

seasonlong grazing treatments. The grazing treatments are part of larger grazing units that are allotments in the Little Missouri National Grasslands, administered by USDA Forest Service and managed in cooperation with North Dakota Grazing Associations. Grazing permits for these allotments run from 1 May through 31 December, however, in most years the grazing season has been shortened because of inclement weather conditions.

Long-Term Regional Weather

The western North Dakota region has cold winters and hot summers typical of continental climates. Mean annual temperature is 40.9° F (4.9° C). January is the coldest month, with a mean temperature of 11.5° F (-11.4° C). July and August are the warmest months, with mean temperatures of 68.7° F (20.4° C) and 67.0° F (19.5° C), respectively. Long-term (1892-2010) mean annual precipitation is 16.03 inches (407.15 mm). The precipitation during the perennial plant growing season (April through October) is 13.54 inches (343.92 mm) and is 84.5% of the annual precipitation. June has the greatest monthly precipitation, at 3.55 inches (90.14 mm).

The precipitation received in the three month period of May, June, and July is 8.13 inches (206.50 mm) and is 50.7% of the annual precipitation (table 1) (Manske 2011c).

Water stress develops in perennial plants during water deficiency periods when the amount of rainfall is less than evapotranspiration demand. Water deficiency months were identified from historical temperature and precipitation data by the ombrothermic diagram technique (Emberger et al. 1963). The long-term (1892-2010) ombrothermic diagram (figure 1) shows near water deficiency conditions during August, September, and October, and favorable water relations during April, May, June, and July. Reoccurrence of water deficiency conditions during April, May, June, and July is 16.9%, 13.6%, 10.2%, and 38.1%, respectively, and during August, September, and October water deficiency reoccurs 52.5%, 50.0%, and 46.6% of the years, respectively. Long-term occurrence of water deficiency conditions is 32.7% of the growing season months, for a mean of 2.0 water deficient months per growing season (Manske et al. 2010).

Table 1. Long-term (1892-2010) mean monthly temperature and monthly precipitation in western North Dakota.

	° F	° C	in.	mm
Jan	11.48	-11.40	0.41	10.39
Feb	15.25	-9.31	0.41	10.34
Mar	26.21	-3.22	0.74	18.71
Apr	41.56	5.31	1.41	35.76
May	52.77	11.54	2.34	59.39
Jun	61.96	16.65	3.55	90.14
Jul	68.74	20.41	2.24	56.92
Aug	67.01	19.45	1.71	43.38
Sep	56.09	13.38	1.34	33.97
Oct	43.74	6.52	0.95	24.20
Nov	28.44	-1.98	0.54	13.62
Dec	16.89	-8.39	0.41	10.33
	MEAN		TOTAL	
	40.85	4.91	16.03	407.15

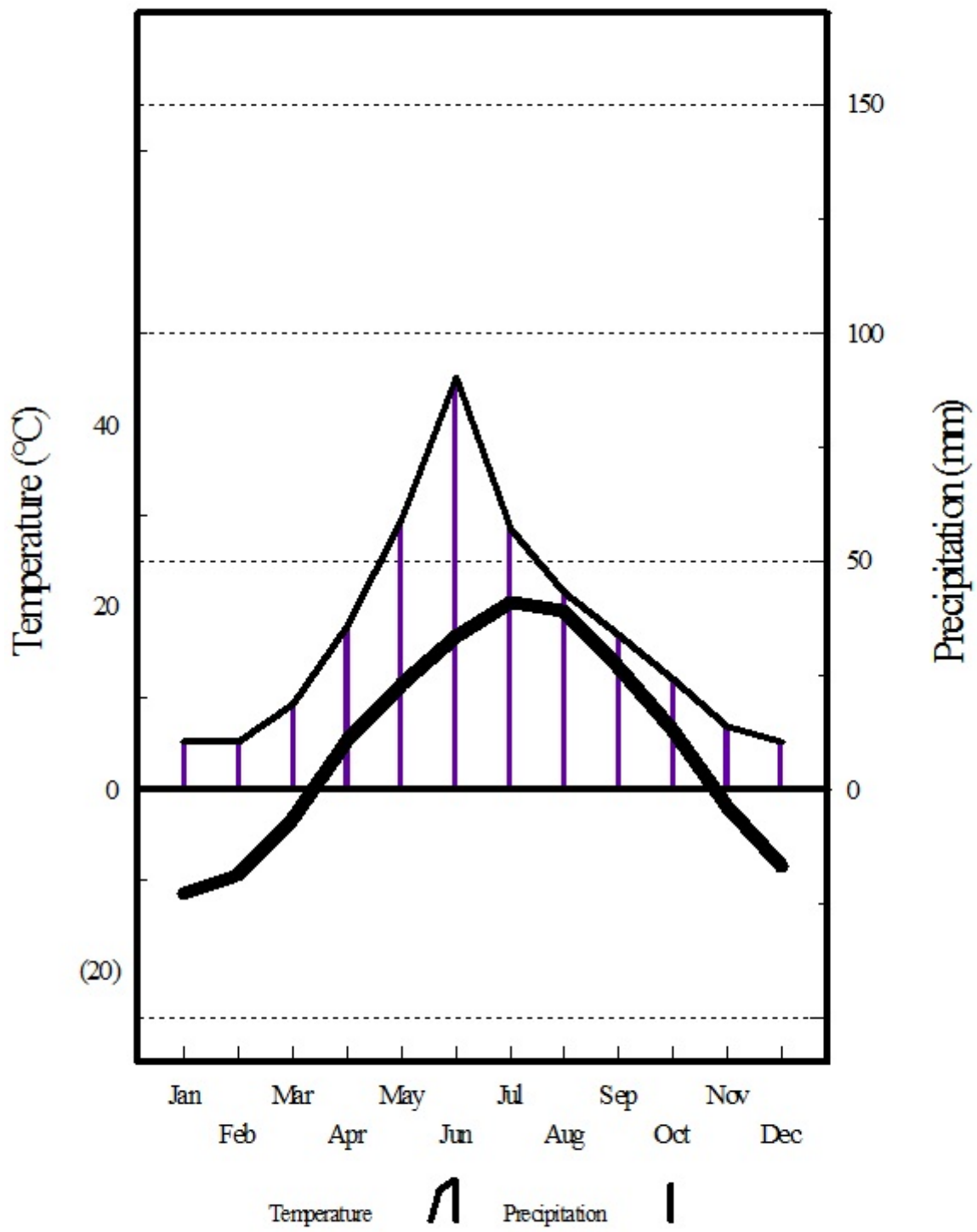


Figure 1. Ombrothermic diagram of long-term (1892-2010) mean monthly temperature and monthly precipitation in western North Dakota.