

CLIMATOLOGICAL REPORT 2008
Range Cattle Research and Education Center

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Weather conditions strongly influence agricultural operations from planting through harvesting. Knowledge of annual rainfall and temperature cycles along with their extremes help producers determine optimum times to prepare and plant seedbeds, fertilize pastures, apply herbicides, control water, and to supplement cattle on pasture or range. Weather conditions influence seed germination, forage growth, palatability, and nutritive value.

This research report presents a summary of rainfall, air temperature, evapotranspiration, and solar radiation for 2008 obtained at the Range Cattle Research and Education Center (REC) Ona, Florida, and is compared to a 66-year summary of data collected from this location. The center is located 82° 55' W and 27° 26' N in south central Florida approximately 45 miles (72 km) east of the Gulf of Mexico and 100 miles (160 km) west of the Atlantic Ocean.

Weather observations were collected with a Weather Watch 2000 (Campbell Scientific, Inc) from 1997 until 2005. Beginning in 2006, observations were collected using the Florida Automated Weather Network (FAWN). Accuracy of rainfall as measured by the Weather Watch 2000 or FAWN was checked by comparing with rainfall measured by a US Weather Service standard gauge. Measurements reported before 2006 were taken at 0900 h, thus data on a given day represent the previous 24-hour period. Beginning in 2006, measurements were recorded for an entire 24-h period beginning at midnight.

Rainfall

Annual rainfall for 2007 was 50.05 inches (Table 1), which was 3.69 inches (6.9%) less than the 67-year average of 53.76 inches (Table 1). The year with the least rainfall was 2000 when 32.02 inches were measured, and the year with the greatest rainfall was 1959 when 78.82 inches were recorded.

Monthly rainfall totals were below the 66-year average for all months except April, June and August (Figure 1; Table 1). Rainfall for the month of July was near normal as rainfall was only 0.29 inches below normal. Rainfall deficits in excess of 1 inch were

recorded in January, September, October, and November. Above normal rainfall in April provided some growth of forages for hay, resulting in a fairly good hay crop.

There were 13 occurrences during 2008 when daily rainfall equaled or exceeded 1 inch, two rain events that exceeded 2 inches (Table 2). The single greatest daily rain event was 21 September when 2.92 inches were recorded.

Table 1. Summary of rainfall by months. Range Cattle REC, 2008.

Month	1942 to 2008		67-year average†	2008	Difference from 67-year average
	Maximum / month	Minimum / month		Total	
	-----inches-----				
January	8.45	0.03	2.14	1.10	-1.04
February	9.59	0.02	2.62	1.71	-0.91
March	12.34	0.13	3.12	2.40	-0.70
April	11.91	0.00	2.50	4.00	1.50
May	10.58	0.00	3.71	2.83	-0.88
June	18.99	2.79	8.72	10.33	1.61
July	19.74	1.87	8.37	8.08	-0.29
August	16.10	3.13	8.28	10.14	1.86
September	20.11	1.14	7.34	5.72	-1.62
October	11.25	0.04	3.05	1.73	-1.32
November	11.22	0.07	1.91	0.79	-1.12
December	8.61	0.16	2.00	1.22	-0.78
Year total				50.05	-3.69
			53.76		

*Inches x 2.54 = cm.

† Since rainfall records began in July 1942, means for January to June are 67-year means.

Evapo-transpiration

Evapo-transpiration is the total amount of water transferred from the earth to the atmosphere. Evapo-transpiration exceeded rainfall in January, February, March, May, and from October-December during 2008 (Figure 2). Evapo-transpiration generally exceeds rainfall in January to May and October to December, which are months with limited rainfall. According to the data, rainfall exceeded evapo-transpiration by 9.26 inches for the entire year.

Table 2. Daily maximum and minimum temperature, precipitation, and solar radiation for 2008, Range Cattle REC.

Day	January				February				March				April			
	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²
1	70	51	0.04	2.55	80	50	0.00	10.29	79	45	0.00	20.83	86	61	0.75	16.78
2	52	32	0.00	17.31	86	45	0.00	16.72	80	49	0.00	22.50	87	60	1.63	22.28
3	56	28	0.00	17.16	85	50	0.00	16.66	82	52	0.00	21.71	86	63	0.08	17.67
4	67	40	0.00	12.90	86	54	0.00	15.67	78	62	0.01	8.86	86	64	0.04	22.20
5	75	45	0.00	12.43	85	58	0.00	15.77	79	59	0.18	15.70	88	64	0.27	23.18
6	79	53	0.00	14.51	84	60	0.00	15.04	78	56	0.05	11.79	86	63	0.82	20.70
7	81	55	0.00	13.99	84	63	0.00	13.28	86	63	0.37	16.58	83	61	0.01	23.28
8	81	53	0.00	15.33	78	62	0.26	9.33	70	38	0.12	24.53	81	65	0.00	14.60
9	85	48	0.00	16.20	75	57	0.11	7.23	71	34	0.00	26.22	83	62	0.00	20.42
10	82	57	0.00	12.55	76	46	0.00	20.49	77	50	0.00	17.33	86	59	0.00	25.48
11	81	51	0.00	13.69	76	41	0.00	20.18	80	60	0.01	13.50	89	58	0.01	9.66
12	84	55	0.00	13.78	77	53	0.34	6.35	78	50	0.35	22.28	87	62	0.00	23.81
13	83	60	0.05	11.45	76	50	0.20	9.59	79	43	0.00	22.98	73	47	0.00	14.45
14	69	41	0.00	17.85	71	40	0.00	22.58	73	43	0.09	12.71	75	45	0.00	24.97
15	68	37	0.00	16.66	79	45	0.00	20.13	85	57	0.00	21.12	65	44	0.00	26.47
16	74	46	0.02	13.35	81	51	0.00	20.94	86	64	0.00	19.39	74	39	0.00	30.89
17	77	65	0.16	2.93	85	51	0.00	18.36	82	60	0.00	25.48	79	45	0.00	27.71
18	68	63	0.01	4.17	85	60	0.24	13.58	82	55	0.00	22.95	82	50	0.00	28.91
19	83	62	0.64	9.81	74	48	0.00	21.97	86	62	0.00	24.81	85	51	0.00	24.59
20	65	42	0.05	5.66	76	46	0.00	13.69	78	51	0.41	10.51	82	58	0.37	19.27
21	74	41	0.00	14.96	80	57	0.21	11.47	81	49	0.00	27.23	83	49	0.00	29.98
22	81	55	0.00	13.90	85	65	0.06	17.81	71	55	0.81	4.84	86	55	0.00	30.58
23	82	61	0.08	10.92	84	63	0.26	12.52	84	63	0.00	17.51	83	50	0.00	27.73
24	72	58	0.00	5.45	81	64	0.00	13.95	73	43	0.00	22.30	85	59	0.00	25.33
25	70	47	0.00	17.96	82	62	0.00	18.72	70	37	0.00	27.76	85	58	0.00	25.74
26	78	45	0.02	13.94	84	69	0.03	17.68	76	44	0.00	22.41	86	54	0.02	26.90
27	71	41	0.30	17.15	69	38	0.00	15.35	81	48	0.00	27.50	87	53	0.00	27.36
28	70	35	0.00	19.64	63	34	0.00	24.71	86	50	0.00	24.77	86	64	0.00	25.00
29	77	34	0.00	17.72	76	35	0.00	22.35	85	55	0.00	22.49	82	54	0.00	18.88
30	81	53	0.00	17.00					86	56	0.00	20.39	83	46	0.00	30.98
31	81	50	0.00	16.29					84	64	0.00	20.97				
<u>Avg</u>	75	49	0.04	13.01	79	52	0.06	15.89	80	52	0.08	19.98	83	55	0.13	24.17
<u>Max</u>	84	65	0.64	19.64	86	69	0.34	24.71	86	64	0.81	27.76	89	65	1.63	30.98
<u>Min</u>	52	28	0.00	2.55	63	34	0.00	6.35	69	34	0.00	4.84	65	39	0.00	14.45
<u>Total</u>			1.10	403			1.71	461			2.40	619			4.00	725

Table 2. Continued.

Day	May				June				July				August			
	Max °F	Min °F	Rain inches	MJ/ m ²	Max °F	Min °F	Rain inches	MJ/ m ²	Max °F	Min °F	Rain inches	MJ/ m ²	Max °F	Min °F	Rain inches	MJ/ m ²
1	85	50	0.00	30.90	94	66	0.00	26.00	91	68	0.11	21.42	91	70	0.00	23.37
2	85	53	0.00	30.06	94	62	0.20	26.20	89	67	0.03	19.24	91	69	0.17	20.10
3	91	53	0.00	29.55	94	64	0.41	20.43	89	69	0.73	16.46	92	70	0.00	23.14
4	90	62	0.00	26.25	96	66	0.00	31.00	95	69	0.25	27.88	91	70	0.28	17.44
5	88	56	0.00	30.28	94	69	0.00	29.02	94	68	0.01	29.00	94	70	1.87	25.32
6	92	52	0.00	30.94	95	69	0.00	27.47	92	70	0.05	24.03	96	71	0.00	27.11
7	91	59	0.00	28.38	93	68	0.00	28.42	88	69	0.34	19.46	94	73	0.00	24.23
8	92	60	0.00	28.42	92	65	0.03	24.26	91	68	0.60	16.56	89	73	0.68	14.87
9	91	66	0.00	25.98	90	65	0.55	14.58	92	69	0.05	23.06	87	73	0.30	12.68
10	92	65	0.00	29.29	93	65	1.02	27.53	95	70	0.00	26.38	90	73	0.07	21.68
11	90	65	0.00	25.19	92	65	0.12	31.08	95	70	0.00	28.35	91	73	0.00	26.66
12	88	52	0.00	31.20	92	68	1.98	19.05	90	72	0.01	14.91	90	72	0.49	17.30
13	91	47	0.00	31.77	88	67	0.08	18.41	85	71	0.47	17.06	90	71	0.00	22.75
14	87	58	0.00	30.01	93	67	0.00	25.95	90	72	0.26	21.14	89	72	0.34	13.91
15	92	56	0.00	30.12	93	69	0.00	28.04	89	71	0.11	18.79	90	74	0.00	13.37
16	90	61	0.00	26.47	88	67	0.00	16.85	76	72	2.47	6.02	90	70	0.65	15.28
17	90	65	0.00	22.58	90	68	0.01	27.04	87	72	0.39	12.63	95	70	0.07	24.58
18	90	70	0.00	22.56	91	69	0.00	25.62	91	71	0.00	27.11	86	72	0.07	13.31
19	84	69	0.30	11.86	90	69	0.03	20.07	96	70	0.00	27.72	76	73	1.87	2.30
20	85	69	0.53	10.96	92	66	0.39	21.62	95	71	0.00	29.08	86	76	0.00	12.45
21	89	71	0.00	24.44	85	69	1.78	7.16	95	72	0.09	26.24	86	76	0.07	19.10
22	88	72	1.36	10.29	88	67	0.00	13.56	94	71	0.95	22.91	88	75	0.35	15.72
23	92	69	0.64	17.59	92	65	0.00	27.47	92	70	0.50	21.96	88	72	1.09	12.11
24	91	67	0.00	27.73	93	69	0.00	24.01	85	71	0.00	15.91	90	73	1.25	17.17
25	91	66	0.00	26.09	92	69	0.07	20.34	95	70	0.01	28.23	93	72	0.00	23.36
26	84	59	0.00	25.50	87	68	0.11	13.14	95	71	0.01	24.93	93	73	0.00	23.90
27	87	60	0.00	24.98	94	67	0.55	18.74	93	72	0.02	21.11	93	74	0.00	20.14
28	92	63	0.00	26.09	96	68	0.13	22.60	89	72	0.10	16.12	94	73	0.00	19.91
29	93	64	0.00	31.47	93	68	0.56	22.44	90	73	0.00	21.10	92	73	0.00	25.38
30	92	66	0.00	29.81	93	69	2.31	23.84	90	72	0.51	18.41	89	74	0.50	11.60
31	99	66	0.00	28.60					90	71	0.01	16.23	85	75	0.02	11.07
<u>Avg</u>	90	62	0.09	25.96	92	67	0.34	22.73	91	70	0.26	21.27	90	72	0.33	18.43
<u>Max</u>	99	72	1.36	31.77	96	69	2.31	31.08	96	73	2.47	29.08	96	76	1.87	27.11
<u>Min</u>	84	47	0.00	10.29	85	62	0.00	7.16	79	67	0.00	6.02	76	69	0.00	2.30
<u>Total</u>			2.83	805			10.33	682			8.08	659			10.14	571

Table 2. Continued.

Day	September				October				November				December			
	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²
1	92	75	0.00	21.77	88	66	0.00	18.95	77	55	0.01	14.98	71	55	0.13	15.51
2	91	75	0.00	24.00	88	63	0.00	22.54	76	62	0.03	6.47	63	36	0.16	17.75
3	92	74	0.00	19.41	90	60	0.00	-	83	61	0.00	6.91	70	33	0.00	17.60
4	90	73	0.00	22.85	84	66	0.00	10.91	72	59	0.00	2.94	79	47	0.00	14.60
5	87	75	0.00	15.00	85	71	0.23	10.63	67	57	0.00	3.20	79	45	0.00	17.32
6	94	67	0.00	25.05	90	72	0.75	11.56	82	54	0.00	10.75	75	45	0.05	12.96
7	92	70	0.00	22.22	86	71	0.01	16.56	84	53	0.00	11.35	69	40	0.00	17.36
8	92	72	0.00	22.23	91	69	0.00	19.32	82	55	0.00	12.22	75	38	0.00	17.06
9	90	77	0.19	14.70	90	70	0.00	17.15	78	49	0.00	11.76	83	51	0.00	12.37
10	88	78	0.02	10.31	91	71	0.11	15.76	79	44	0.00	12.74	85	64	0.00	13.15
11	92	81	0.00	20.39	82	69	0.00	14.48	81	52	0.00	11.71	71	59	0.85	4.17
12	92	74	0.00	23.56	90	74	0.00	18.93	87	64	0.00	8.74	64	42	0.00	12.30
13	94	72	0.00	24.33	87	72	0.02	14.72	88	69	0.00	9.88	68	39	0.00	14.83
14	94	72	0.44	23.75	86	70	0.01	17.84	89	67	0.00	8.79	76	52	0.00	8.42
15	96	71	0.01	23.72	86	64	0.00	17.92	84	64	0.00	7.51	81	60	0.00	8.78
16	93	73	1.56	19.22	86	65	0.00	18.20	65	41	0.00	14.16	82	57	0.00	14.75
17	92	72	0.02	19.33	87	63	0.00	17.09	71	37	0.00	13.96	80	58	0.00	11.49
18	91	71	0.06	20.62	87	63	0.00	19.13	73	40	0.00	13.32	82	58	0.00	13.59
19	89	69	0.00	22.23	82	58	0.00	21.93	67	35	0.02	18.47	82	54	0.00	16.06
20	93	69	0.09	21.88	82	61	0.00	14.19	72	36	0.00	19.12	79	52	0.00	15.03
21	92	72	2.92	20.19	84	59	0.00	19.65	77	43	0.00	16.18	79	49	0.00	15.72
22	90	73	0.05	18.01	83	61	0.00	14.37	71	42	0.00	18.45	66	45	0.00	16.12
23	88	73	0.02	17.49	83	70	0.21	8.92	73	45	0.00	17.49	76	45	0.00	15.38
24	86	40	0.03	15.15	80	69	0.35	6.34	76	47	0.00	16.68	81	56	0.03	14.14
25	87	63	0.00	21.02	83	68	0.04	10.54	78	45	0.00	11.44	86	67	0.00	10.41
26	89	61	0.00	24.86	80	55	0.00	21.29	74	39	0.00	19.20	82	59	0.00	16.22
27	92	62	0.00	21.08	81	50	0.00	20.90	75	36	0.00	17.96	80	59	0.00	15.69
28	83	69	0.04	0.08	66	44	0.00	21.88	80	36	0.00	17.93	83	57	0.00	14.90
29	86	71	0.15	11.85	70	38	0.00	20.66	80	43	0.00	17.59	82	51	0.00	15.60
30	80	67	0.12	6.02	75	40	0.00	21.00	77	56	0.73	5.37	79	47	0.00	16.51
31					79	54	0.00	17.76					76	42	0.00	14.70
<u>Avg</u>	90	71	0.09	19.08	84	63	0.06	16.71	77	50	0.03	12.58	77	50	0.04	14.21
<u>Max</u>	96	81	2.92	25.05	92	74	0.75	22.54	89	69	0.73	19.20	86	67	0.85	17.75
<u>Min</u>	80	61	0.00	0.08	66	38	0.00	6.38	65	65	0.00	2.94	63	33	0.00	4.17
<u>Total</u>			5.72	572			1.73	501			0.79	377			1.22	440

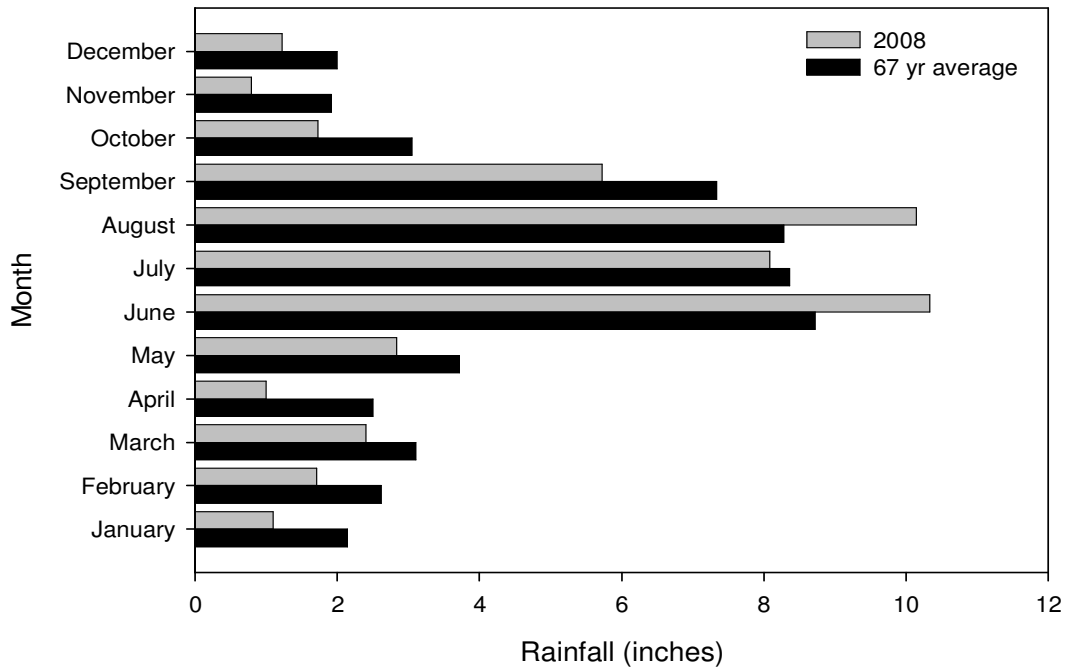


Figure 1. Monthly rainfall in 2008 compared with the 67-year average.

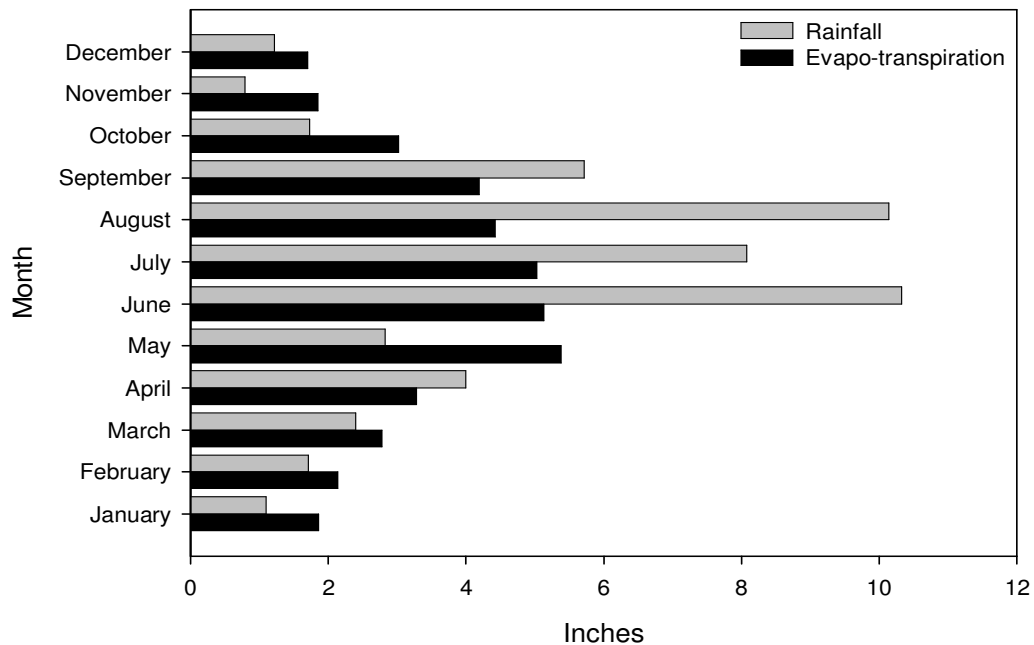


Figure 2. Monthly rainfall compared with evapo-transpiration during 2008. Cumulative rainfall = 50.05" and cumulative evapo-transpiration = 40.79".

Solar Radiation:

Daily solar radiation is shown in Table 2, and 2008 total monthly solar radiation can be seen in Figure 3. For interpretation of solar radiation as it pertains to plant growth, 1 MJ results in about 14.3 lb/A of plant dry matter if soil water, temperature, and fertility are not limiting and vegetative cover is complete. Theoretically, enough solar radiation was received in April 2008 (725 MJ) to produce 10,368 lb/A of plant dry matter. Total solar radiation for 2008 was 6,817 MJ.

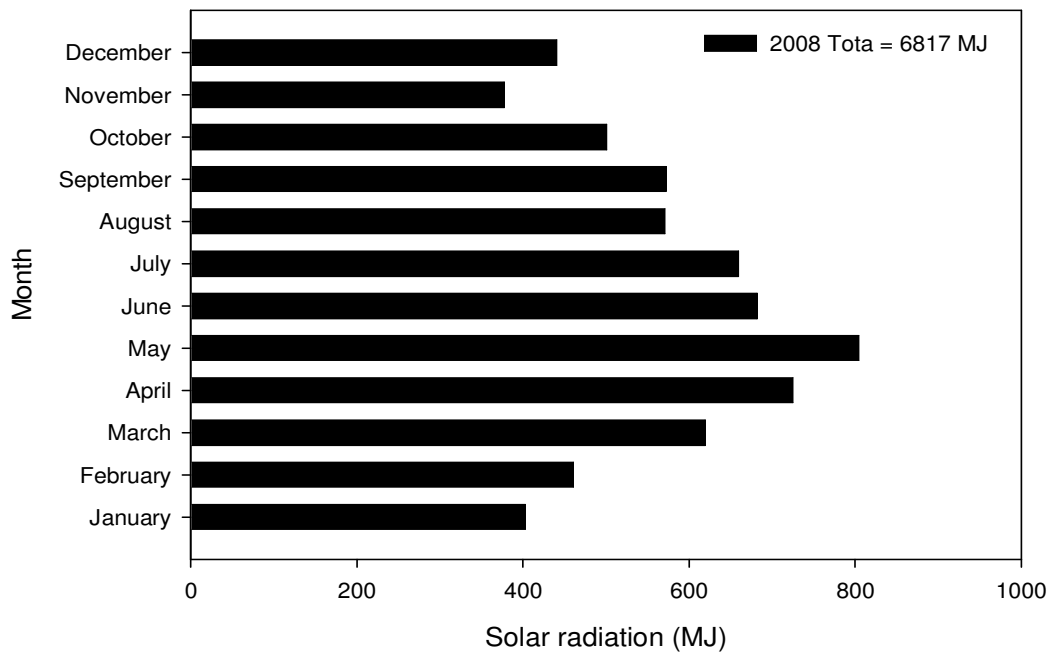


Figure 3. Total monthly solar radiation for 2008. Cumulative solar radiation in 2008 = 6,817 MJ (MJ = Joules x 1,000,000)

Temperature

There were two days when daily-low shelter temperature was at or below 32 °F (Table 2). The extreme low temperature for 2008 occurred on 3 January when shelter temperature reached 28.1 °F. Scattered frost begins when air temperature drops to 35 °F. Based on this fact, there were 9 days when frost was widespread or scattered across the landscape (data not shown) in 2008. Except for February, August and September, all months in 2008 had lower mean low temperatures compared with the 64-year means (Table 3). Overall, mean low temperature for 2008 was 0.5 °F lower than the 64-year mean.

Table 3. Summary of minimum temperature* for 2008 by months, Range Cattle REC.

Month	Shelter†			Year	Ground level‡		
	1944-08 Avg. low	2008 Avg. low	1944-08 Extreme low		2008 Extrem e low	2008 Avg. low	Extrem e low
	-----°F-----				-----°F-----		
January	49.3	48.5	18	1981	28.1	63.6	57.2
February	50.6	52.3	26	1976	34.2	66.1	61.2
March	54.5	52.2	26	1980	34.4	67.4	61.9
April	58.0	55.5	34	1971	38.8	71.7	67.1
May	63.2	61.6	43	1945	47.1	77.4	72.4
June	68.9	67.2	52	1984	62.2	79.2	76.2
July	71.2	70.5	62	several	67.0	80.0	71.1
August	71.8	72.5	61	1977	69.1	78.4	78.4
September	71.1	71.3	51	1962	60.7	79.7	68.6
October	64.8	62.7	38	2008	37.5	75.0	64.0
November	56.8	49.5	25	1970	34.9	67.1	60.5
December	51.3	50.4	20	1962	32.9	63.4	56.8
Average	61.0	59.5				72.4	66.3

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 0.555$$

† Air temperature is measured using a thermometer in an instrument shelter designed to protect meteorological equipment from exposure to direct sunlight, precipitation, and condensations, while allowing for adequate ventilation so that the instruments measure environmental parameters accurately.

‡ Ground level temperature is measured with a soil probe, which measures the temperature 4 inches below the soil surface.

Freeze hazard

The fall and spring freeze hazards for the Range Cattle REC are shown in Figures 4 and 5, respectively. The fall freeze hazard shows the chance of experiencing the first attainment of a critical temperature before a selected date, while the spring freeze hazard shows the chance of the last attainment of a critical temperature before a critical date. Based on records from 1944 to 1991, these data will not predict what will occur in a given year, but what can be expected over a period of years. In an example using the spring freeze hazard, a frost susceptible crop (assuming 32 °F) planted before the 1st of February would stand a 50% chance of survival (Figure 4). A grower has a significant likelihood of experiencing five crop frosts over ten years by planting before the 1st of February.

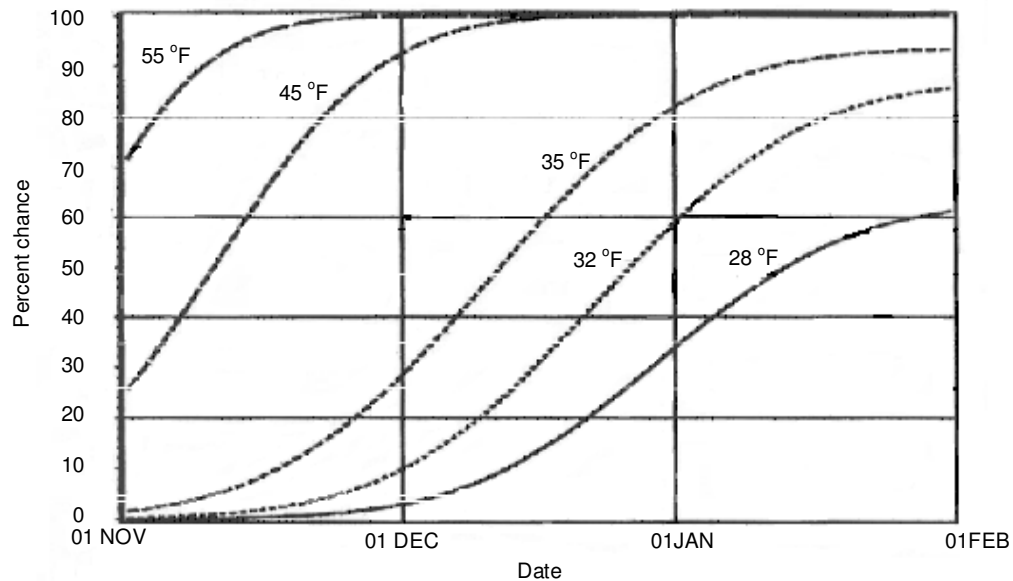


Figure 4. Fall freeze hazard showing the chance of the first attainment of a given temperature before a selected date.

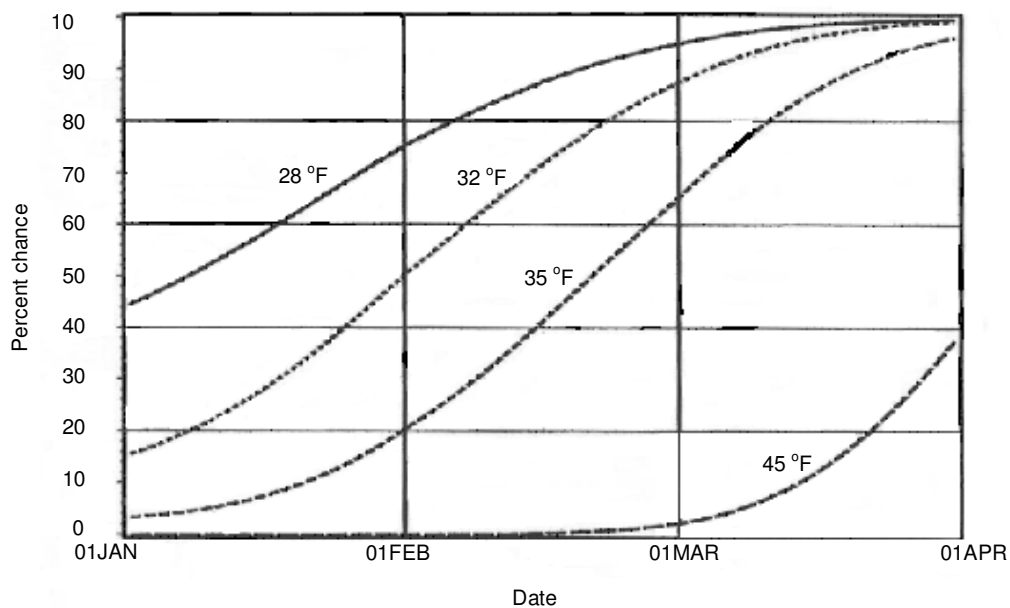


Figure 5. Spring freeze hazard showing the chance of the last attainment of a given temperature before a selected date.

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