 29.1 | 46.0 | 59.8 | 68.9 | 75.0 | 71.6 | 62.4 | 51.2 | 32.5 | 19.3 | 45.8 | -- | | |
| Normal | 7.9 | 11.4 | 23.2 | 40.3 | 53.5 | 62.9 | 68.7 | 66.1 | 56.5 | 45.8 | 28.6 | 14.6 | 40.0 | -- | | |
| Effective night temperature | 2.5 | 4.7 | 17.5 | 33.8 | 46.7 | 56.8 | 62.6 | 59.9 | 50.7 | 39.6 | 23.7 | 9.3 | 34.6 | -- | | |
| Average minimum | -3.3 | -1.6 | 11.6 | 27.7 | 40.2 | 50.7 | 56.5 | 54.0 | 44.9 | 33.8 | 19.4 | 4.2 | 29.0 | -- | | |
| Extreme minimum | -53 | -50 | -41 | -8 | 4 | 24 | 32 | 29 | 17 | 0 | -21 | -47 | -- | -- | -53 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 129 | 419 | 687 | 890 | 809 | 495 | 239 | -- | -- | -- | 3668 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 24 | 171 | 387 | 580 | 499 | 225 | 77 | -- | -- | -- | 1963 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/22-7/27) | | | | | | | | | | | | | | 1923 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/4-10/21) | | | | | | | | | | | | | | 1702 | | |
| Heating degree days, $T_b$ = 65° | 1770 | 1501 | 1296 | 741 | 363 | 123 | 43 | 74 | 270 | 595 | 1092 | 1562 | -- | 9430 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **PIPESTONE** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 59 | 64 | 85 | 93 | 108 | 106 | 108 | 108 | 103 | 91 | 82 | 62 | -- | -- | 108 | 148 |
| Average maximum..... | 23.8 | 28.1 | 39.4 | 56.0 | 69.7 | 78.8 | 86.7 | 83.4 | 73.9 | 61.4 | 41.4 | 28.6 | 55.9 | -- | | |
| Effective day temperature... | 18.7 | 22.8 | 34.4 | 50.3 | 63.7 | 73.1 | 80.4 | 77.3 | 67.7 | 55.3 | 36.4 | 23.9 | 50.3 | -- | | |
| Normal..... | 13.0 | 16.9 | 28.3 | 44.1 | 57.2 | 67.0 | 73.4 | 71.1 | 60.9 | 49.0 | 31.1 | 19.2 | 44.3 | -- | | |
| Effective night temperature. | 8.4 | 12.0 | 24.3 | 38.8 | 51.8 | 61.7 | 67.6 | 65.1 | 55.3 | 43.0 | 26.3 | 14.5 | 39.1 | -- | | |
| Average minimum..... | 3.3 | 6.7 | 19.3 | 33.1 | 45.8 | 56.0 | 61.3 | 59.0 | 49.1 | 36.9 | 21.3 | 98 | 33.5 | -- | | |
| Extreme minimum..... | -40 | -38 | -26 | 5 | 20 | 30 | 38 | 32 | 15 | -3 | -13 | -34 | -- | -- | -40 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 186 | 533 | 810 | 1035 | 964 | 627 | 313 | -- | -- | -- | 4468 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 51 | 285 | 510 | 725 | 654 | 345 | 115 | -- | -- | -- | 2685 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/7-8/26)..... | | | | | | | | | | | | | | 3335 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/20-10/31)..... | | | | | | | | | | | | | | 2455 | | |
| Heating degree days, $T_b$ = 65° | 1612 | 1347 | 1138 | 627 | 298 | 93 | 22 | 31 | 189 | 502 | 1017 | 1420 | -- | 8296 | | |
| **POKEGAMA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 53 | 60 | 81 | 90 | 101 | 98 | 103 | 98 | 99 | 85 | 71 | 60 | -- | -- | 103 | 162 |
| Average maximum..... | 18.8 | 22.6 | 34.5 | 51.7 | 66.0 | 74.7 | 80.1 | 77.0 | 67.7 | 55.8 | 35.2 | 22.8 | 50.6 | -- | | |
| Effective day temperature... | 12.9 | 16.1 | 28.4 | 46.5 | 59.3 | 68.4 | 73.8 | 70.9 | 61.8 | 50.2 | 31.0 | 17.7 | 45.0 | -- | | |
| Normal..... | 6.7 | 10.1 | 22.2 | 39.7 | 52.7 | 62.1 | 67.5 | 65.4 | 55.7 | 45.0 | 27.4 | 12.9 | 39.0 | -- | | |
| Effective night temperature. | 1.0 | 2.9 | 16.1 | 33.1 | 45.9 | 55.7 | 61.0 | 58.9 | 49.8 | 38.9 | 22.7 | 7.5 | 33.9 | -- | | |
| Average minimum..... | -4.9 | -3.6 | 10.0 | 26.9 | 39.2 | 49.4 | 54.7 | 52.8 | 43.9 | 33.3 | 18.5 | 2.4 | 28.3 | -- | | |
| Extreme minimum..... | -57 | -59 | -49 | -17 | 12 | 20 | 33 | 27 | 12 | -1 | -45 | -57 | -- | -- | -59 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 117 | 394 | 663 | 853 | 787 | 471 | 217 | -- | -- | -- | 3502 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 24 | 136 | 363 | 543 | 477 | 201 | 65 | -- | -- | -- | 1809 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/20-7/9)..... | | | | | | | | | | | | | | 1347 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/11-10/18)..... | | | | | | | | | | | | | | 1499 | | |
| Heating degree days, $T_b$ = 65° | 1807 | 1537 | 1327 | 759 | 388 | 129 | 47 | 78 | 288 | 620 | 1128 | 1615 | -- | 9723 | | |
| **RED LAKE FALLS** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 53 | 53 | 77 | 93 | 102 | 103 | 110 | 99 | 96 | 90 | 73 | 57 | -- | -- | 110 | 160 |
| Average maximum..... | 15.0 | 18.2 | 32.1 | 52.0 | 67.8 | 75.8 | 82.8 | 80.4 | 70.2 | 56.6 | 35.0 | 21.5 | 50.6 | -- | | |
| Effective day temperature... | 9.8 | 12.6 | 27.0 | 46.3 | 61.3 | 69.6 | 76.2 | 73.9 | 63.9 | 50.8 | 30.5 | 16.5 | 45.3 | -- | | |
| Normal..... | 4.7 | 8.4 | 21.8 | 40.9 | 54.8 | 63.6 | 69.5 | 67.6 | 57.2 | 45.5 | 26.4 | 12.0 | 39.4 | -- | | |
| Effective night temperature. | -0.7 | 1.4 | 16.7 | 34.9 | 48.3 | 57.2 | 63.0 | 61.0 | 51.1 | 39.1 | 21.4 | 6.5 | 34.6 | -- | | |
| Average minimum..... | -5.9 | -4.2 | 11.6 | 29.2 | 41.8 | 51.0 | 56.4 | 54.5 | 44.8 | 33.3 | 16.9 | 1.5 | 29.3 | -- | | |
| Extreme minimum..... | -45 | -50 | -39 | -11 | 16 | 27 | 35 | 30 | 18 | -4 | -24 | -43 | -- | -- | -50 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 138 | 459 | 708 | 915 | 856 | 516 | 233 | -- | -- | -- | 3825 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 27 | 205 | 408 | 605 | 546 | 240 | 71 | -- | -- | -- | 2102 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/20-7/30)..... | | | | | | | | | | | | | | 2103 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/7-10/17)..... | | | | | | | | | | | | | | 1754 | | |
| Heating degree days, $T_b$ = 65° | 1869 | 1585 | 1339 | 723 | 335 | 111 | 31 | 50 | 255 | 605 | 1158 | 1643 | -- | 9704 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **RED LAKE INDIAN AGENCY** | | | | | | | | | | | | | | | | |
| Extreme maximum | 48 | 60 | 80 | 90 | 95 | 102 | 97 | 99 | 99 | 90 | 73 | 65 | -- | -- | 102 | 152 |
| Average maximum | 16.6 | 20.5 | 31.9 | 49.6 | 64.3 | 74.0 | 79.7 | 77.0 | 67.7 | 55.4 | 35.2 | 21.7 | 49.5 | -- | | |
| Effective day temperature | 11.1 | 14.4 | 26.2 | 44.1 | 58.4 | 68.3 | 74.0 | 71.5 | 62.2 | 50.3 | 30.9 | 16.8 | 44.4 | -- | | |
| Normal | 4.6 | 7.7 | 20.4 | 38.3 | 52.5 | 62.6 | 68.5 | 66.2 | 56.3 | 45.3 | 26.3 | 11.7 | 38.4 | -- | | |
| Effective night temperature | 0.0 | 2.4 | 14.8 | 33.1 | 46.6 | 57.0 | 62.5 | 60.5 | 51.2 | 39.9 | 22.5 | 6.8 | 34.3 | -- | | |
| Average minimum | -5.5 | -3.7 | 9.1 | 27.6 | 40.7 | 51.3 | 56.8 | 55.0 | 45.7 | 34.8 | 18.2 | 1.9 | 29.2 | -- | | |
| Extreme minimum | -46 | -50 | -38 | -7 | 17 | 27 | 35 | 28 | 18 | 0 | -27 | -44 | -- | -- | -50 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 96 | 387 | 678 | 883 | 812 | 489 | 226 | -- | -- | -- | 3571 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 12 | 152 | 378 | 573 | 502 | 216 | 71 | -- | -- | -- | 1904 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/20-7/24) | | | | | | | | | | | | | | 1783 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/5-10/27) | | | | | | | | | | | | | | 1677 | | |
| Heating degree days, $T_b$ = 65° | 1872 | 1604 | 1383 | 801 | 394 | 123 | 37 | 62 | 276 | 611 | 1161 | 1652 | -- | 9976 | | |
| **REDWOOD FALLS** | | | | | | | | | | | | | | | | |
| Extreme maximum | 64 | 59 | 86 | 94 | 107 | 108 | 110 | 105 | 105 | 93 | 76 | 70 | -- | -- | 110 | 143 |
| Average maximum | 24.5 | 28.6 | 39.9 | 57.2 | 72.1 | 80.9 | 87.6 | 84.4 | 75.7 | 63.5 | 41.6 | 28.6 | 57.1 | -- | | |
| Effective day temperature | 19.6 | 23.5 | 35.2 | 51.7 | 66.0 | 75.0 | 81.3 | 78.5 | 69.5 | 58.4 | 36.9 | 24.2 | 51.6 | -- | | |
| Normal | 13.9 | 17.8 | 29.6 | 46.0 | 59.3 | 68.7 | 74.3 | 72.1 | 62.4 | 50.8 | 32.3 | 19.7 | 45.6 | -- | | |
| Effective night temperature | 9.9 | 13.3 | 25.7 | 40.5 | 53.7 | 63.3 | 69.1 | 66.7 | 57.0 | 45.1 | 27.7 | 15.7 | 40.6 | -- | | |
| Average minimum | 5.0 | 8.2 | 21.0 | 35.0 | 47.6 | 57.4 | 62.6 | 60.8 | 50.8 | 39.0 | 23.0 | 10.9 | 35.1 | -- | | |
| Extreme minimum | -32 | -33 | -25 | 3 | 21 | 34 | 45 | 36 | 25 | 6 | -14 | -26 | -- | -- | -33 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 234 | 598 | 861 | 1063 | 995 | 672 | 360 | -- | -- | -- | 4783 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 72 | 329 | 561 | 753 | 685 | 381 | 143 | -- | -- | -- | 2924 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/4-9/5) | | | | | | | | | | | | | | 3839 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/13-11/2) | | | | | | | | | | | | | | 2731 | | |
| Heating degree days, $T_b$ = 65° | 1584 | 1322 | 1097 | 570 | 245 | 66 | 9 | 22 | 156 | 446 | 981 | 1404 | -- | 7902 | | |
| **ROCHESTER** | | | | | | | | | | | | | | | | |
| Extreme maximum | 58 | 60 | 77 | 87 | 106 | 105 | 108 | 100 | 98 | 87 | 75 | 63 | -- | -- | 108 | 148 |
| Average maximum | 23.0 | 26.1 | 36.8 | 55.0 | 68.4 | 78.0 | 84.0 | 81.7 | 72.3 | 60.4 | 39.9 | 27.3 | 54.4 | -- | | |
| Effective day temperature | 18.8 | 21.6 | 32.6 | 49.7 | 62.5 | 72.2 | 77.9 | 75.7 | 66.5 | 54.9 | 36.0 | 23.4 | 49.3 | -- | | |
| Normal | 14.6 | 17.2 | 28.4 | 44.5 | 56.7 | 66.5 | 71.8 | 69.8 | 60.7 | 49.4 | 32.0 | 19.6 | 44.3 | -- | | |
| Effective night temperature | 10.4 | 12.7 | 24.1 | 39.2 | 50.9 | 60.7 | 65.6 | 63.8 | 54.9 | 43.9 | 28.0 | 15.7 | 39.2 | -- | | |
| Average minimum | 6.2 | 8.2 | 19.9 | 33.9 | 45.0 | 54.9 | 59.5 | 57.8 | 49.1 | 38.4 | 24.1 | 11.8 | 34.1 | -- | | |
| Extreme minimum | -40 | -34 | -29 | 9 | 24 | 31 | 42 | 33 | 22 | 10 | -17 | -31 | -- | -- | -40 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 201 | 521 | 795 | 986 | 924 | 621 | 322 | -- | -- | -- | 4370 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 57 | 267 | 495 | 676 | 614 | 333 | 121 | -- | -- | -- | 2563 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/4-8/21) | | | | | | | | | | | | | | 3108 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/19-10/31) | | | | | | | | | | | | | | 2347 | | |
| Heating degree days, $T_b$ = 65° | 1562 | 1338 | 1135 | 615 | 301 | 96 | 25 | 34 | 186 | 490 | 990 | 1407 | -- | 8179 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **ROSEAU** | | | | | | | | | | | | | | | | |
| Extreme maximum | 50 | 55 | 81 | 92 | 101 | 102 | 107 | 98 | 98 | 87 | 69 | 52 | -- | -- | 107 | 159 |
| Average maximum | 13.3 | 17.8 | 31.2 | 50.3 | 66.2 | 74.8 | 81.3 | 78.3 | 68.0 | 54.6 | 32.8 | 19.0 | 49.0 | -- | | |
| Effective day temperature | 7.8 | 11.8 | 25.3 | 44.6 | 59.7 | 68.5 | 75.0 | 71.8 | 61.8 | 49.1 | 28.5 | 14.1 | 43.8 | -- | | |
| Normal | 2.4 | 6.5 | 19.6 | 39.0 | 53.0 | 62.3 | 68.1 | 65.5 | 55.2 | 44.0 | 24.7 | 9.5 | 37.5 | -- | | |
| Effective night temperature | -3.1 | -0.2 | 13.7 | 33.1 | 46.5 | 56.0 | 61.3 | 58.9 | 49.3 | 38.2 | 20.1 | 4.2 | 33.5 | -- | | |
| Average minimum | -8.6 | -6.2 | 7.8 | 27.4 | 40.0 | 49.7 | 55.0 | 52.4 | 43.1 | 32.7 | 15.8 | -0.7 | 28.3 | -- | | |
| Extreme minimum | -49 | -52 | -44 | -16 | 12 | 21 | 31 | 23 | 12 | -16 | -36 | -45 | -- | -- | -52 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 102 | 403 | 669 | 871 | 791 | 456 | 195 | -- | -- | -- | 3487 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 15 | 167 | 369 | 561 | 481 | 189 | 56 | -- | -- | -- | 1838 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/23-7/14) | | | | | | | | | | | | | | 1496 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/6-10/15) | | | | | | | | | | | | | | 1563 | | |
| Heating degree days, $T_b$ = 65° | 1941 | 1638 | 1407 | 780 | 384 | 129 | 40 | 71 | 303 | 651 | 1209 | 1721 | -- | 10274 | | |
| **SAINT CLOUD** | | | | | | | | | | | | | | | | |
| Extreme maximum | 55 | 58 | 81 | 91 | 105 | 102 | 107 | 105 | 106 | 90 | 71 | 63 | -- | -- | 107 | 149 |
| Average maximum | 20.4 | 24.3 | 35.3 | 53.6 | 67.4 | 76.6 | 83.1 | 80.5 | 70.7 | 58.9 | 38.1 | 25.7 | 52.9 | -- | | |
| Effective day temperature | 15.3 | 18.8 | 30.4 | 48.2 | 61.5 | 70.9 | 77.0 | 74.6 | 64.8 | 53.1 | 33.8 | 21.1 | 47.5 | -- | | |
| Normal | 10.1 | 13.4 | 25.6 | 42.8 | 55.6 | 65.2 | 71.0 | 68.6 | 58.8 | 47.3 | 29.5 | 16.6 | 42.0 | -- | | |
| Effective night temperature | 4.9 | 8.0 | 20.7 | 37.3 | 49.6 | 59.5 | 65.0 | 62.6 | 52.8 | 41.4 | 25.1 | 12.0 | 36.6 | -- | | |
| Average minimum | -0.2 | 2.5 | 15.8 | 31.9 | 43.7 | 53.8 | 58.9 | 56.7 | 46.9 | 35.6 | 20.8 | 7.4 | 31.2 | -- | | |
| Extreme minimum | -42 | -35 | -32 | 2 | 18 | 33 | 41 | 34 | 18 | 6 | -23 | -32 | -- | -- | -42 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 174 | 484 | 756 | 961 | 887 | 564 | 276 | -- | -- | -- | 4102 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 48 | 233 | 456 | 651 | 577 | 288 | 124 | -- | -- | -- | 2377 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/7-8/31) | | | | | | | | | | | | | | 3227 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/17-11/3) | | | | | | | | | | | | | | 2209 | | |
| Heating degree days, $T_b$ = 65° | 1702 | 1445 | 1221 | 666 | 326 | 105 | 28 | 47 | 225 | 549 | 1065 | 1500 | -- | 8879 | | |
| **SAINT PETER** | | | | | | | | | | | | | | | | |
| Extreme maximum | 65 | 68 | 84 | 92 | 107 | 104 | 109 | 104 | 103 | 91 | 77 | 67 | -- | -- | 109 | 149 |
| Average maximum | 25.2 | 28.8 | 40.3 | 58.1 | 71.1 | 80.7 | 86.7 | 84.0 | 75.1 | 63.5 | 42.5 | 29.3 | 57.1 | -- | | |
| Effective day temperature | 20.4 | 23.7 | 35.6 | 52.6 | 65.2 | 75.0 | 80.6 | 78.0 | 69.1 | 57.4 | 37.9 | 24.9 | 51.7 | -- | | |
| Normal | 15.2 | 18.8 | 30.5 | 47.1 | 59.4 | 69.3 | 74.3 | 72.0 | 62.8 | 51.4 | 33.5 | 20.9 | 46.3 | -- | | |
| Effective night temperature | 10.8 | 13.5 | 26.2 | 41.5 | 53.4 | 63.6 | 68.4 | 65.9 | 57.0 | 45.4 | 28.7 | 16.2 | 40.9 | -- | | |
| Average minimum | 6.0 | 8.4 | 21.5 | 36.0 | 47.5 | 57.9 | 62.3 | 59.9 | 51.0 | 39.3 | 24.1 | 11.8 | 35.5 | -- | | |
| Extreme minimum | -40 | -36 | -30 | -5 | 21 | 32 | 34 | 34 | 21 | 4 | -22 | -31 | -- | -- | -40 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 258 | 601 | 879 | 1063 | 992 | 684 | 372 | -- | -- | -- | 4849 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 84 | 329 | 579 | 753 | 682 | 390 | 155 | -- | -- | -- | 2972 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/2-8/24) | | | | | | | | | | | | | | 3560 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/19-11/1) | | | | | | | | | | | | | | 2701 | | |
| Heating degree days, $T_b$ = 65° | 1544 | 1294 | 1070 | 537 | 248 | 66 | 9 | 19 | 150 | 434 | 945 | 1367 | -- | 7683 | | |

Appendix Table 1. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **SANDY LAKE DAM** | | | | | | | | | | | | | | | | |
| Extreme maximum | 54 | 56 | 78 | 86 | 101 | 97 | 100 | 99 | 95 | 86 | 70 | 60 | -- | -- | 101 | 153 |
| Average maximum | 19.5 | 23.0 | 34.0 | 50.9 | 65.3 | 74.0 | 79.4 | 76.2 | 67.4 | 55.8 | 35.9 | 23.9 | 50.4 | -- | | |
| Effective day temperature | 14.2 | 17.1 | 28.5 | 45.3 | 59.2 | 68.3 | 73.6 | 70.7 | 61.8 | 50.5 | 31.8 | 19.2 | 45.1 | -- | | |
| Normal | 8.7 | 11.6 | 22.9 | 40.1 | 53.3 | 62.5 | 67.8 | 65.6 | 56.2 | 45.6 | 28.1 | 14.7 | 39.8 | -- | | |
| Effective night temperature | 3.5 | 5.4 | 17.6 | 34.2 | 47.2 | 56.7 | 62.1 | 59.8 | 50.7 | 39.9 | 23.6 | 9.7 | 34.5 | -- | | |
| Average minimum | -1.8 | -0.5 | 12.1 | 28.6 | 41.1 | 51.0 | 56.3 | 54.3 | 45.1 | 34.6 | 19.5 | 5.0 | 29.2 | -- | | |
| Extreme minimum | -52 | -49 | -40 | -9 | 13 | 27 | 35 | 27 | 17 | 3 | -32 | -45 | -- | -- | -52 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 126 | 412 | 675 | 862 | 794 | 486 | 236 | -- | -- | -- | 3591 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 24 | 152 | 375 | 552 | 484 | 216 | 74 | -- | -- | -- | 1877 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/18-7/29) | | | | | | | | | | | | | | 1948 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/7-10/23) | | | | | | | | | | | | | | 1604 | | |
| Heating degree days, $T_b$ = 65° | 1745 | 1495 | 1305 | 747 | 369 | 123 | 47 | 81 | 279 | 601 | 1107 | 1559 | -- | 9458 | | |
| **TRACY** | | | | | | | | | | | | | | | | |
| Extreme maximum | 61 | 65 | 83 | 94 | 107 | 105 | 108 | 105 | 105 | 93 | 77 | 69 | -- | -- | 108 | 141 |
| Average maximum | 24.2 | 28.2 | 39.2 | 56.9 | 70.9 | 79.9 | 86.8 | 83.9 | 75.5 | 63.1 | 42.0 | 29.1 | 56.6 | -- | | |
| Effective day temperature | 19.5 | 23.3 | 34.5 | 51.2 | 64.9 | 74.1 | 80.6 | 77.8 | 69.3 | 57.1 | 37.3 | 24.6 | 51.1 | -- | | |
| Normal | 14.8 | 18.7 | 29.6 | 45.9 | 59.8 | 68.6 | 74.4 | 72.2 | 63.0 | 51.4 | 32.9 | 20.7 | 45.9 | -- | | |
| Effective night temperature | 10.1 | 13.4 | 25.1 | 40.0 | 53.0 | 62.4 | 68.1 | 65.6 | 56.8 | 45.2 | 27.9 | 15.7 | 40.3 | -- | | |
| Average minimum | 5.4 | 8.5 | 20.4 | 34.3 | 47.0 | 56.6 | 61.9 | 59.5 | 50.6 | 39.2 | 23.2 | 11.2 | 34.8 | -- | | |
| Extreme minimum | -33 | -30 | -22 | 4 | 20 | 33 | 44 | 22 | 22 | 2 | -19 | -26 | -- | -- | -33 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 228 | 586 | 858 | 1066 | 998 | 690 | 372 | -- | -- | -- | 4798 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 69 | 322 | 558 | 756 | 688 | 396 | 152 | -- | -- | -- | 2941 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/6-9/8) | | | | | | | | | | | | | | 3881 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/17-11/1) | | | | | | | | | | | | | | 2705 | | |
| Heating degree days, $T_b$ = 65° | 1556 | 1296 | 1097 | 573 | 260 | 75 | 12 | 22 | 150 | 434 | 963 | 1373 | -- | 7811 | | |
| **TWO HARBORS** | | | | | | | | | | | | | | | | |
| Extreme maximum | 57 | 59 | 75 | 85 | 90 | 98 | 99 | 99 | 92 | 83 | 70 | 62 | -- | -- | 99 | 135 |
| Average maximum | 23.9 | 26.0 | 34.6 | 47.9 | 59.7 | 68.1 | 75.7 | 74.6 | 66.2 | 55.3 | 38.3 | 28.2 | 49.9 | -- | | |
| Effective day temperature | 19.5 | 21.3 | 30.5 | 43.5 | 54.3 | 62.2 | 69.9 | 69.8 | 61.5 | 51.5 | 34.8 | 24.1 | 45.2 | -- | | |
| Normal | 14.8 | 16.7 | 26.3 | 39.4 | 49.1 | 56.7 | 64.4 | 65.3 | 56.8 | 46.8 | 31.6 | 19.8 | 40.6 | -- | | |
| Effective night temperature | 10.6 | 11.9 | 22.2 | 34.6 | 43.6 | 50.5 | 58.3 | 60.2 | 52.3 | 41.8 | 28.0 | 16.0 | 35.9 | -- | | |
| Average minimum | 6.2 | 7.2 | 18.1 | 30.2 | 38.2 | 44.6 | 52.5 | 55.4 | 47.6 | 38.0 | 24.5 | 11.9 | 31.2 | -- | | |
| Extreme minimum | -36 | -36 | -23 | 3 | 9 | 29 | 37 | 37 | 23 | 10 | -18 | -33 | -- | -- | -36 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 111 | 282 | 501 | 756 | 784 | 504 | 260 | -- | -- | -- | 3198 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 18 | 71 | 216 | 446 | 474 | 225 | 84 | -- | -- | -- | 1534 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/8-7/30) | | | | | | | | | | | | | | 1599 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/24-11/6) | | | | | | | | | | | | | | 1463 | | |
| Heating degree days, $T_b$ = 65° | 1556 | 1352 | 1200 | 768 | 493 | 258 | 90 | 81 | 261 | 564 | 1002 | 1401 | -- | 9026 | | |

Appendix Table 1. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **VIRGINIA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 53 | 61 | 81 | 91 | 96 | 102 | 103 | 97 | 99 | 88 | 68 | 56 | -- | -- | 103 | 148 |
| Average maximum..... | 18.4 | 22.7 | 34.6 | 51.5 | 66.4 | 75.0 | 81.1 | 77.0 | 67.7 | 55.3 | 34.4 | 21.9 | 50.5 | -- | | |
| Effective day temperature... | 13.3 | 16.9 | 29.0 | 46.5 | 59.7 | 68.6 | 74.6 | 70.9 | 61.7 | 49.7 | 30.3 | 17.4 | 44.9 | -- | | |
| Normal..... | 8.3 | 11.9 | 23.5 | 39.9 | 53.0 | 62.5 | 68.1 | 65.4 | 55.7 | 44.9 | 26.8 | 13.1 | 39.4 | -- | | |
| Effective night temperature. | 2.9 | 5.3 | 17.8 | 33.5 | 46.1 | 55.7 | 61.5 | 58.8 | 49.8 | 38.6 | 22.2 | 8.2 | 33.7 | -- | | |
| Average minimum..... | -2.2 | -0.5 | 12.2 | 27.5 | 39.4 | 49.3 | 55.0 | 52.7 | 43.8 | 33.0 | 18.1 | 3.7 | 28.1 | -- | | |
| Extreme minimum..... | -45 | -44 | -31 | -8 | 11 | 27 | 35 | 25 | 18 | -1 | -36 | -41 | -- | -- | -45 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 123 | 403 | 675 | 871 | 787 | 471 | 214 | -- | -- | -- | 3544 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 27 | 136 | 375 | 561 | 477 | 198 | 62 | -- | -- | -- | 1836 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/22-7/18)..... | | | | | | | | | | | | | | 1620 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/4-10/25)..... | | | | | | | | | | | | | | 1621 | | |
| Heating degree days, $T_b$ = 65° | 1758 | 1487 | 1287 | 753 | 372 | 117 | 40 | 78 | 288 | 623 | 1146 | 1609 | -- | 9558 | | |
| **WADENA** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 58 | 55 | 79 | 88 | 104 | 100 | 112 | 103 | 104 | 89 | 71 | 65 | -- | -- | 112 | 155 |
| Average maximum..... | 19.1 | 22.9 | 35.6 | 53.2 | 68.1 | 76.7 | 83.9 | 80.8 | 70.6 | 58.4 | 37.2 | 23.7 | 52.5 | -- | | |
| Effective day temperature... | 13.6 | 17.0 | 30.4 | 47.5 | 61.8 | 71.6 | 77.4 | 74.5 | 64.4 | 52.7 | 32.7 | 18.8 | 46.9 | -- | | |
| Normal..... | 8.2 | 11.8 | 24.9 | 42.0 | 55.4 | 64.9 | 70.8 | 68.2 | 58.0 | 46.3 | 28.2 | 14.4 | 41.1 | -- | | |
| Effective night temperature. | 2.6 | 5.4 | 20.1 | 36.0 | 49.0 | 58.2 | 64.5 | 61.9 | 51.9 | 41.3 | 23.7 | 8.8 | 35.6 | -- | | |
| Average minimum..... | -2.9 | -0.5 | 14.9 | 30.3 | 42.7 | 52.1 | 58.0 | 55.6 | 45.7 | 35.6 | 19.2 | 3.9 | 30.0 | -- | | |
| Extreme minimum..... | -42 | -43 | -33 | -3 | 17 | 28 | 37 | 32 | 18 | -4 | -35 | -33 | -- | -- | -43 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 159 | 477 | 747 | 955 | 874 | 540 | 254 | -- | -- | -- | 4006 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 42 | 220 | 447 | 645 | 564 | 264 | 87 | -- | -- | -- | 2269 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-8/14)..... | | | | | | | | | | | | | | 2674 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/28-10/21)..... | | | | | | | | | | | | | | 2004 | | |
| Heating degree days, $T_b$ = 65° | 1761 | 1490 | 1243 | 690 | 326 | 99 | 28 | 43 | 237 | 580 | 1104 | 1569 | -- | 9170 | | |
| **WALKER** | | | | | | | | | | | | | | | | |
| Extreme maximum..... | 52 | 59 | 83 | 86 | 98 | 97 | 105 | 102 | 99 | 86 | 69 | 59 | -- | -- | 105 | 148 |
| Average maximum..... | 18.5 | 22.5 | 34.6 | 51.9 | 66.0 | 74.7 | 80.5 | 77.5 | 68.3 | 56.4 | 35.6 | 23.4 | 50.8 | -- | | |
| Effective day temperature... | 13.4 | 17.0 | 29.3 | 46.3 | 60.1 | 69.2 | 75.0 | 72.1 | 62.8 | 51.1 | 31.5 | 18.7 | 45.6 | -- | | |
| Normal..... | 8.2 | 12.0 | 23.8 | 40.7 | 54.1 | 63.4 | 69.0 | 66.9 | 57.0 | 46.3 | 27.7 | 14.2 | 40.3 | -- | | |
| Effective night temperature. | 3.3 | 6.0 | 18.9 | 35.0 | 48.2 | 58.0 | 63.8 | 61.4 | 51.9 | 40.7 | 23.4 | 9.2 | 35.2 | -- | | |
| Average minimum..... | -1.8 | 0.5 | 13.6 | 29.4 | 42.3 | 52.5 | 58.3 | 56.0 | 46.4 | 35.4 | 19.3 | 4.5 | 30.0 | -- | | |
| Extreme minimum..... | -43 | -40 | -33 | -6 | 15 | 30 | 36 | 33 | 23 | 4 | -21 | -40 | -- | -- | -43 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 138 | 437 | 702 | 899 | 834 | 510 | 251 | -- | -- | -- | 3771 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 33 | 183 | 402 | 589 | 524 | 240 | 81 | -- | -- | -- | 2052 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/17-7/30)..... | | | | | | | | | | | | | | 2077 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/26-10/30)..... | | | | | | | | | | | | | | 1866 | | |
| Heating degree days, $T_b$ = 65° | 1761 | 1484 | 1277 | 729 | 350 | 111 | 37 | 59 | 261 | 580 | 1119 | 1575 | -- | 9343 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **WARROAD** | | | | | | | | | | | | | | | | |
| Extreme maximum | 50 | 56 | 81 | 90 | 99 | 102 | 103 | 97 | 96 | 86 | 70 | 53 | -- | -- | 103 | 158 |
| Average maximum | 14.2 | 18.8 | 31.8 | 48.8 | 63.6 | 72.8 | 79.6 | 77.1 | 67.0 | 54.9 | 33.5 | 20.0 | 48.5 | -- | | |
| Effective day temperature | 8.5 | 12.5 | 25.7 | 43.3 | 57.8 | 67.3 | 73.7 | 71.2 | 61.3 | 49.5 | 29.2 | 14.9 | 43.6 | -- | | |
| Normal | 3.0 | 6.9 | 19.6 | 38.0 | 52.0 | 61.9 | 67.9 | 65.6 | 55.3 | 44.5 | 25.5 | 10.2 | 37.5 | -- | | |
| Effective night temperature | -3.0 | -0.2 | 13.5 | 32.3 | 46.3 | 56.3 | 61.7 | 59.5 | 49.8 | 38.6 | 20.8 | 4.6 | 33.6 | -- | | |
| Average minimum | -8.7 | -6.5 | 7.4 | 26.8 | 40.5 | 50.8 | 55.8 | 53.6 | 44.1 | 33.2 | 16.5 | -0.5 | 28.7 | -- | | |
| Extreme minimum | -55 | -55 | -42 | -18 | 14 | 28 | 32 | 29 | 17 | -12 | -30 | -50 | -- | -- | -55 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 60 | 372 | 657 | 865 | 794 | 459 | 208 | -- | -- | -- | 3415 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 9 | 139 | 357 | 555 | 484 | 192 | 62 | -- | -- | -- | 1798 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/21-7/19) | | | | | | | | | | | | | | 1579 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (6/5-10/23) | | | | | | | | | | | | | | 1584 | | |
| Heating degree days, $T_b$ = 65° | 1922 | 1627 | 1407 | 810 | 409 | 135 | 43 | 71 | 300 | 636 | 1185 | 1699 | -- | 10244 | | |
| **WASECA** | | | | | | | | | | | | | | | | |
| Extreme maximum | 62 | 63 | 80 | 90 | 106 | 105 | 106 | 101 | 100 | 91 | 77 | 61 | -- | -- | 106 | 143 |
| Average maximum | 24.4 | 27.8 | 39.2 | 57.1 | 70.6 | 79.6 | 85.4 | 82.5 | 74.2 | 62.3 | 41.9 | 28.4 | 56.1 | -- | | |
| Effective day temperature | 19.7 | 23.0 | 34.6 | 51.5 | 64.7 | 73.8 | 79.3 | 76.6 | 68.2 | 56.4 | 37.3 | 24.1 | 50.8 | -- | | |
| Normal | 14.8 | 18.3 | 29.5 | 46.1 | 58.7 | 68.1 | 72.9 | 70.9 | 62.0 | 50.7 | 32.8 | 20.2 | 45.4 | -- | | |
| Effective night temperature | 10.3 | 13.4 | 25.5 | 40.3 | 52.7 | 62.3 | 67.1 | 64.7 | 56.1 | 44.7 | 28.2 | 15.6 | 40.0 | -- | | |
| Average minimum | 5.6 | 8.6 | 20.9 | 34.7 | 46.8 | 56.5 | 61.0 | 58.8 | 50.1 | 38.8 | 23.6 | 11.3 | 34.7 | -- | | |
| Extreme minimum | -37 | -33 | -27 | -3 | 22 | 32 | 39 | 34 | 20 | -1 | -18 | -32 | -- | -- | -37 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 234 | 580 | 843 | 1020 | 958 | 660 | 357 | -- | -- | -- | 4652 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 72 | 310 | 543 | 710 | 648 | 369 | 143 | -- | -- | -- | 2795 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/5-8/23) | | | | | | | | | | | | | | 3356 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/22-10/29) | | | | | | | | | | | | | | 2499 | | |
| Heating degree days, $T_b$ = 65° | 1556 | 1308 | 1101 | 567 | 264 | 78 | 22 | 31 | 159 | 450 | 966 | 1389 | -- | 7891 | | |
| **WHEATON** | | | | | | | | | | | | | | | | |
| Extreme maximum | 58 | 64 | 80 | 93 | 106 | 106 | 113 | 109 | 108 | 95 | 81 | 74 | -- | -- | 113 | 151 |
| Average maximum | 21.4 | 25.2 | 37.3 | 56.2 | 71.5 | 80.8 | 87.7 | 85.3 | 75.9 | 62.4 | 39.9 | 26.5 | 55.8 | -- | | |
| Effective day temperature | 16.3 | 19.9 | 32.4 | 50.3 | 64.9 | 74.3 | 80.8 | 78.4 | 69.0 | 55.8 | 35.1 | 21.8 | 49.9 | -- | | |
| Normal | 11.6 | 15.4 | 28.1 | 45.0 | 58.4 | 67.8 | 73.8 | 72.0 | 62.1 | 49.7 | 31.2 | 17.9 | 44.4 | -- | | |
| Effective night temperature | 13.1 | 9.5 | 22.6 | 38.6 | 51.6 | 61.2 | 67.0 | 64.7 | 54.9 | 42.7 | 25.5 | 12.4 | 38.0 | -- | | |
| Average minimum | 0.8 | 4.2 | 17.7 | 32.7 | 45.0 | 54.7 | 60.1 | 57.8 | 48.0 | 36.1 | 20.7 | 7.7 | 32.1 | -- | | |
| Extreme minimum | -38 | -35 | -30 | -7 | 14 | 31 | 38 | 31 | 18 | -4 | -17 | -33 | -- | -- | -38 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 210 | 570 | 834 | 1048 | 992 | 663 | 338 | -- | -- | -- | 4655 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 83 | 307 | 536 | 738 | 682 | 366 | 133 | -- | -- | -- | 2823 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/13-8/18) | | | | | | | | | | | | | | 3163 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/19-10/25) | | | | | | | | | | | | | | 2552 | | |
| Heating degree days, $T_b$ = 65° | 1655 | 1369 | 1144 | 690 | 264 | 72 | 9 | 19 | 162 | 481 | 1014 | 1460 | -- | 8269 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **WILLMAR** | | | | | | | | | | | | | | | | |
| Extreme maximum | 51 | 69 | 79 | 91 | 105 | 103 | 107 | 102 | 105 | 91 | 73 | 64 | -- | -- | 107 | 145 |
| Average maximum | 20.6 | 24.4 | 36.0 | 54.2 | 69.1 | 78.2 | 85.0 | 81.8 | 73.1 | 60.3 | 38.7 | 25.4 | 53.9 | -- | | |
| Effective day temperature | 16.0 | 19.7 | 31.7 | 49.1 | 63.4 | 72.7 | 79.0 | 76.0 | 67.1 | 54.6 | 34.5 | 21.3 | 49.0 | -- | | |
| Normal | 11.4 | 15.3 | 27.3 | 44.3 | 57.8 | 67.3 | 72.9 | 70.5 | 61.1 | 49.3 | 30.6 | 17.7 | 43.8 | -- | | |
| Effective night temperature | 6.9 | 10.1 | 23.3 | 39.1 | 51.9 | 61.7 | 67.1 | 64.4 | 55.2 | 43.2 | 26.0 | 12.9 | 38.2 | -- | | |
| Average minimum | 2.3 | 5.4 | 19.0 | 34.0 | 46.2 | 56.2 | 61.1 | 58.6 | 49.2 | 37.5 | 21.8 | 8.8 | 33.3 | -- | | |
| Extreme minimum | -37 | -38 | -31 | -5 | 21 | 32 | 39 | 33 | 20 | -1 | -22 | -35 | -- | -- | -38 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 201 | 552 | 819 | 1020 | 945 | 633 | 322 | -- | -- | -- | 4492 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 57 | 291 | 519 | 710 | 635 | 345 | 124 | -- | -- | -- | 2681 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/8-9/3) | | | | | | | | | | | | | | 3493 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/18-10/30) | | | | | | | | | | | | | | 2456 | | |
| Heating degree days, $T_b$ = 65° | 1662 | 1392 | 1169 | 621 | 273 | 81 | 22 | 31 | 183 | 493 | 1032 | 1466 | -- | 8425 | | |
| **WINNEBAGO** | | | | | | | | | | | | | | | | |
| Extreme maximum | 63 | 61 | 80 | 95 | 106 | 104 | 107 | 106 | 100 | 93 | 80 | 63 | -- | -- | 107 | 142 |
| Average maximum | 23.9 | 27.5 | 39.2 | 56.3 | 69.6 | 78.7 | 85.1 | 82.3 | 73.8 | 62.1 | 41.6 | 28.5 | 55.7 | -- | | |
| Effective day temperature | 19.2 | 22.6 | 34.5 | 50.8 | 63.9 | 73.3 | 79.3 | 76.5 | 67.8 | 56.2 | 37.0 | 24.2 | 50.4 | -- | | |
| Normal | 14.3 | 17.8 | 28.9 | 45.2 | 58.1 | 67.9 | 73.3 | 70.9 | 61.7 | 50.2 | 32.5 | 20.1 | 45.1 | -- | | |
| Effective night temperature | 10.0 | 13.0 | 24.9 | 39.6 | 52.5 | 62.6 | 67.7 | 64.8 | 55.9 | 44.3 | 27.9 | 15.6 | 39.9 | -- | | |
| Average minimum | 5.3 | 8.1 | 20.2 | 34.1 | 46.8 | 57.2 | 61.9 | 59.0 | 49.9 | 38.4 | 23.3 | 11.3 | 34.6 | -- | | |
| Extreme minimum | -35 | -31 | -25 | 0 | 23 | 32 | 38 | 32 | 22 | 0 | -11 | -26 | -- | -- | -35 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 207 | 561 | 837 | 1032 | 958 | 651 | 341 | -- | -- | -- | 4587 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 60 | 298 | 537 | 722 | 648 | 363 | 130 | -- | -- | -- | 2758 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/4-9/6) | | | | | | | | | | | | | | 3704 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/15-11/3) | | | | | | | | | | | | | | 2544 | | |
| Heating degree days, $T_b$ = 65° | 1572 | 1322 | 1119 | 594 | 248 | 51 | 6 | 19 | 153 | 465 | 975 | 1392 | -- | 7916 | | |
| **WINNIBIGOSHISH** | | | | | | | | | | | | | | | | |
| Extreme maximum | 52 | 58 | 80 | 87 | 100 | 99 | 103 | 99 | 100 | 85 | 70 | 55 | -- | -- | 103 | 152 |
| Average maximum | 17.4 | 21.6 | 33.6 | 50.7 | 65.7 | 74.3 | 79.9 | 76.7 | 66.6 | 55.3 | 34.5 | 22.0 | 49.9 | -- | | |
| Effective day temperature | 11.5 | 15.4 | 28.1 | 45.0 | 59.4 | 68.5 | 74.2 | 71.0 | 61.5 | 50.2 | 30.7 | 17.2 | 44.4 | -- | | |
| Normal | 6.7 | 10.2 | 22.2 | 39.5 | 53.5 | 63.2 | 68.9 | 66.6 | 56.6 | 45.6 | 27.3 | 13.0 | 39.4 | -- | | |
| Effective night temperature | -0.4 | 3.1 | 16.9 | 33.7 | 46.8 | 56.8 | 62.7 | 59.6 | 51.5 | 40.1 | 23.2 | 7.6 | 33.5 | -- | | |
| Average minimum | -6.3 | -3.1 | 11.4 | 28.0 | 40.5 | 51.0 | 57.0 | 53.9 | 46.4 | 35.0 | 19.4 | 2.8 | 28.0 | -- | | |
| Extreme minimum | -46 | -49 | -40 | -11 | 16 | 29 | 40 | 31 | 22 | 4 | -29 | -45 | -- | -- | -49 | |
| Growing degree days, $T_b$ = 40° | -- | -- | -- | 117 | 419 | 696 | 896 | 825 | 498 | 236 | -- | -- | -- | 3687 | | |
| Growing degree days, $T_b$ = 50° | -- | -- | -- | 24 | 158 | 396 | 586 | 515 | 228 | 74 | -- | -- | -- | 1981 | | |
| Growing degree days, $T_b$ = 40° Early spring through summer (4/17-7/25) | | | | | | | | | | | | | | 1895 | | |
| Growing degree days, $T_b$ = 50° Late spring through late fall (5/30-10/27) | | | | | | | | | | | | | | 1797 | | |
| Heating degree days, $T_b$ = 65° | 1807 | 1534 | 1327 | 765 | 363 | 108 | 34 | 59 | 267 | 601 | 1131 | 1612 | -- | 9608 | | |

Appendix Table 2. Monthly temperature summary (Cont.)

| | Months | | | | | | | | | | | | | | Temperature | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D | Ave. | Total | Extreme | Range |
| **WINONA** | | | | | | | | | | | | | | | | |
| Extreme maximum | 64 | 67 | 84 | 96 | 107 | 106 | 108 | 103 | 102 | 92 | 84 | 61 | -- | -- | 108 | 148 |
| Average maximum | 27.3 | 30.2 | 41.5 | 58.8 | 71.8 | 81.4 | 87.0 | 83.6 | 75.2 | 66.3 | 43.8 | 30.6 | 58.1 | -- | | |
| Effective day temperature | 22.8 | 25.5 | 36.9 | 53.5 | 66.4 | 76.1 | 81.4 | 78.3 | 69.7 | 60.2 | 39.8 | 26.8 | 53.1 | -- | | |
| Normal | 17.8 | 20.5 | 31.4 | 47.7 | 60.4 | 70.3 | 75.1 | 72.7 | 63.7 | 52.2 | 35.5 | 22.8 | 47.5 | -- | | |
| Effective night temperature | 13.9 | 16.1 | 27.8 | 43.0 | 55.5 | 65.7 | 70.2 | 67.6 | 58.7 | 48.2 | 31.7 | 19.1 | 43.1 | -- | | |
| Average minimum | 9.4 | 11.4 | 23.2 | 37.7 | 50.1 | 60.4 | 64.6 | 62.3 | 53.2 | 42.1 | 27.7 | 15.3 | 38.1 | -- | | |
| Extreme minimum | -40 | -33 | -28 | 4 | 21 | 35 | 43 | 33 | 25 | 5 | -19 | -25 | -- | -- | -40 | |
| Growing degree days, $T_b = 40^\circ$ | -- | -- | -- | 270 | 632 | 909 | 1088 | 1014 | 711 | 394 | -- | -- | -- | 5018 | | |
| Growing degree days, $T_b = 50^\circ$ | -- | -- | -- | 93 | 347 | 609 | 778 | 704 | 411 | 167 | -- | -- | -- | 3109 | | |
| Growing degree days, $T_b = 40^\circ$ Early spring through summer (3/28-9/9) | | | | | | | | | | | | | | 4126 | | |
| Growing degree days, $T_b = 50^\circ$ Late spring through late fall (5/11-11/11) | | | | | | | | | | | | | | 2904 | | |
| Heating degree days, $T_b = 65^\circ$ | 1463 | 1246 | 1042 | 519 | 220 | 54 | 0 | 12 | 126 | 409 | 885 | 1308 | -- | 7284 | | |
| **WORTHINGTON** | | | | | | | | | | | | | | | | |
| Extreme maximum | 62 | 64 | 81 | 89 | 100 | 102 | 110 | 107 | 102 | 92 | 78 | 65 | -- | -- | 110 | 147 |
| Average maximum | 24.4 | 27.7 | 38.6 | 55.8 | 69.5 | 78.3 | 85.1 | 82.0 | 73.2 | 61.4 | 41.3 | 28.6 | 55.5 | -- | | |
| Effective day temperature | 19.8 | 23.0 | 34.0 | 50.4 | 63.7 | 72.9 | 79.2 | 76.3 | 67.4 | 55.6 | 36.8 | 24.4 | 50.3 | -- | | |
| Normal | 14.6 | 18.0 | 28.5 | 44.8 | 57.6 | 67.3 | 72.9 | 70.7 | 61.2 | 49.6 | 32.1 | 20.3 | 44.8 | -- | | |
| Effective night temperature | 10.7 | 13.6 | 24.8 | 39.5 | 52.1 | 62.0 | 67.3 | 64.9 | 55.7 | 43.9 | 27.8 | 16.0 | 39.9 | -- | | |
| Average minimum | 6.1 | 8.9 | 20.2 | 34.1 | 46.3 | 56.6 | 61.4 | 59.2 | 49.9 | 38.1 | 23.3 | 11.8 | 34.7 | -- | | |
| Extreme minimum | -36 | -37 | -23 | 6 | 21 | 33 | 40 | 33 | 22 | 0 | -13 | -30 | -- | -- | -37 | |
| Growing degree days, $T_b = 40^\circ$ | -- | -- | -- | 198 | 546 | 819 | 1020 | 952 | 636 | 329 | -- | -- | -- | 4500 | | |
| Growing degree days, $T_b = 50^\circ$ | -- | -- | -- | 54 | 298 | 519 | 710 | 642 | 351 | 124 | -- | -- | -- | 2698 | | |
| Growing degree days, $T_b = 40^\circ$ Early spring through summer (4/6-8/31) | | | | | | | | | | | | | | 3502 | | |
| Growing degree days, $T_b = 50^\circ$ Late spring through late fall (5/17-10/31) | | | | | | | | | | | | | | 2486 | | |
| Heating degree days, $T_b = 65^\circ$ | 1562 | 1316 | 1132 | 606 | 285 | 84 | 31 | 28 | 180 | 484 | 987 | 1386 | -- | 8081 | | |
| **ZUMBROTA** | | | | | | | | | | | | | | | | |
| Extreme maximum | 58 | 63 | 82 | 89 | 106 | 103 | 109 | 105 | 100 | 87 | 78 | 66 | -- | -- | 109 | 154 |
| Average maximum | 25.2 | 27.9 | 38.6 | 56.8 | 70.5 | 79.3 | 85.7 | 82.9 | 74.0 | 61.9 | 42.1 | 28.9 | 56.2 | -- | | |
| Effective day temperature | 20.1 | 22.6 | 33.8 | 51.0 | 64.3 | 73.4 | 79.2 | 76.6 | 67.7 | 55.8 | 37.5 | 24.4 | 50.6 | -- | | |
| Normal | 15.0 | 18.1 | 29.2 | 45.7 | 58.1 | 67.5 | 72.6 | 70.6 | 61.5 | 50.2 | 33.0 | 20.3 | 45.2 | -- | | |
| Effective night temperature | 10.1 | 12.2 | 24.3 | 39.4 | 51.8 | 61.5 | 66.2 | 64.0 | 55.2 | 43.8 | 28.3 | 15.3 | 39.3 | -- | | |
| Average minimum | 5.0 | 6.9 | 19.5 | 33.6 | 45.6 | 55.6 | 59.7 | 57.7 | 48.9 | 37.7 | 23.7 | 10.8 | 33.7 | -- | | |
| Extreme minimum | -45 | -34 | -36 | 0 | 19 | 28 | 38 | 32 | 20 | 3 | -40 | -34 | -- | -- | -45 | |
| Growing degree days, $T_b = 40^\circ$ | -- | -- | -- | 228 | 561 | 825 | 1011 | 949 | 645 | 341 | -- | -- | -- | 4560 | | |
| Growing degree days, $T_b = 50^\circ$ | -- | -- | -- | 72 | 295 | 525 | 701 | 639 | 354 | 130 | -- | -- | -- | 2716 | | |
| Growing degree days, $T_b = 40^\circ$ Early spring through summer (4/3-8/18) | | | | | | | | | | | | | | 3160 | | |
| Growing degree days, $T_b = 50^\circ$ Late spring through late fall (5/23-10/28) | | | | | | | | | | | | | | 2417 | | |
| Heating degree days, $T_b = 65^\circ$ | 1550 | 1313 | 1110 | 579 | 264 | 84 | 19 | 28 | 165 | 465 | 960 | 1386 | -- | 7923 | | |

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## SUMMARY

This bulletin summarizes air temperature data for the state of Minnesota. Data are based upon the 66 U. S. Weather Bureau cooperative and class A stations that have continuous records from 1931-60. The normal, average daily and average monthly maxima and minima, and extreme maxima and minima air temperatures are presented. Also shown are computed effective day and night temperatures, growing degree days, and heating degree days for each station.

A brief summary of published information relative to apparent effects of air temperature upon various animals and plants is given.

An attempt is also made, with growing degree days as the sole criterion, to show a possible northern growing limit of certain varieties or crops grown in southern Minnesota. In addition, 12 representative stations are ranked according to their ability to meet the optimum day and night temperature requirements of various crops. The station rankings are based only upon computed average monthly effective day and night temperatures.


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Submitted for publication, April 30, 1964

Approved for publication, August 24, 1964

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