



THE STATE OF WYOMING

Water Development Office

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TECHNICAL MEMORANDUM

TO: Water Development Commission

DATE: December 21, 2012

FROM: Water Resources Data System,
University of Wyoming

REFERENCE: Snake/Salt River Basin Plan
Update, 2012

SUBJECT: Climate – *Tab XVI (2012)*

Contents

1.0 Precipitation	1
2.0 Temperature	6
2.1 Maximum Temperature	6
2.2 Minimum Temperature	6
3.0 Growing Season	10

1.0 Precipitation

Wyoming’s Snake/Salt River Basin receives a mean annual precipitation of just less than 36 inches. However, with elevations ranging from about 5,500 feet at Palisades Reservoir, where the Snake River leaves the state, to 13,770 feet at the summit of Grand Teton Peak, the basin has quite a variation in total precipitation. As illustrated in Figure 1, the average annual precipitation in the Wyoming portion of the basin ranges from a low of 16 inches just south of Jackson to a high of 95 inches at the southern end of the Teton Range.

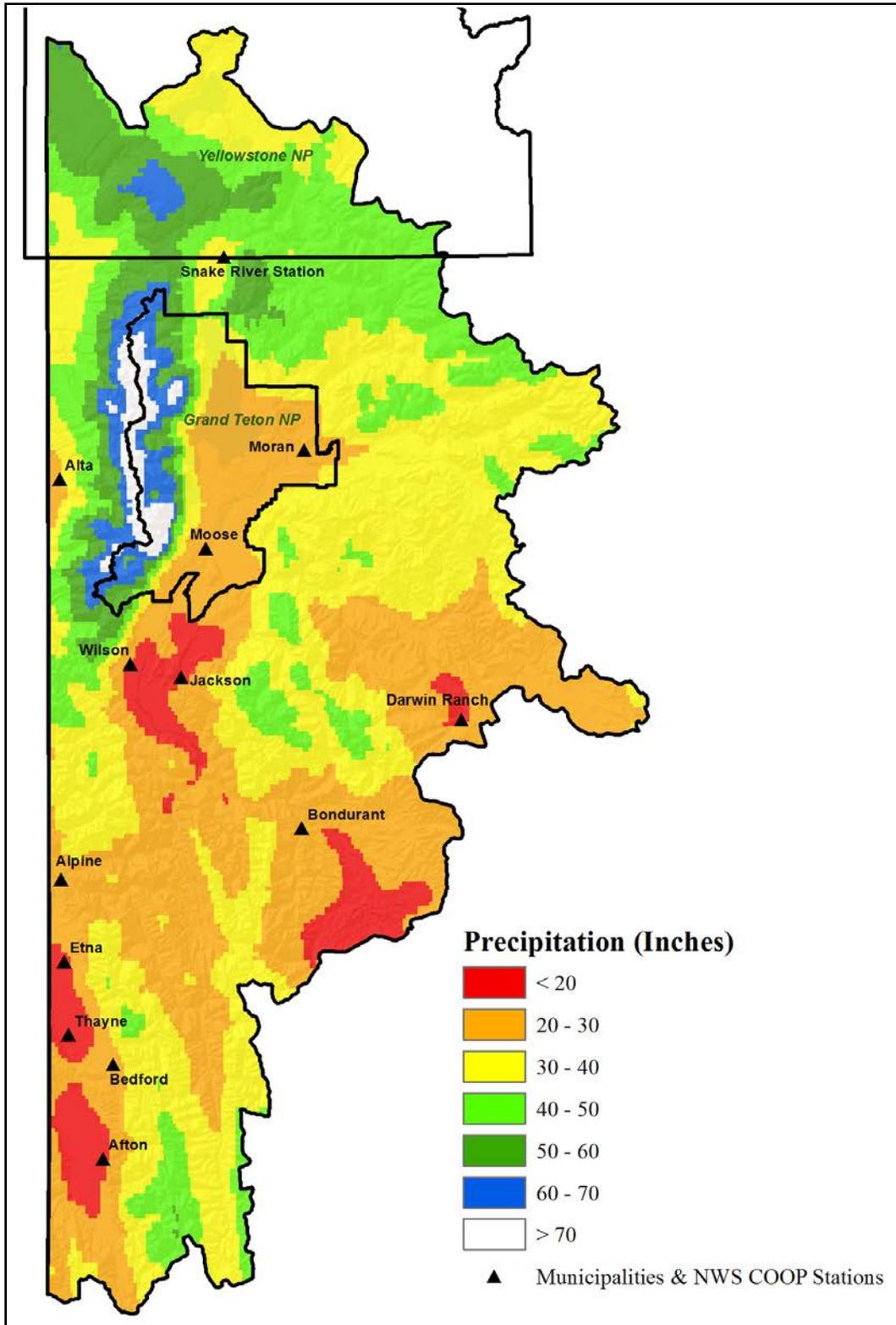


Figure 1: Annual Precipitation in the Snake/Salt River Basin

Two major types of precipitation patterns exist in the basin. The first is a snow-dominated winter precipitation pattern where the greatest precipitation contributions come during the months of November/December through January. Typically this pattern is seen in the higher elevation areas where annual precipitation totals are 40 inches or greater.

Within the snow-dominated pattern, there are two *transitional* patterns. The first transitional pattern has winter precipitation dominance, but the May peak starts to become apparent and begins to overtake the snow-derived precipitation. The second transitional pattern relates to the snow-dominated pattern, but the months of November through May provide more equal contributions to the annual total. In this latter precipitation pattern, the June through October period is usually noticeably drier than the rest of the year. This transitional pattern is most noticeable in areas receiving between 25 and 40 inches for the year. Generally, when going from areas with low annual precipitation to areas with high annual precipitation, the contribution of the May precipitation to the whole becomes less and less, and the graph of monthly precipitation across the year takes on the appearance of an inverse bell.

The second pattern in the basin has a more uniform distribution of precipitation throughout the year; however, May typically has the greatest precipitation, and occasionally there is a second peak in July. This pattern is usually seen in the areas of the basin receiving less than 25 inches of precipitation annually.

Figure 2 shows four high elevation stations that illustrate the first major precipitation pattern, which is the snow-dominated winter precipitation pattern. Mount Woodring and Grand Teton Peak show the fully snow-dominated pattern of precipitation with a noticeable inverse bell curve to their monthly totals through the year. The Snake River station exhibits the first transitional pattern with a small increase in May. This station receives the lowest annual precipitation in the basin, but the winter months make the greatest contribution to the total. Grouse Mountain exhibits the second transition pattern type where the winter months show a more even contribution to the annual total with a significant drop-off for the summer months.

As shown on Figure 3, Moose and Moran weather stations are other good examples of the snow-dominated winter precipitation pattern with their peak precipitation months being November through January. Both of these locations have the inverse bell graph interrupted by a peak in May that is somewhat less than the November through January amounts. Bondurant, in the southeastern portion of the basin shows this pattern as well, although the November through January peaks are not as high. In the western portion of the basin, the Town of Alta's May peak precipitation is the highest during the spring months but the snow-dominated precipitation signature is still evident. The Moran, Moose, and Bondurant stations on Figure 2 also exhibit the second transitional precipitation pattern where the months of November through May provide a more equal contribution to the annual total.

Figure 4 shows three stations located in valleys within the basin that illustrate the second major precipitation pattern with a more even distribution of precipitation. Jackson receives 16.84 inches throughout the year with May being the peak month at about 1.98 inches. Afton in Star Valley (the Salt River Sub-basin) has a similar precipitation regime and receives 18.16 inches in a year with its peak also being in May at almost 2.26 inches. Other stations located in Star

Valley include Thayne, Alpine, and Etna. Thayne is slightly drier, receiving about 17.30 inches during the year. Thayne is also an example of a location that exhibits a double peak in May and July, receiving 1.90 inches and 1.92 inches respectively during those months. Alpine receives slightly more with a total 22.54 inches with January being the wettest with 2.50 inches. Etna’s annual precipitation is about 18.35 inches with peaks in January of 2.09 inches and May at 2.05 inches.

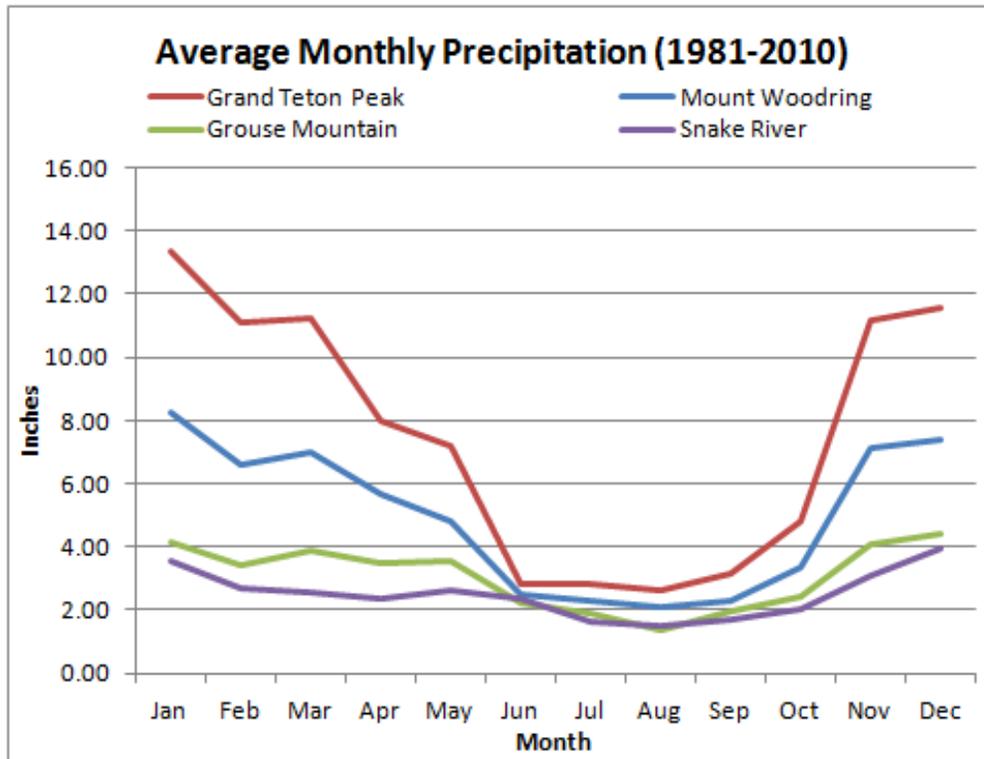


Figure 2: Average Monthly Precipitation of Select Sites Showing Snow-Dominated Precipitation Pattern

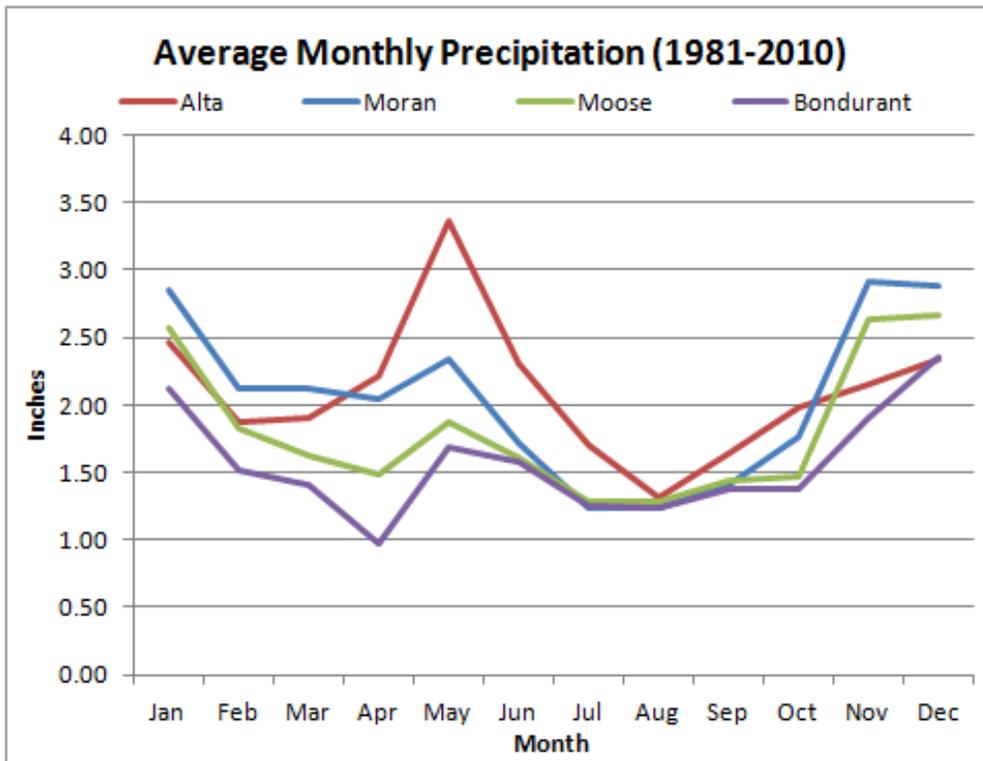


Figure 3: Average Monthly Precipitation of Select Sites Showing May Peak and Winter Precipitation Influence

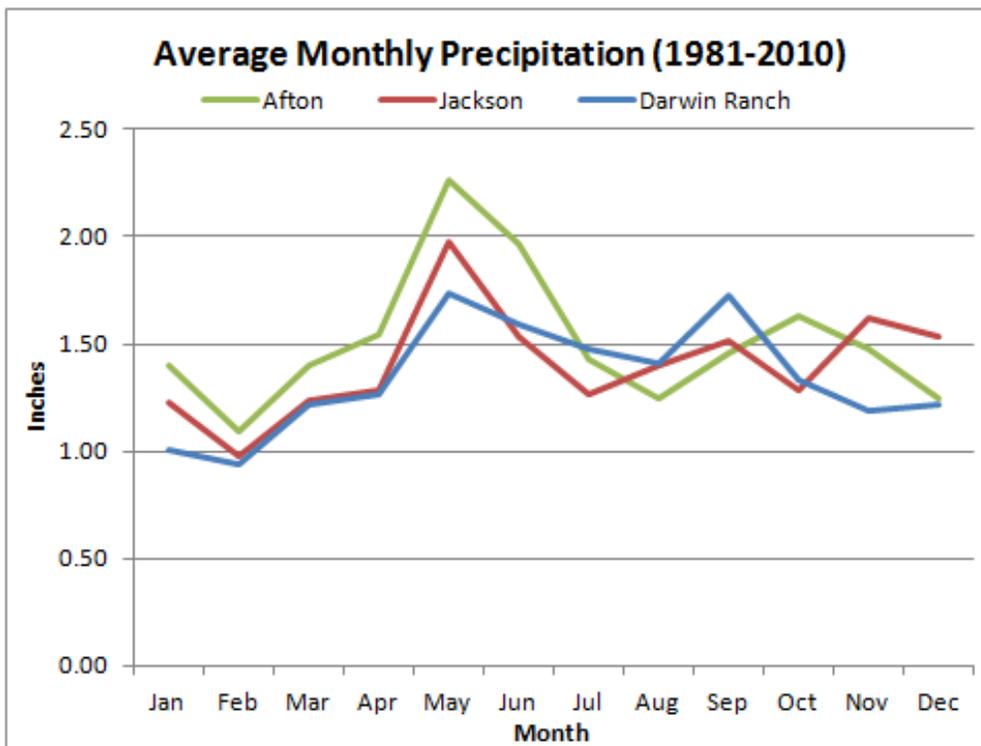


Figure 4: Average Monthly Precipitation at Select Sites Showing May Peak

2.0 Temperature

The average, maximum, and minimum temperatures in the Snake/Salt River Basin are illustrated on Figure 5. Maximum temperatures and minimum temperatures are discussed in the following sections.

2.1 Maximum Temperature

The average monthly maximum temperatures in the basin valleys are generally highest in July and lowest in December. Figure 6 shows the average monthly maximum temperatures for nine stations in the basin. On the figure, Darwin Ranch stands out as having significantly lower temperatures than the other eight stations during the summer months. The reason for this is elevation; Darwin Ranch is about 1,400 feet higher in elevation than the next highest station, Moran.

The remaining eight stations (Jackson, Afton, Moose, Bedford, Bondurant, Moran, Alta, and Snake River) have a tight band of temperature separation from each other through the year with the exception of Bondurant whose average monthly maximum drops below Darwin Ranch during the months of December through February. When considering all eight stations, the winter months have less range on average between the stations than do the summer months (about 5°F in winter compared with about 10°F in the peak of summer). When removing the outlying stations of Bondurant and Darwin Ranch, the same pattern exists, though more tightly grouped (about 2.5°F in January/December separates the stations compared with about 5°F separation in July).

2.2 Minimum Temperature

The average monthly minimum temperatures, as shown in Figure 7, are lowest in January (except Alta which is in December). July has the maximum monthly minimum temperatures for these nine stations. The monthly range of average temperature for each month varies more for the minimum than it does for the maximum. Average monthly minimum January temperatures range from a low of -7.1°F at Darwin Ranch to a high of 11.2°F at Alta. These two stations have the greatest difference in July as well with the average monthly minimum temperature at Darwin Ranch in July being 35.1°F compared with 48.5°F at Alta.

While the range of average monthly minimum and maximum temperatures at these nine stations goes from a minimum of -7.1°F at Darwin Ranch in January to a maximum of 82.4°F at Jackson in July, the range of absolute daily temperatures is significantly greater. Of the nine climate stations shown here, the all-time minimum was -63°F at Moran on February 9th, 1933, while the all-time maximum was 101°F set at Jackson on July 17th and again on the 20th just one year later in 1934.

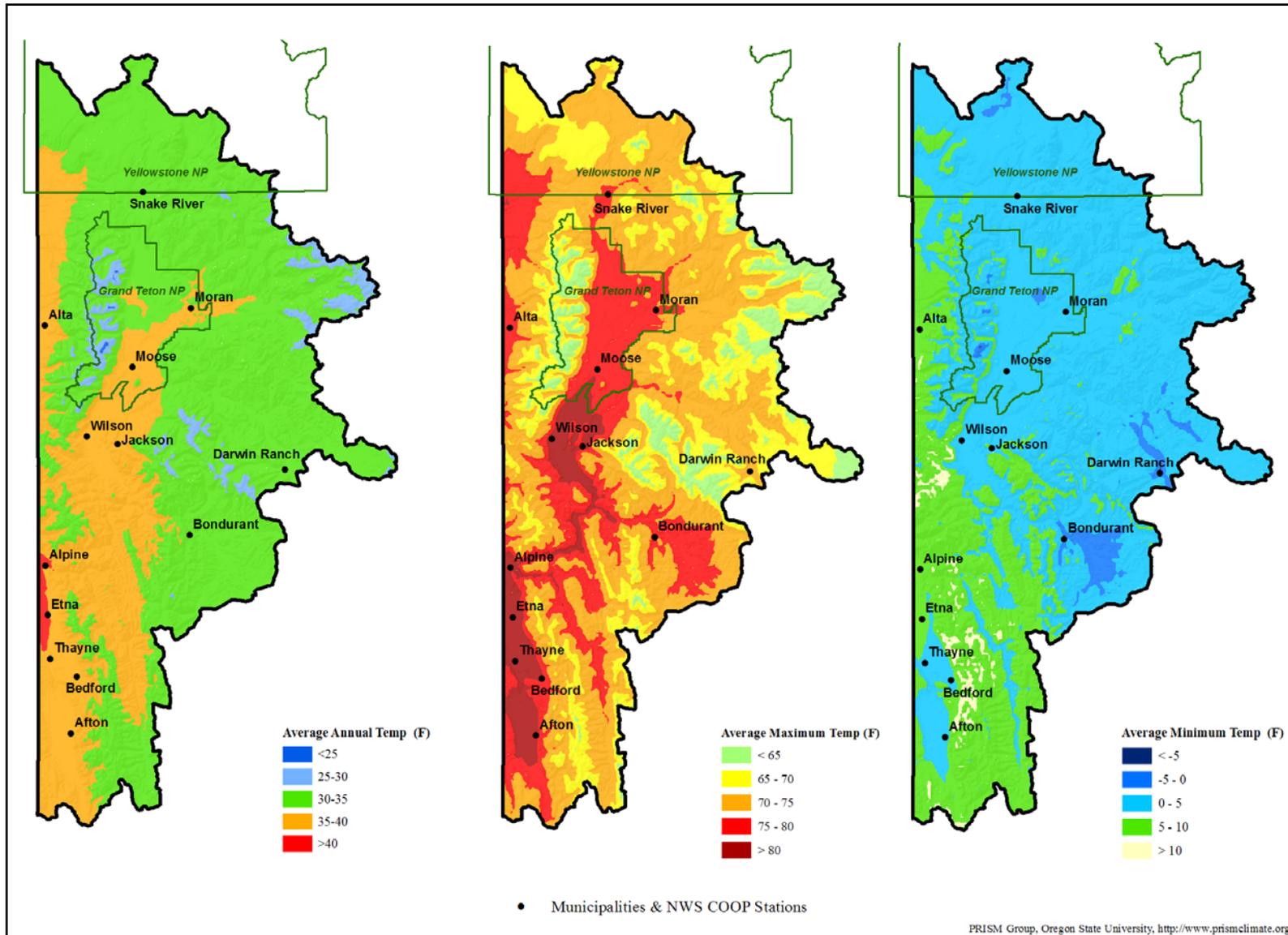


Figure 5: Average, Maximum, and Minimum temperatures in the Snake/Salt River Basin

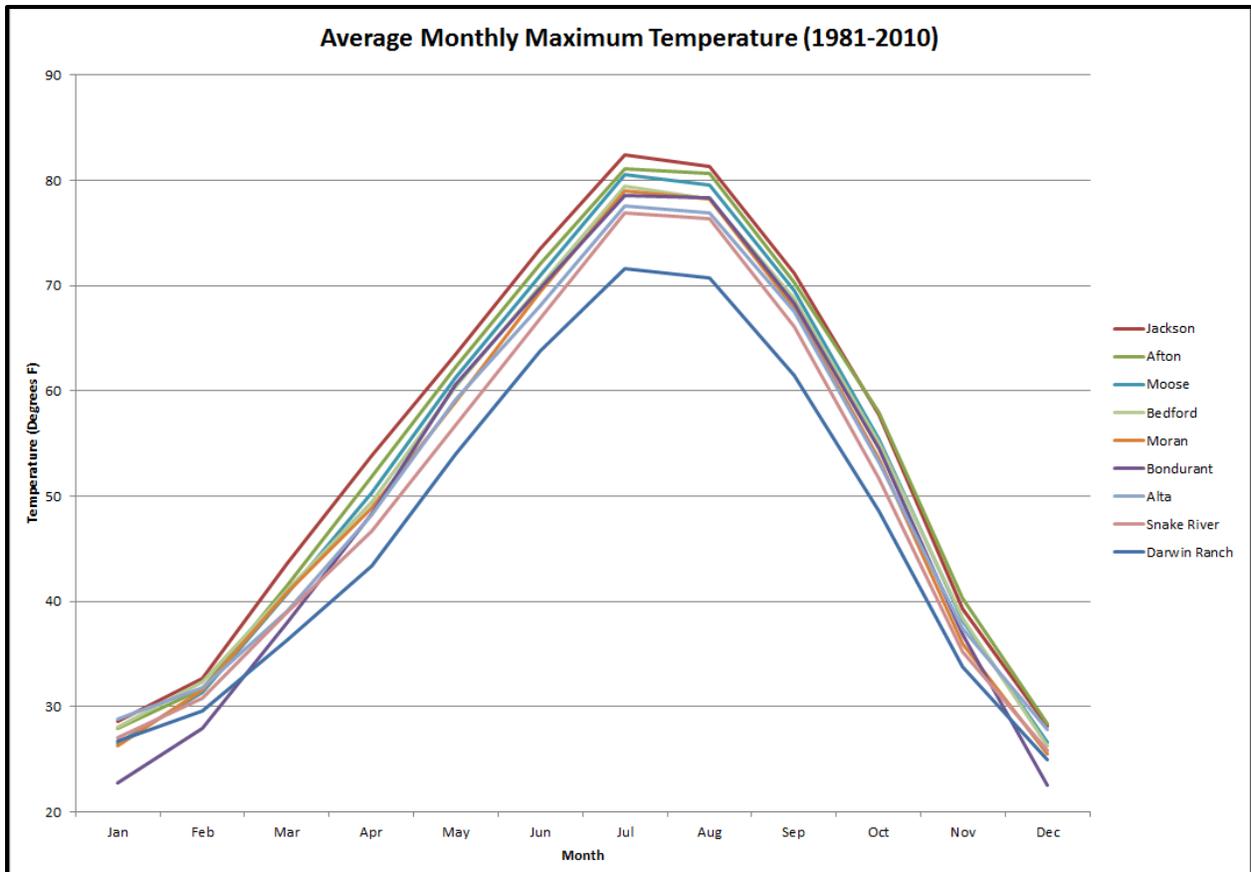


Figure 6: Average Monthly Maximum Temperatures for Select Stations in the Snake/Salt Basin

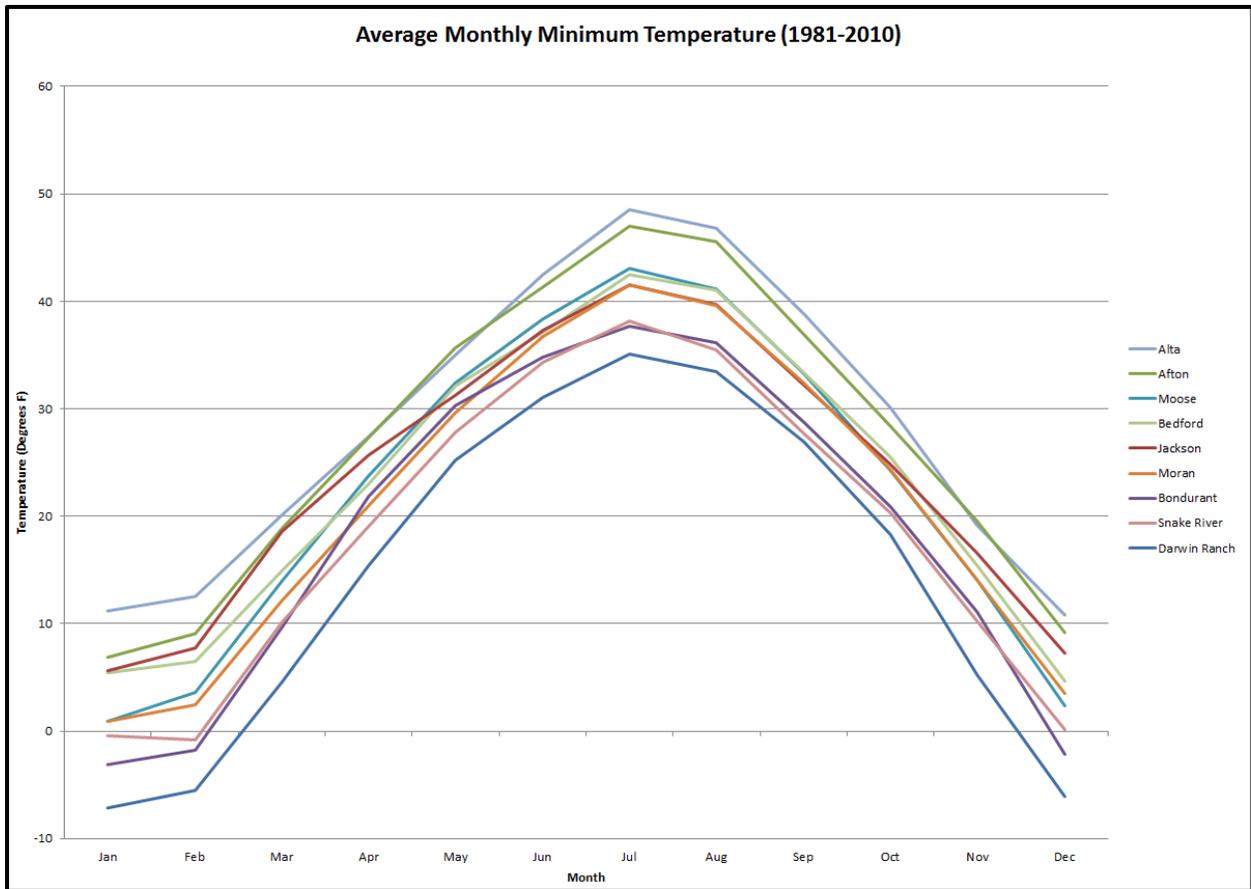


Figure 7 Average Monthly Minimum Temperatures for Select Stations in the Snake/Salt Basin

3.0 Growing Season

With a minimum elevation of about 5,500 feet for the basin and with most agricultural areas being above 6,000 feet elevation, the growing season in the Snake/Salt Basin is quite short. The average last frost ($\leq 32^{\circ}\text{F}$) in Afton occurs on July 1st while the average first frost is on August 26th giving a frost-free season of 55 days. Looking at freezes ($\leq 28^{\circ}\text{F}$), the average last freeze in the spring for Afton is June 7th and the average first freeze in the fall is September 7th.

Bedford's season is very similar with dates of last and first frost being June 25th and August 28th respectively, while the last and first freeze dates are June 4th and September 12th. The higher elevation site of Darwin Ranch has an even shorter frost free season with the average last frost in the spring being on July 23rd and the average first frost of the fall being on August 6th giving an average frost-free season of only 13 days. When considering freeze dates for Darwin Ranch, the average last freeze is around July 11th while the average first freeze in the fall is around August 16th. Table 1 presents a list of frost/freeze dates for stations within the Snake/Salt River Basin.

Table 1: List of Freeze and Frost Dates for Select Stations in the Snake/Salt River Basin

Station	Average Date of:			
	Last Freeze $\leq 28^{\circ}\text{F}$	Last Frost $\leq 32^{\circ}\text{F}$	First Frost $\leq 32^{\circ}\text{F}$	First Freeze $\leq 28^{\circ}\text{F}$
Afton	07 Jun	01 Jul	26 Aug	07 Sep
Alta 1NNW	02 Jun	29 Jun	30 Aug	11 Sep
Bedford 3SE	04 Jun	25 Jun	28 Aug	12 Sep
Bondurant	15 Jul	27 Jul	04 Aug	10 Aug
Darwin Ranch	11 Jul	23 Jul	06 Aug	16 Aug
Jackson	20 Jun	10 Jul	16 Aug	30 Aug
Moose	12 Jun	02 Jul	22 Aug	03 Sep
Moran 5WNW	16 Jun	10 Jul	17 Aug	01 Sep
Snake River	05 Jul	21 Jul	08 Aug	15 Aug

Source: High Plains Regional Climate Center CLIMOD System