

Range Cattle Research and Education Center

January 2021

Research Report RC-2021-1

CLIMATOLOGICAL REPORT 2020
Range Cattle Research and Education Center

Brent Sellers

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 supplement cattle on pasture or range. Weather conditions influence forage seed germination, growth and development, palatability, and nutritive value.

This research report presents a summary of weather conditions observed during 2020 at the Range Cattle Research and Education Center (RCREC), Ona, Florida. The center is located 81° 56.406' W and 27° 23.733' 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). Measurements reported prior to 2006 were recorded at 0900 h; thus, data on a given day represented the previous 24-hour period. Beginning in 2006, measurements were recorded for an entire 24-h period beginning at midnight.

Daily observations of rainfall, temperature, and solar radiation are summarized in Table 1. These data are then compared to a 79-year summary of rainfall data and a 77-year summary of temperature data collected at this location. In addition, monthly evapotranspiration and freeze hazard information are reported.

Table 1. Daily maximum and minimum temperature, precipitation, and solar radiation for 2020, Range Cattle REC.

Day	January				February				March				April			
	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²
1	76.03	47.08	0.00	15.67	67.23	54.25	0.38	3.53	73.65	33.47	0.00	23.86	80.60	63.70	0.13	28.25
2	83.48	50.13	0.00	14.97	65.01	40.13	0.00	19.67	79.32	44.16	0.00	20.58	82.13	46.53	0.00	27.85
3	86.97	63.99	0.00	14.15	75.33	37.09	0.00	20.01	84.54	54.21	0.00	20.32	87.55	48.42	0.00	25.67
4	80.62	59.74	0.29	5.70	79.48	41.49	0.00	17.41	88.23	58.84	0.00	20.90	86.38	50.88	0.00	22.89
5	66.47	38.99	0.00	17.72	81.75	55.35	0.00	11.37	88.68	68.31	0.00	18.20	73.11	59.36	0.06	4.32
6	71.38	35.23	0.00	17.51	85.33	66.76	0.00	13.24	78.37	66.92	0.00	16.94	82.85	63.75	0.00	14.86
7	73.36	39.51	0.00	16.37	76.95	46.65	1.02	13.63	69.01	42.12	0.00	25.12	89.83	59.32	0.00	23.90
8	71.13	44.01	0.00	17.43	72.88	39.92	0.00	19.49	72.91	46.72	0.00	13.35	90.18	59.88	0.00	26.08
9	78.13	48.40	0.00	14.31	78.24	51.44	0.00	19.66	79.27	51.78	0.00	19.40	86.56	66.83	0.00	18.12
10	79.23	61.16	0.00	11.43	83.21	53.94	0.00	16.38	79.99	58.78	0.00	17.51	87.73	69.57	0.07	16.58
11	85.53	67.66	0.00	12.94	86.72	62.73	0.00	15.06	82.47	53.38	0.00	20.61	87.40	60.33	0.00	17.54
12	86.16	66.79	0.00	13.52	87.76	64.44	0.04	15.50	84.06	53.82	0.00	16.93	95.40	71.64	0.00	21.33
13	83.95	65.75	0.00	14.72	85.84	65.88	0.00	15.14	86.47	55.40	0.00	20.86	92.68	75.63	0.00	24.44
14	84.65	61.23	0.00	12.58	81.88	62.65	0.46	10.04	87.67	57.67	0.00	22.40	96.19	66.34	0.00	22.91
15	84.49	64.17	0.00	16.44	81.07	58.71	0.00	18.51	88.39	58.12	0.00	19.65	91.49	71.49	0.00	18.36
16	84.16	57.49	0.00	14.43	83.23	59.59	0.00	16.65	85.12	58.33	0.00	21.09	72.01	63.19	0.00	4.27
17	78.37	59.27	0.00	11.25	84.42	64.22	0.00	15.61	88.16	59.50	0.00	19.30	90.57	67.05	0.00	17.40
18	78.44	54.66	0.00	16.33	86.13	63.99	0.00	18.43	87.33	61.16	0.00	23.79	83.61	63.63	0.68	11.01
19	81.52	55.00	0.00	14.36	87.40	70.45	0.00	13.09	88.83	56.35	0.00	21.65	92.01	64.53	0.00	23.30
20	66.69	42.65	0.00	18.10	85.87	68.65	0.00	17.61	88.29	57.76	0.00	21.49	84.25	73.18	0.35	5.96
21	58.32	38.52	0.00	18.30	59.43	45.86	0.08	6.72	90.00	57.63	0.00	19.74	87.85	60.12	0.00	28.28
22	59.36	31.39	0.00	13.58	73.51	43.07	0.00	21.23	88.59	62.82	0.00	21.71	87.55	53.11	0.00	27.27
23	76.32	51.10	0.00	14.38	77.56	50.92	0.00	19.36	87.94	57.81	0.00	18.40	93.31	62.17	0.00	24.08
24	78.26	57.22	0.00	12.77	81.07	53.08	0.00	20.42	87.93	60.31	0.00	20.56	75.78	67.10	2.30	1.29
25	73.11	58.86	0.00	18.82	84.29	56.95	0.00	20.13	86.41	62.55	0.00	20.34	87.13	66.92	0.39	11.64
26	71.80	36.00	0.00	17.95	83.48	60.98	0.09	11.42	91.58	66.61	0.00	22.11	86.23	68.38	0.00	13.85
27	73.09	52.25	0.00	8.47	63.72	50.36	0.01	22.26	93.04	66.60	0.00	23.72	81.68	58.24	0.00	30.64
28	72.88	56.61	0.00	18.00	64.99	33.56	0.00	23.40	93.45	59.27	0.00	26.72	84.33	51.57	0.00	29.90
29	78.60	45.55	0.07	15.17	67.53	35.94	0.00	23.99	93.38	60.13	0.00	25.31	87.96	57.18	0.00	24.87
30	68.20	51.55	0.01	7.63					91.87	58.89	0.00	22.72	80.62	55.42	1.60	12.02
31	76.26	53.22	0.02	10.11					85.98	63.54	0.01	20.99				
Avg	76.35	52.10	0.01	14.36	78.32	53.76	0.07	15.52	85.51	57.19	0.00	20.85	86.17	62.18	0.19	19.29
Max	86.97	67.66	0.29	18.82	87.76	70.45	1.02	23.99	93.45	68.31	0.01	26.72	96.19	75.63	2.30	30.64
Min	58.32	31.39	0.00	5.70	59.43	33.56	0.00	3.53	69.01	33.47	0.00	13.35	72.01	46.53	0.00	1.29
Total			0.39	445.11			2.08	478.95			0.01	646.26			5.58	578.83

Table 1. Continued.

Day	May				June				July				August			
	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²
1	81.36	52.30	0.00	30.61	91.13	69.62	0.00	19.37	92.39	70.79	0.00	22.27	94.93	72.41	0.00	24.57
2	86.49	51.71	0.00	30.96	88.03	72.81	0.04	18.30	90.91	71.80	0.00	17.91	89.40	73.40	0.00	20.12
3	87.35	57.85	0.00	30.02	82.04	71.06	0.20	11.04	93.33	70.81	0.00	24.36	94.75	71.56	0.01	25.26
4	89.04	57.76	0.00	28.30	82.26	71.74	0.56	6.74	91.65	71.20	0.00	23.95	94.78	74.30	1.51	22.85
5	88.75	59.34	0.00	26.55	85.59	70.97	3.09	10.79	91.40	71.64	0.15	25.54	91.44	71.89	0.03	15.99
6	86.34	59.63	0.00	25.27	86.38	71.82	0.39	7.17	91.38	72.22	0.72	18.08	93.13	71.46	0.74	23.41
7	80.98	58.62	0.00	29.91	90.46	73.81	0.03	15.81	90.59	71.29	0.00	21.25	94.68	71.58	0.00	22.63
8	85.82	46.06	0.00	30.08	91.71	77.92	0.00	26.35	89.83	73.49	0.00	20.17	95.85	70.21	0.00	26.87
9	90.12	58.01	0.16	26.23	94.62	72.05	0.00	22.20	93.18	72.39	0.00	24.01	95.09	73.65	0.00	24.47
10	78.19	67.26	0.01	7.45	94.89	73.29	0.69	22.03	91.13	74.52	0.00	18.14	94.42	72.52	0.00	23.36
11	86.88	62.91	0.01	29.01	92.21	70.25	0.01	21.61	92.26	75.81	0.09	20.31	94.42	72.23	0.08	17.14
12	88.16	58.91	0.00	29.52	90.07	68.61	0.00	26.95	94.44	75.74	0.00	22.25	95.34	70.54	0.20	21.29
13	87.24	59.05	0.00	28.55	84.42	72.00	0.02	11.83	94.46	71.76	0.03	26.19	95.85	72.90	0.12	22.55
14	85.95	62.96	0.00	24.29	90.72	69.84	0.00	23.56	94.37	74.59	0.07	18.92	96.55	73.67	0.93	26.55
15	87.84	67.50	0.00	20.38	91.17	71.85	0.00	28.44	92.46	72.14	0.25	18.88	93.34	71.83	0.03	24.94
16	88.11	69.80	0.01	21.76	88.68	62.62	0.00	26.22	92.98	69.46	0.00	25.43	88.39	72.97	0.31	16.37
17	91.20	64.83	0.01	27.31	90.84	66.33	0.00	26.30	91.96	71.92	0.18	18.14	91.67	73.89	0.04	13.48
18	76.64	64.53	0.82	6.65	92.80	67.89	1.84	22.04	91.09	72.19	0.01	22.84	91.81	71.74	0.76	17.53
19	87.39	64.98	0.00	27.25	87.57	70.97	0.01	19.03	90.43	73.51	0.21	17.95	83.66	70.97	0.09	7.31
20	87.69	59.72	0.00	28.40	92.80	69.51	0.05	24.79	93.06	72.39	0.25	23.68	93.15	71.44	0.00	22.24
21	92.61	66.61	0.19	24.20	93.07	70.02	0.00	27.31	89.64	72.30	0.00	23.23	91.33	72.81	0.63	16.42
22	93.70	63.68	0.02	25.31	93.09	70.20	0.00	25.99	85.51	72.66	0.33	12.91	88.07	73.33	1.04	9.31
23	90.23	66.72	0.00	23.13	93.36	69.82	0.00	23.71	86.27	72.66	0.12	11.06	93.49	74.14	0.07	19.30
24	83.44	70.09	0.13	8.72	94.87	71.24	0.12	25.47	91.38	71.96	0.13	24.08	91.67	77.38	0.79	17.25
25	83.68	69.91	0.25	11.29	95.81	73.51	0.00	25.77	91.22	71.67	0.76	18.91	93.79	74.91	0.00	23.83
26	89.33	71.26	0.09	19.05	94.48	72.82	0.13	25.74	91.42	71.91	0.00	24.34	93.69	76.60	0.00	22.23
27	90.63	71.83	0.05	21.90	93.96	72.36	0.00	25.41	92.91	70.84	0.05	18.12	93.09	74.62	0.00	21.58
28	92.32	69.15	1.91	19.10	94.41	72.43	0.00	22.23	91.24	73.22	0.23	15.11	93.38	75.81	0.00	18.83
29	90.61	67.41	0.01	22.52	95.25	72.68	0.27	19.79	93.25	71.69	0.00	20.18	93.74	75.99	0.28	16.90
30	93.22	67.82	0.02	23.29	93.09	73.69	0.00	18.27	94.14	73.31	0.50	28.08	91.54	73.92	0.39	11.68
31	92.32	67.55	0.00	26.62					95.63	72.64	0.01	25.40	90.12	72.43	1.63	12.29
<u>Avg</u>	87.54	63.09	0.12	23.67	90.99	71.12	0.25	21.01	91.81	72.40	0.13	21.02	92.79	73.13	0.31	19.63
<u>Max</u>	93.70	71.83	1.91	30.96	95.81	77.92	3.09	28.44	95.63	75.81	0.76	28.08	96.55	77.38	1.63	26.87
<u>Min</u>	76.64	46.06	0.00	6.65	82.04	69.62	0.00	6.74	85.51	69.46	0.00	11.06	83.66	70.21	0.00	7.31
<u>Total</u>			3.69	733.65			7.45	630.25			4.09	654.66			9.68	608.45

Table 1. Continued.

Day	September				October				November				December			
	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²	Max °F	Min °F	Rain inch	S Rad MJ/m ²
1	94.66	71.58	0.00	24.93	85.80	69.66	0.00	15.86	87.17	69.49	0.37	12.09	61.32	38.96	0.00	17.09
2	94.12	73.87	0.00	24.21	81.36	69.51	0.00	9.37	75.76	58.41	0.00	19.45	65.86	35.22	0.00	17.53
3	95.11	74.08	0.01	19.23	82.45	69.39	0.13	11.76	77.58	53.26	0.00	18.29	74.95	41.70	0.00	14.98
4	95.27	74.84	0.00	24.31	81.23	71.53	0.13	7.37	81.54	58.51	0.00	16.73	76.06	56.77	0.00	7.53
5	95.00	75.67	0.23	18.42	89.55	73.58	0.10	15.08	84.07	63.95	0.00	14.22	79.05	60.73	0.00	13.77
6	88.34	72.79	0.35	13.66	91.29	75.38	0.59	16.51	85.78	66.02	0.00	16.80	75.47	47.48	0.00	13.02
7	90.43	71.80	0.01	16.94	91.31	74.93	0.00	19.83	81.41	70.74	0.30	9.90	67.51	49.08	0.72	7.49
8	91.83	70.81	0.01	20.71	91.65	73.65	0.01	19.50	75.69	72.05	0.10	3.53	60.55	40.40	0.00	16.64
9	90.97	73.40	0.06	11.74	90.23	72.12	0.00	21.14	82.81	74.30	0.06	5.51	64.69	36.47	0.00	16.28
10	91.13	73.27	0.13	13.88	91.29	73.22	0.00	17.90	83.01	74.34	0.33	9.65	74.21	39.41	0.00	12.75
11	91.96	74.66	0.01	21.61	88.74	74.43	0.01	14.57	79.95	73.56	0.86	2.79	73.92	43.78	0.00	15.29
12	84.79	76.93	0.06	15.31	88.79	70.30	0.00	18.62	81.91	71.55	0.30	9.39	78.03	59.18	0.00	10.66
13	77.23	74.73	0.43	3.22	88.21	68.38	0.06	19.07	85.15	68.50	0.00	11.16	82.47	56.26	0.00	13.16
14	88.16	75.06	0.01	10.87	89.46	66.72	0.00	20.09	84.94	68.40	0.00	14.27	77.29	62.40	0.10	7.59
15	90.99	75.81	0.00	11.46	91.11	67.46	0.00	19.16	89.78	71.15	0.86	12.76	73.27	64.63	0.03	5.39
16	91.90	75.42	0.00	19.58	89.98	70.48	0.00	16.00	84.92	67.62	0.00	14.44	78.80	56.98	0.09	9.33
17	90.45	75.65	0.00	18.10	88.12	70.72	0.00	17.27	78.33	54.05	0.00	17.89	67.68	49.30	0.00	11.11
18	87.12	76.15	0.67	17.85	89.60	68.52	0.06	18.16	78.08	52.21	0.00	16.41	63.05	43.02	0.00	15.89
19	91.20	71.67	0.00	20.90	84.31	71.92	0.39	8.44	75.69	57.61	0.00	11.25	73.06	44.06	0.00	14.75
20	87.98	75.90	0.70	11.00	84.67	69.15	0.43	8.81	80.46	61.57	0.00	13.64	76.28	49.98	0.01	8.61
21	86.63	73.80	0.00	17.92	84.51	71.28	0.06	8.63	74.59	64.33	0.16	9.05	71.15	48.47	0.06	15.56
22	87.58	68.05	0.00	20.90	82.33	70.66	0.00	12.88	84.00	63.66	0.01	12.20	72.27	46.02	0.00	13.52
23	87.55	65.71	0.00	21.76	83.30	70.93	0.22	10.30	79.84	66.97	0.00	14.14	76.60	42.67	0.00	14.31
24	91.09	68.86	0.00	19.73	87.71	68.32	0.00	16.08	80.85	57.42	0.00	16.58	81.79	52.47	0.09	11.56
25	92.21	72.91	0.00	17.19	90.03	72.09	0.00	13.42	81.34	60.03	0.00	15.48	58.86	40.80	0.21	15.03
26	91.94	71.78	0.01	18.50	88.83	71.64	0.02	14.26	84.29	60.84	0.00	14.10	57.24	33.63	0.00	15.86
27	91.99	70.99	0.62	18.49	89.76	74.35	0.10	14.78	84.04	60.91	0.00	16.27	71.74	37.27	0.00	14.92
28	86.27	74.41	0.21	15.27	89.15	73.60	0.11	14.91	84.09	58.86	0.00	14.45	75.94	48.56	0.00	14.02
29	86.36	71.33	1.36	14.09	88.30	70.90	0.00	14.92	82.92	59.68	0.00	14.30	76.44	51.19	0.00	14.16
30	77.63	65.53	0.04	11.90	82.58	63.43	0.46	17.08	72.34	67.17	0.30	5.54	77.04	52.90	0.00	10.78
31					83.08	62.53	0.00	8.17					81.63	65.43	0.00	12.33
Avg	89.60	72.92	0.16	17.12	87.38	70.67	0.09	14.84	81.41	64.24	0.12	12.74	72.39	48.23	0.04	12.93
Max	95.27	76.93	1.36	24.93	91.65	75.38	0.59	21.14	89.78	74.34	0.86	19.45	82.47	65.43	0.72	17.53
Min	77.23	65.53	0.00	3.22	81.23	62.53	0.00	7.37	72.34	52.21	0.00	2.79	57.24	33.63	0.00	5.39
Total			4.92	513.69			2.88	459.93			3.65	382.25			1.31	400.90

Rainfall

Daily rainfall equaled or exceeded 1 inch on 10 separate occasions, with a daily total rainfall maximum of 3.09 inches on 5 June (Table 1). Annual rainfall for 2020 totaled 45.73 inches, which was 7.15 inches lower than the 79-year average of 52.97 inches (Table 2). Only 0.01 inches of rainfall fell during March, which is a new record low rainfall for the month. The lowest annual total on record was observed in 2000 when 32.02 inches were measured, and the greatest annual rainfall total observed was in 1959 when 78.82 inches were recorded. Nine months of rainfall was below normal. Monthly rainfall during 2020 is graphically compared to historical mean, median, maximum, and minimum rainfall in Figure 1.

Table 2. Summary of rainfall by months. Range Cattle REC, 2020.

Month	1942 to 2020		79-year average†	2020	Difference from 79-year average
	Maximum / month	Minimum / month		Total	
-----inches*-----					
January	8.45	0.03	2.15	0.39	- 1.76
February	9.59	0.02	2.46	2.08	- 0.38
March	12.34	0.01	2.92	0.01	- 2.91
April	11.91	0.00	2.47	5.58	3.11
May	13.55	0.00	3.80	3.69	- 0.11
June	18.99	2.79	8.56	7.45	- 1.11
July	19.74	1.87	8.24	4.09	- 4.15
August	16.10	3.13	8.35	9.68	1.33
September	20.11	0.89	7.22	4.92	- 2.30
October	11.23	0.00	2.89	2.88	- 0.01
November	11.22	0.07	1.86	3.65	1.79
December	8.61	0.07	1.96	1.31	- 0.65
<i>Year total</i>			52.97	45.73	- 7.15

*Inches x 2.54 = cm.

† Since rainfall records began in July 1942, means for January to June are 78-year means.

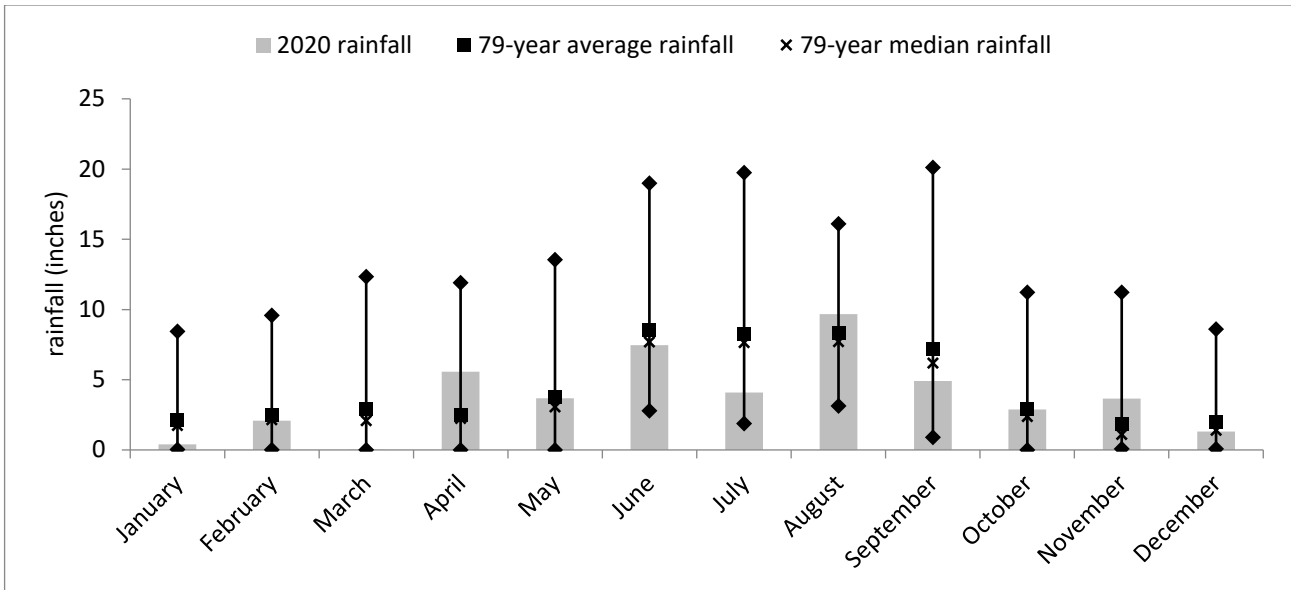


Figure 1. Monthly rainfall at the Range Cattle REC during 2020 relative to historical average, median, minimum, and maximum monthly rainfall. Current rainfall is indicated by the gray bars, historical average and median rainfall are indicated by squares (■) and “X’s” (x), respectively. Historical high and low rainfall are indicated by diamonds (◆).

Evapotranspiration

Evapotranspiration is the total amount of water transferred from the earth to the atmosphere. Monthly evaporation in 2020 was 1.21 inches greater than the 15-year average (Table 3). Evapotranspiration exceeded rainfall in January through March, May, July, October, and December 2020 (Figure 2). It is quite normal for evapotranspiration to exceed rainfall in January, February, March, and December.

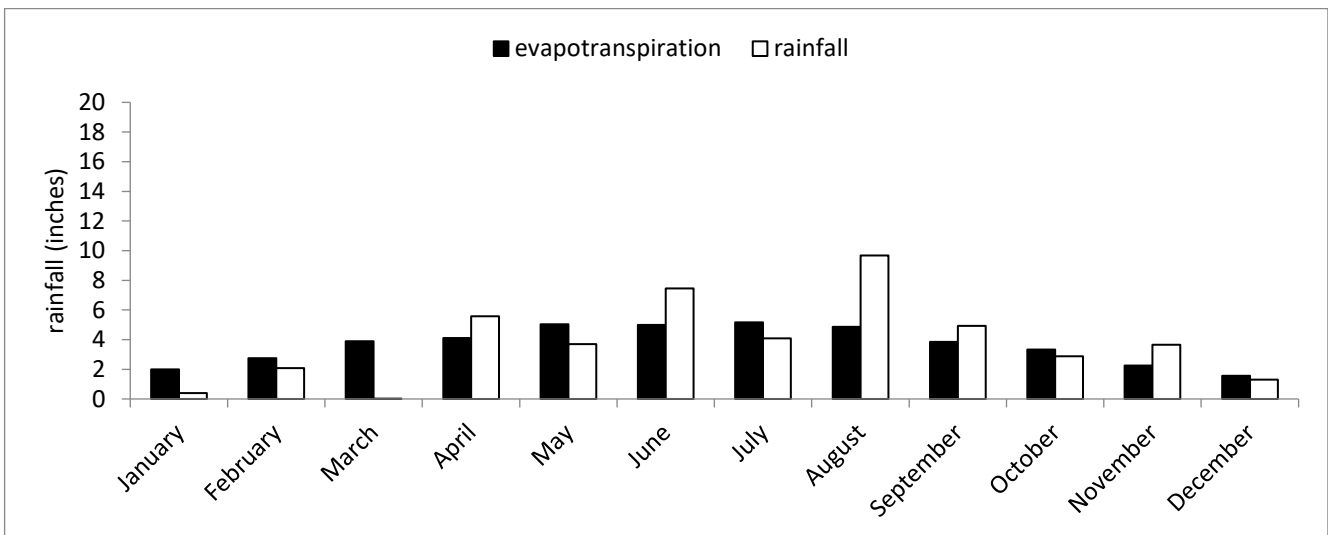


Figure 2. Comparison of monthly evapotranspiration and rainfall at the Range Cattle REC during 2020.

Solar Radiation

Total solar radiation for 2020 was 6530.02 MJ. Daily solar radiation is shown in Table 1, and 2020 total monthly solar radiation can be seen in Table 3. If soil water, temperature, and fertility are not limiting and vegetative cover is complete, 1 MJ results in about 14.3 lb/A of plant dry matter. Theoretically, enough solar radiation was received in April 2020 (578.83 MJ) to produce approximately 8,277 lb/A of plant dry matter.

Table 3. Monthly solar radiation and evapotranspiration at the Range Cattle REC in 2020.

Month	2006-2020	2020	2006-2020	2020
	Evapotranspiration		Solar radiation	
	-----inches-----		-----MJ/m ² -----	
January	1.89	2.00	416.30	445.11
February	2.50	2.75	458.03	478.95
March	3.43	3.90	644.41	646.26
April	4.36	4.10	701.90	578.83
May	5.21	5.03	767.19	733.65
June	4.92	5.00	660.74	630.25
July	4.92	5.17	648.24	651.66
August	4.60	4.87	588.68	608.54
September	3.97	3.84	532.13	513.69
October	3.21	3.33	499.20	459.93
November	2.03	2.25	398.33	382.25
December	1.56	1.57	372.67	400.90
<i>Total</i>	<i>42.60</i>	<i>43.81</i>	<i>6687.82</i>	<i>6530.02</i>

Temperature

The highest temperature observed during 2020 was 96.55 °F on 14 August (Table 1). Monthly average-high temperatures were at or exceeded the 77-year average in all months except May and December (Table 4). Monthly average low temperatures were above the 77-year average in all months except May and December (Table 5). Daily low temperatures fell to less than 32 °F only on 22 January (31.39 °F) (Table 1). Scattered frost begins to occur when air temperature drops to near 35 °F; therefore scattered frost likely occurred approximately seven times in 2020. Overall, mean low temperature for 2020 was 2.4 degrees greater than the 77-year mean.

Table 4. Summary of maximum temperature* during 2020 by month, Range Cattle REC.

Month	Shelter†					Ground level‡	
	1944-2020	2020	1944-2020	2020	2020		
	Avg. high	Avg. high	Extreme high	Year	Extreme high	Avg. high	Extreme high
-----°F-----						-----°F-----	
January	73.2	76.4	90.0	1982	87.0	69.1	75.1
February	75.4	78.3	91.0	1962	87.8	70.7	76.4
March	79.2	85.5	94.0	1946	93.5	78.9	87.8
April	83.6	86.2	97.0	1945	96.2	82.9	89.3
May	88.1	87.5	103.0	1945	93.7	83.0	86.5
June	90.2	91.0	103.0	1945	95.8	85.1	87.8
July	90.9	91.8	101.0	1972	95.6	86.8	89.2
August	91.1	92.8	98.0	several	96.7	85.5	89.0
September	89.6	89.6	96.2	several	95.3	83.8	87.6
October	85.1	87.4	96.5	2015	91.6	80.9	83.5
November	79.3	81.4	94.0	1990	89.8	75.5	79.7
December	74.6	72.4	89.0	1945	82.5	66.2	71.2
Average	83.4	85.0				79.0	

*°C = (°F – 32) x 0.555

† Prior to 2006, 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.

Table 5. Summary of minimum temperature* for 2020 by month, Range Cattle REC.

Month	Shelter†					Ground level‡	
	1944-2020	2020	1944-2020	2020	2020		
	Avg. low	Avg. low	Extreme low	Year	Extreme low	Avg. low	Extreme low
	-----°F-----					-----°F-----	
January	49.2	52.1	18.0	1981	31.4	63.8	56.5
February	50.8	53.8	23.8	2009	33.6	64.6	55.9
March	54.2	57.2	26.0	1980	33.5	70.3	58.3
April	58.1	62.2	34.0	1971	46.5	73.5	69.1
May	63.4	63.1	43.0	1945	46.1	74.2	66.7
June	69.2	71.1	52.0	1984	62.6	78.9	75.3
July	71.4	72.4	62.0	several	69.5	80.2	77.7
August	72.0	73.1	61.0	1977	70.2	80.6	81.0
September	71.2	72.9	51.0	1962	65.5	79.6	76.4
October	65.0	70.7	37.5	2008	62.5	77.0	74.5
November	57.0	64.2	25.0	1970	52.2	72.0	68.4
December	51.6	48.2	20.0	1962	33.6	61.9	55.1
<i>Average</i>	<i>61.1</i>	<i>63.5</i>				<i>73.1</i>	

*°C = (°F – 32) x 0.555

† Prior to 2006, 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 Figure 3. The spring freeze hazard estimates the likelihood of temperatures reaching below the critical temperature after a selected date, while the fall freeze hazard estimates the likelihood of experiencing the first attainment of a critical temperature before a selected date. Based on records from 1964 to 2017, 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, one should expect approximately a 30% chance of a frost (assuming 35 °F) occurring before the 1st of March (Figure 4C). A grower has a significant likelihood of experiencing three frosts over ten years after the 1st of March; however, the likelihood drops to approximately 10% by March 20th.

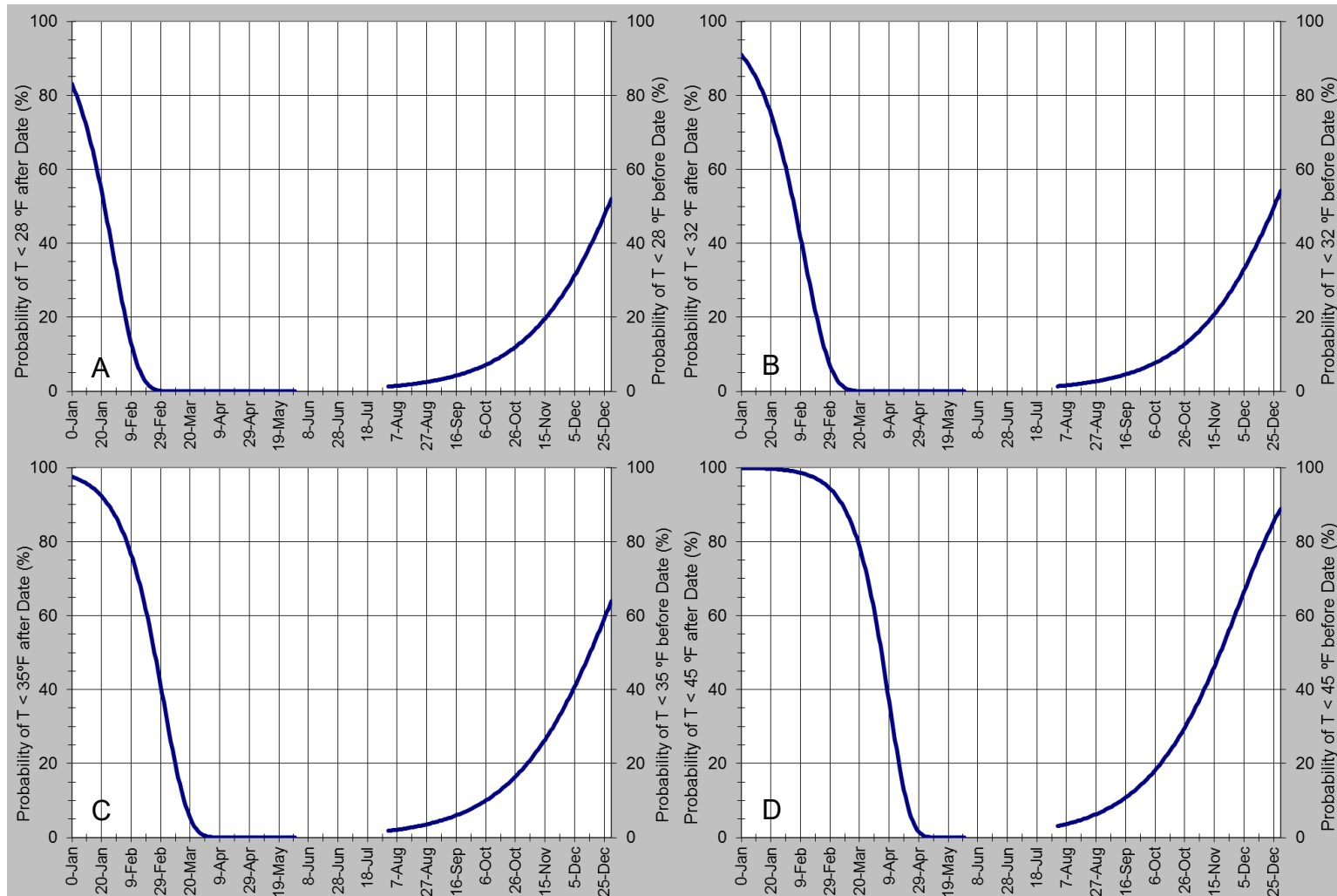


Figure 3. Spring and fall freeze hazard showing temperature probabilities after a given spring date and before a given fall date. Trend lines for temperature probabilities <28 °F (A), <32 °F (B), <35 °F (C), and <45 °F (D). Graphs were constructed using minimum temperature data from 1960 – 2010 using FRISKNH as developed by R. Snyder and J. Paulo de Melo-Abreu.