

Range Cattle Research and Education Center

February 2015

Research Report RC-2015-1

CLIMATOLOGICAL REPORT 2014
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 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 2014 at the Range Cattle Research and Education Center (REC), Ona, Florida. The center is located $81^{\circ} 56.406'$ W and $27^{\circ} 23.733'$ 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). Accuracy of rainfall as measured by the Weather Watch 2000 or 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 73-year summary of rainfall data and a 71-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 2014, 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	73.54	59.79	0.00	6.59	75.88	61.72	0.02	4.400	78.62	42.16	0.00	22.35	83.55	46.98	0.00	27.50
2	82.54	62.24	0.08	11.47	85.86	60.71	0.00	14.55	82.54	51.22	0.00	22.11	86.02	51.76	0.00	27.86
3	61.50	42.16	0.00	13.16	84.22	59.50	0.00	13.24	81.27	51.49	0.00	22.06	86.09	53.64	0.00	25.41
4	66.38	44.33	0.00	3.48	86.58	60.35	0.00	13.20	82.71	55.67	0.00	15.09	84.27	55.74	0.00	23.00
5	82.65	58.98	0.07	13.31	83.48	65.23	0.00	10.67	83.79	57.99	0.00	16.71	86.76	55.85	0.00	24.86
6	77.92	46.09	0.01	9.16	77.32	57.88	0.02	7.04	68.09	62.49	0.63	2.37	87.22	55.44	0.00	25.59
7	51.49	36.42	0.00	17.00	74.16	52.32	0.00	10.70	66.79	52.39	0.01	17.67	89.04	61.72	0.08	23.04
8	66.87	39.60	0.00	6.77	75.69	57.99	0.00	8.15	74.93	39.71	0.00	22.02	76.23	60.08	0.54	22.39
9	72.66	59.00	0.08	4.93	76.39	49.75	0.00	15.35	80.37	49.84	0.00	22.73	73.26	54.72	0.01	25.99
10	81.54	65.23	0.08	8.10	79.21	47.30	0.00	18.71	78.26	51.62	0.02	18.10	79.11	50.22	0.00	25.07
11	83.07	66.94	0.58	10.52	81.14	51.71	0.00	17.48	81.43	48.11	0.00	22.08	81.97	51.33	0.00	20.34
12	72.48	46.33	0.00	16.66	79.63	49.28	0.83	10.93	80.53	62.87	0.03	13.77	84.99	62.26	0.00	22.91
13	79.84	46.36	0.00	11.65	65.17	43.23	0.01	16.23	72.14	45.93	0.00	26.95	84.38	55.56	0.00	20.62
14	74.08	58.77	0.02	6.90	67.21	35.45	0.00	19.90	76.69	39.68	0.00	25.79	87.24	66.25	0.00	22.54
15	63.43	46.87	0.00	6.10	70.57	40.19	0.00	16.27	82.22	47.66	0.00	22.04	84.67	62.35	0.00	16.60
16	57.29	33.53	0.05	18.55	75.25	34.91	0.00	20.11	84.29	52.52	0.00	23.28	77.68	56.01	0.00	19.83
17	65.75	29.06	0.00	16.71	81.03	40.73	0.00	19.91	78.08	67.84	0.89	3.45	82.63	61.93	0.35	16.89
18	59.94	31.99	0.00	18.98	82.65	46.13	0.00	19.65	74.01	53.55	0.23	23.63	82.24	66.96	0.00	10.01
19	69.03	27.11	0.00	14.64	84.72	48.74	0.00	20.25	81.01	50.11	0.00	23.86	75.69	61.63	0.00	19.14
20	74.97	39.36	0.00	14.78	85.62	53.51	0.00	19.10	82.42	56.95	0.00	18.69	75.16	60.82	0.00	15.15
21	74.82	47.64	0.06	11.00	84.25	61.75	0.00	11.04	83.84	58.44	0.00	21.50	72.55	54.75	0.00	14.05
22	59.59	34.30	0.00	19.13	84.38	63.27	0.04	13.64	82.85	56.28	0.00	20.50	79.74	51.37	0.00	23.93
23	66.07	29.29	0.00	19.12	85.06	64.71	0.00	17.44	82.53	59.99	0.06	15.76	82.33	52.95	0.00	27.49
24	64.11	41.11	0.00	14.88	82.17	60.10	0.00	13.38	69.22	63.86	0.84	3.65	87.66	55.98	0.00	24.73
25	70.61	42.50	0.00	11.52	82.67	59.94	0.00	16.77	74.86	50.99	0.23	15.62	86.67	56.95	0.00	26.10
26	65.35	47.82	0.08	5.63	77.13	68.40	0.32	10.00	65.35	44.62	0.00	28.55	89.76	55.45	0.00	23.79
27	80.78	55.83	0.00	13.65	71.42	52.50	0.07	13.32	65.35	45.63	0.03	6.10	92.01	64.71	0.00	26.02
28	81.73	52.74	0.00	14.72	71.94	48.09	0.00	22.04	80.13	59.02	0.00	11.81	93.09	63.57	0.00	26.57
29	64.22	46.38	1.00	4.30					79.07	65.25	0.34	5.16	89.06	67.62	0.00	22.74
30	53.44	47.34	0.68	2.29					76.28	57.51	0.00	27.91	90.14	67.96	0.01	19.87
31	70.12	52.47	1.04	4.42					76.62	45.84	0.01	18.47				
<u>Avg</u>	69.93	46.37	0.12	11.29	78.96	53.41	0.04	14.77	77.62	53.14	0.11	18.06	83.71	56.21	0.04	20.96
<u>Max</u>	83.07	66.94	1.04	19.13	86.58	68.40	0.83	22.04	84.29	67.84	0.89	28.55	93.09	66.96	0.54	27.86
<u>Min</u>	51.49	27.11	0.00	2.29	65.17	34.91	0.00	4.40	65.35	39.68	0.00	2.37	72.55	46.98	0.00	2.24
<u>Total</u>			3.83	350.11			1.31	413.47			3.32	559.78			1.16	649.86

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	89.11	64.13	0.00	21.47	85.80	69.57	0.00	21.63	93.47	71.98	0.00	24.67	92.23	71.56	0.00	19.67
2	84.33	68.52	0.98	10.57	82.20	71.33	0.00	12.64	93.51	70.05	0.00	26.77	94.05	72.84	0.00	23.09
3	74.32	63.86	1.81	3.72	83.73	67.95	0.00	16.98	91.56	74.32	0.00	23.58	93.99	74.75	0.00	20.29
4	83.59	55.15	0.00	29.52	87.04	64.22	0.00	25.69	90.77	70.79	0.46	22.76	88.43	73.53	1.11	8.14
5	87.80	53.56	0.00	29.05	87.94	64.63	0.00	24.97	91.29	70.07	0.01	16.95	87.67	73.63	0.15	12.56
6	88.43	57.72	0.00	29.74	92.44	65.71	0.00	24.36	90.23	70.11	1.28	21.61	93.76	72.05	0.19	18.98
7	89.06	60.26	0.00	27.65	91.74	68.50	0.00	26.04	85.91	68.97	0.06	12.09	93.13	72.28	0.00	15.53
8	89.51	63.55	0.00	27.54	92.43	66.83	0.13	24.19	90.54	70.07	0.00	17.58	90.99	70.92	0.09	17.57
9	89.95	64.83	0.00	28.69	92.95	67.30	0.00	24.37	86.67	68.72	0.00	15.27	91.18	70.95	0.03	16.77
10	90.27	64.94	0.97	24.15	92.17	69.30	1.68	24.30	91.92	69.31	0.04	18.10	92.41	72.50	0.00	24.16
11	88.05	69.49	0.00	24.13	89.28	69.21	0.06	21.24	90.59	69.82	0.44	14.82	91.96	72.14	0.00	23.95
12	87.19	64.67	0.00	23.46	88.79	67.71	0.06	22.07	92.48	71.33	1.64	18.08	91.49	70.23	0.02	20.71
13	88.38	67.60	0.43	21.27	87.26	69.01	0.31	13.60	91.99	70.63	0.08	20.84	91.20	72.54	0.00	20.33
14	86.79	70.70	0.02	18.72	89.06	68.41	0.62	14.95	91.22	71.24	0.01	24.33	90.32	72.48	0.11	15.37
15	87.22	70.39	0.01	21.99	91.87	67.14	0.53	19.37	88.99	71.11	0.37	20.92	85.51	72.39	0.05	12.22
16	80.73	64.69	0.00	31.33	90.99	66.25	0.65	24.94	85.69	71.96	0.34	0	85.95	70.27	0.42	12.43
17	82.49	51.62	0.00	31.44	88.93	67.50	0.00	23.03	88.97	72.03	0.31	19.82	94.03	71.11	0.00	25.05
18	84.72	57.18	0.00	31.70	88.48	66.38	2.13	15.11	92.03	68.86	0.00	25.27	93.24	72.14	0.00	19.78
19	85.68	56.71	0.00	29.20	89.69	67.51	0.17	19.17	94.35	72.19	0.00	25.64	94.44	71.22	0.05	20.79
20	87.30	59.58	0.00	27.23	88.68	67.66	0.13	21.53	91.99	73.76	0.00	18.11	95.90	71.71	0.00	25.70
21	87.17	58.53	0.00	29.75	88.93	69.76	0.00	23.88	93.90	71.19	0.96	20.17	96.55	73.76	0.25	22.02
22	91.09	57.38	0.00	29.82	89.85	70.43	0.00	24.83	91.78	69.73	0.13	19.85	96.28	71.26	0.07	24.01
23	92.32	60.57	0.00	29.45	91.54	70.61	0.00	24.19	93.76	71.35	0.00	22.41	94.69	71.60	0.00	23.41
24	94.06	64.53	0.00	25.79	92.57	67.35	0.00	21.91	91.67	72.19	0.10	20.88	96.91	72.82	0.61	24.55
25	92.08	66.99	0.50	21.69	93.22	70.50	0.00	24.88	92.34	71.29	1.77	19.03	91.53	74.53	0.00	22.42
26	91.94	66.18	0.01	26.00	94.15	69.42	0.06	25.07	91.78	72.36	0.06	17.85	91.26	73.24	0.00	23.48
27	85.68	66.58	0.00	23.69	93.31	70.66	0.02	20.19	91.02	73.33	0.08	16.95	92.52	68.65	0.00	22.78
28	91.49	67.26	0.60	21.33	94.23	69.08	0.00	24.89	92.86	73.06	0.01	24.20	92.35	71.71	0.00	21.98
29	91.38	67.05	0.32	21.27	95.18	70.12	0.00	25.26	89.11	74.70	0.27	15.60	92.28	70.00	0.59	17.04
30	88.84	66.56	0.16	21.50	93.43	71.56	0.05	20.97	91.67	73.76	0.01	19.32	92.86	71.37	0.07	19.87
31	76.71	67.24	0.13	18.51					92.25	70.77	0.01	24.64	93.70	72.54	0.00	21.13
<u>Avg</u>	87.34	63.16	0.19	24.56	90.26	68.39	0.21	21.87	91.17	71.32	0.27	19.62	92.35	77.02	0.12	19.97
<u>Max</u>	94.06	70.70	1.81	31.70	94.23	71.33	2.13	26.04	94.35	74.32	1.77	161.60	96.91	74.75	1.11	25.70
<u>Min</u>	74.32	51.62	0.00	3.72	82.20	64.22	0.00	12.64	85.69	68.72	0.00	0.00	85.51	68.65	0.00	8.14
<u>Total</u>			5.94	761.36			6.6	656.25			8.44	608.12			3.81	615.91

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	94.01	70.63	0.00	21.88	87.98	72.72	0.01	18.57	65.66	45.28	0.00	19.36	79.45	56.10	0.00	12.42
2	92.30	72.41	0.02	21.88	91.60	71.80	0.02	21.11	68.18	39.58	0.00	21.49	77.16	60.80	0.00	10.61
3	92.37	69.28	0.04	22.47	90.66	73.27	0.00	17.92	75.43	41.18	0.00	18.97	80.47	59.41	0.00	12.52
4	91.33	70.30	0.19	18.94	85.30	63.01	0.19	11.97	79.84	53.58	0.00	15.30	81.72	59.41	0.00	13.63
5	91.27	70.81	0.00	20.44	79.30	58.21	0.00	23.03	82.00	58.77	0.00	12.06	80.15	62.40	0.00	11.57
6	91.29	70.18	0.05	14.00	82.78	59.41	0.00	16.86	84.61	61.65	0.00	16.69	82.80	63.03	0.00	12.47
7	92.10	70.65	0.87	14.38	86.29	68.52	0.01	10.45	81.59	58.73	0.00	16.70	73.76	64.33	0.00	5.13
8	91.87	70.68	2.38	16.39	89.31	69.51	0.01	17.45	77.92	51.76	0.63	13.32	69.67	56.17	0.07	69.57
9	92.30	71.92	0.00	18.87	88.72	67.32	0.00	20.54	65.17	57.13	0.71	4.51	65.75	48.00	0.09	12.54
10	90.79	71.02	0.00	20.99	89.15	66.34	0.00	19.71	77.92	56.68	0.00	15.15	67.10	41.57	0.00	0.32
11	91.17	71.20	0.18	19.47	89.91	67.62	0.00	20.25	77.79	51.84	0.00	17.53	66.22	39.31	0.00	14.16
12	87.58	72.66	0.09	16.13	89.96	66.63	0.00	20.16	80.85	51.89	0.00	17.42	58.86	43.88	0.00	6.74
13	90.00	71.64	0.00	22.69	89.65	68.27	0.00	19.10	81.75	48.47	0.00	17.79	70.48	39.27	0.00	15.75
14	89.06	69.87	0.13	16.53	86.18	71.62	0.51	9.63	71.24	51.94	0.00	10.89	72.55	37.49	0.00	15.94
15	93.18	69.75	0.00	21.58	84.63	62.55	0.02	14.01	77.45	49.10	0.00	16.15	73.42	36.81	0.00	15.59
16	88.92	70.29	0.00	16.75	81.82	58.71	0.00	20.73	83.25	56.71	0.00	14.92	74.86	39.72	0.00	14.55
17	76.24	71.51	0.35	3.02	81.97	55.71	0.00	20.65	82.96	62.58	1.48	11.01	74.39	51.06	0.00	9.76
18	90.09	68.52	0.00	18.66	82.76	56.01	0.00	20.68	68.27	44.39	0.20	3.31	71.26	41.44	0.00	14.61
19	82.40	70.29	0.79	5.66	83.86	57.18	0.00	17.98	60.10	41.54	0.00	10.20	74.82	42.95	0.00	14.56
20	85.50	70.70	0.56	14.48	85.77	60.93	0.00	17.70	69.37	45.34	0.00	15.21	79.66	47.32	0.00	14.14
21	87.04	70.68	0.02	14.85	84.65	66.78	0.00	10.70	71.28	53.08	0.01	6.64	79.20	55.69	0.01	8.60
22	84.51	70.70	0.19	7.94	86.16	66.33	0.00	0.24	76.91	65.10	0.00	5.25	80.29	64.99	0.01	0.45
23	86.52	69.58	0.01	14.98	82.76	59.90	0.00	18.60	86.58	68.67	0.00	11.34	83.26	65.53	0.00	9.76
24	88.07	70.83	0.29	14.38	82.18	58.69	0.00	19.38	85.12	68.90	0.00	13.06	82.80	65.12	0.07	8.63
25	89.58	70.90	0.34	14.58	81.39	58.66	0.00	20.37	83.19	71.64	0.61	4.49	70.99	52.97	0.00	10.15
26	86.92	73.29	2.14	15.42	82.45	52.99	0.00	20.63	72.75	45.14	0.69	4.84	70.11	50.92	0.00	4.42
27	89.87	72.12	1.19	16.30	84.00	53.24	0.00	20.00	71.58	41.71	0.00	15.79	78.66	60.76	0.00	6.09
28	89.49	73.56	1.41	11.65	85.44	57.42	0.00	17.62	63.21	41.24	0.00	17.42	80.55	61.50	0.00	12.67
29	89.20	72.81	0.03	16.12	87.39	59.41	0.00	17.41	73.44	44.83	0.00	15.80	81.88	58.08	0.00	10.78
30	84.47	72.93	0.64	11.35	86.54	59.81	0.07	13.33	78.28	50.63	0.00	13.92	77.97	62.78	0.01	6.72
31					77.92	52.70	0.00	17.28					68.40	62.56	0.00	2.79
<u>Avg</u>	88.98	71.06	0.38	14.65	85.43	62.62	0.03	17.23	75.79	52.64	0.14	13.22	75.12	53.27	0.01	10.17
<u>Max</u>	94.01	73.56	2.14	22.69	91.60	73.27	23.03	32.48	86.58	71.64	1.48	21.49	83.26	65.53	0.09	15.94
<u>Min</u>	76.24	68.52	0.00	0.00	79.30	52.99	0.00	0.24	60.10	39.58	0.00	3.31	58.86	36.81	0.00	0.32
<u>Total</u>			11.91	482.80			0.84	534.06			4.33	396.54			0.26	315.22

Rainfall

Daily rainfall equaled or exceeded 1 inch on fourteen separate occasions, with daily rainfall exceeding 2 inches on three of these occasions (Table 1). The single greatest daily rain event was 8 September when 2.38 inches were recorded. Annual rainfall for 2014 totaled 51.75 inches, which was 1.61 inches less than the 73-year average of 53.36 inches (Table 2). 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. Seven months of 2014 saw rainfall that fell below the 73-year average. Rainfall was one or more inches less than the 73-year average in February, April, June, August, October, and December, two or more inches in August and October, and four or more inches in August. Total rainfall was more than two inches greater than the 73-year average in May and November and more than four inches in September. Monthly rainfall during 2014 is graphically compared to historical mean, median, maximum, and minimum rainfall in Figure 1.

Table 2. Summary of rainfall by months. Range Cattle REC, 2014.

Month	1942 to 2014		73-year average†	2014	Difference from 73-year average
	Maximum / month	Minimum / month		Total	
January	8.45	0.03	2.11	3.83	1.72
February	9.59	0.02	2.48	1.31	-1.17
March	12.34	0.13	3.09	3.32	0.23
April	11.91	0.00	2.45	1.16	-1.29
May	10.58	0.00	3.73	5.94	2.21
June	18.99	2.79	8.58	6.60	-1.98
July	19.74	1.87	8.33	8.84	0.51
August	16.10	3.13	8.34	3.81	-4.53
September	20.11	1.14	7.36	11.91	4.55
October	11.23	0.00	2.95	0.84	-2.11
November	11.22	0.07	1.89	4.33	2.44
December	8.61	0.07	1.93	0.26	-1.67
<i>Year total</i>			53.36	51.75	-1.61

*Inches x 2.54 = cm.

† Since rainfall records began in July 1942, means for January to June are 72-year means.

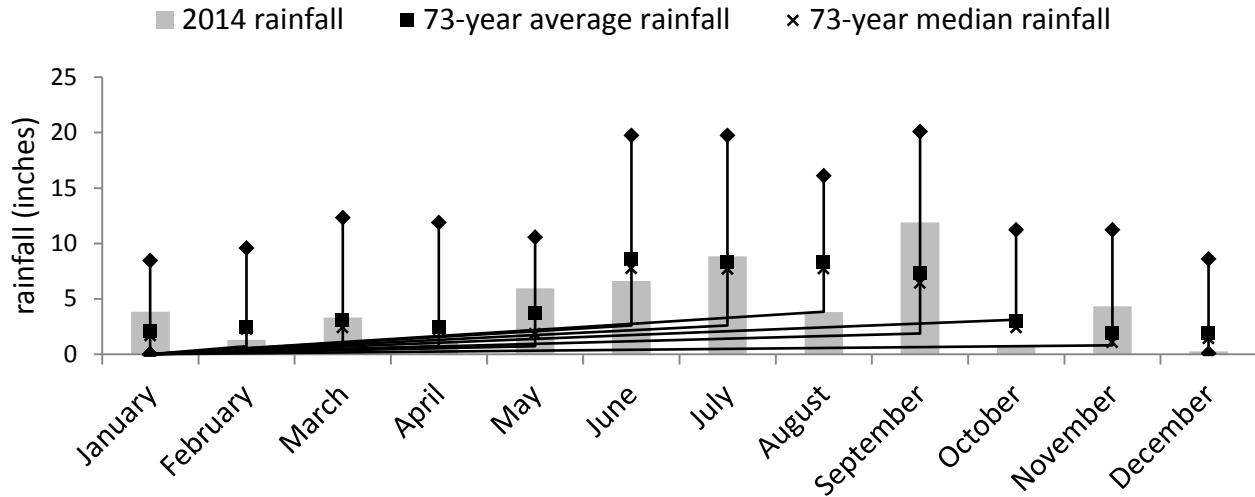


Figure 1. Monthly rainfall at the Range Cattle REC during 2014 relative to historical average, median, minimum, and maximum monthly rainfall. Current rainfall is indicated by the gray bars, historical average and median rainfall are indicated by squares (■) and “X’s” (x), respectively. Historical high and low rainfall are indicated by diamonds (◆).

Evapotranspiration

Evapotranspiration is the total amount of water transferred from the earth to the atmosphere. Monthly evaporation was greater than the nine-year average during January, March through May, and September (no evapotranspiration data was collected in February due to equipment malfunction) (Table 3). Evapotranspiration exceeded rainfall in April, August, and October in 2014 (Figure 2). Historically, evapotranspiration generally exceeds rainfall in January to May and October to December, which are months with limited rainfall. Rainfall exceeded evapotranspiration by 11.68 inches for the entire year.

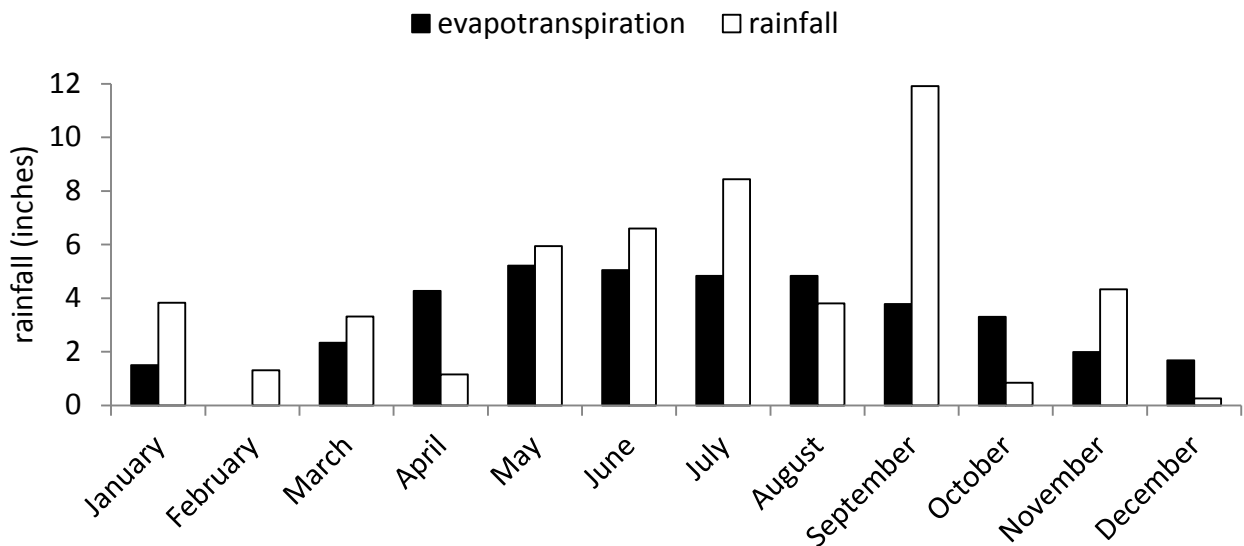


Figure 2. Comparison of monthly evapotranspiration and rainfall at the Range Cattle REC during 2014.

Solar Radiation

Total solar radiation for 2014 was 6437.39 MJ. Daily solar radiation is shown in Table 1, and 2014 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 2014 (649.86 MJ) to produce approximately 9,293 lb/A of plant dry matter.

Table 3. Monthly solar radiation and evapotranspiration at the Range Cattle REC in 2014.

Month	2006-2014	2014	2006-2014	2014
	Evapotranspiration		Solar radiation	
	-----inches-----		-----MJ/m ² -----	
January	1.91	1.50	419.02	350.11
February	2.38	.	451.91	413.47
March	3.28	2.34	653.42	559.78
April	4.37	4.27	725.95	649.86
May	5.30	5.22	783.43	761.36
June	4.83	5.05	667.76	656.25
July	4.79	4.83	638.23	745.40
August	4.51	4.83	565.22	615.91
September	3.79	3.78	501.10	439.44
October	3.05	3.31	484.14	534.05
November	1.88	1.99	380.30	396.54
December	1.41	1.68	365.39	315.22
<i>Year total</i>		<i>40.07</i>		<i>6437.39</i>

Temperature

The highest temperature observed during 2014 was 96.9 °F on August 24 (Table 1). Monthly average-high shelter temperatures exceeded the 71-year average in February, April, June through October, and December (Table 4). Monthly average-low shelter temperatures were below the 71-year average in January, March, May, June, October, and November (Table 5). Daily-low shelter temperatures at or below 32 °F were observed on four days in 2014, with two events in February, and two in March (Table 1). The extreme low temperature for 2014 occurred on 19 January when shelter temperature reached 27.11 °F, with the temperature of the two previous nights falling to 32 and 29.1 °F. Scattered frost begins when air temperature drops to 35 °F. Air temperatures at or below 35°F were observed three additional days in 2014, resulting in widespread or scattered frost across the landscape (data not shown). Overall, mean low temperature for 2014 was 0.4 °F lower than the 71-year mean.

Table 4. Summary of maximum temperature* during 2014 by month, Range Cattle REC.

Month	Shelter†				Ground level‡		
	1944-2014 Avg. high	2014 Avg. high	1944-2014 Extreme high	2014 Year	2014 Extreme high	2014 Avg. high	2014 Extreme high
	-----°F-----				-----°F-----		
January	73.2	69.9	90.0	1982	83.1	65.5	72.5
February	75.1	79.0	91.0	1962	86.6	69.7	74.2
March	79.0	77.6	94.0	1946	84.3	71.8	75.3
April	83.4	83.7	97.0	1945	93.1	77.0	83.6
May	88.1	87.3	103.0	1945	94.1	82.2	86.4
June	90.1	90.3	103.0	1945	95.2	85.2	88.5
July	90.8	91.2	101.0	1972	94.4	86.7	88.9
August	91.1	92.3	98.0	several	96.9	87.4	90.8
September	89.5	90.0	96.2	several	94.0	84.5	88.0
October	84.9	85.4	95.0	several	91.6	79.1	84.9
November	79.1	75.8	94.0	1990	86.6	70.6	75.8
December	74.3	75.1	89.0	1945	83.2	67.8	73.0
<i>Average</i>	83.2	83.7				77.3	

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

† 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.

Table 5. Summary of minimum temperature* for 2014 by month, Range Cattle REC.

Month	Shelter†				Ground level‡		
	1944-2014 Avg. low	2014 Avg. low	1944-2014 Extreme low	2014 Year	2014 Extreme low	2014 Avg. low	2014 Extreme low
-----°F-----					-----°F-----		
January	49.1	46.4	18.0	1981	27.1	61.1	53.8
February	50.6	53.4	23.8	2009	34.9	64.2	48.1
March	54.1	53.1	26.0	1980	39.7	66.2	61.9
April	58.0	58.1	34.0	1971	47.0	70.0	63.7
May	63.3	63.2	43.0	1945	51.6	74.5	69.1
June	69.0	68.4	52.0	1984	64.2	78.0	75.0
July	71.3	71.3	62.0	several	68.7	79.8	77.5
August	71.9	72.0	61.0	1977	68.6	80.7	78.6
September	71.1	71.1	51.0	1962	68.5	78.0	71.4
October	64.7	62.6	37.5	2008	52.7	73.9	69.3
November	56.7	52.6	25.0	1970	39.6	65.3	58.9
December	51.3	53.3	20.0	1962	36.8	62.9	55.3
<i>Average</i>	<i>60.9</i>	<i>60.5</i>				<i>71.2</i>	

*°C = (°F – 32) x 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 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 2014, 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.

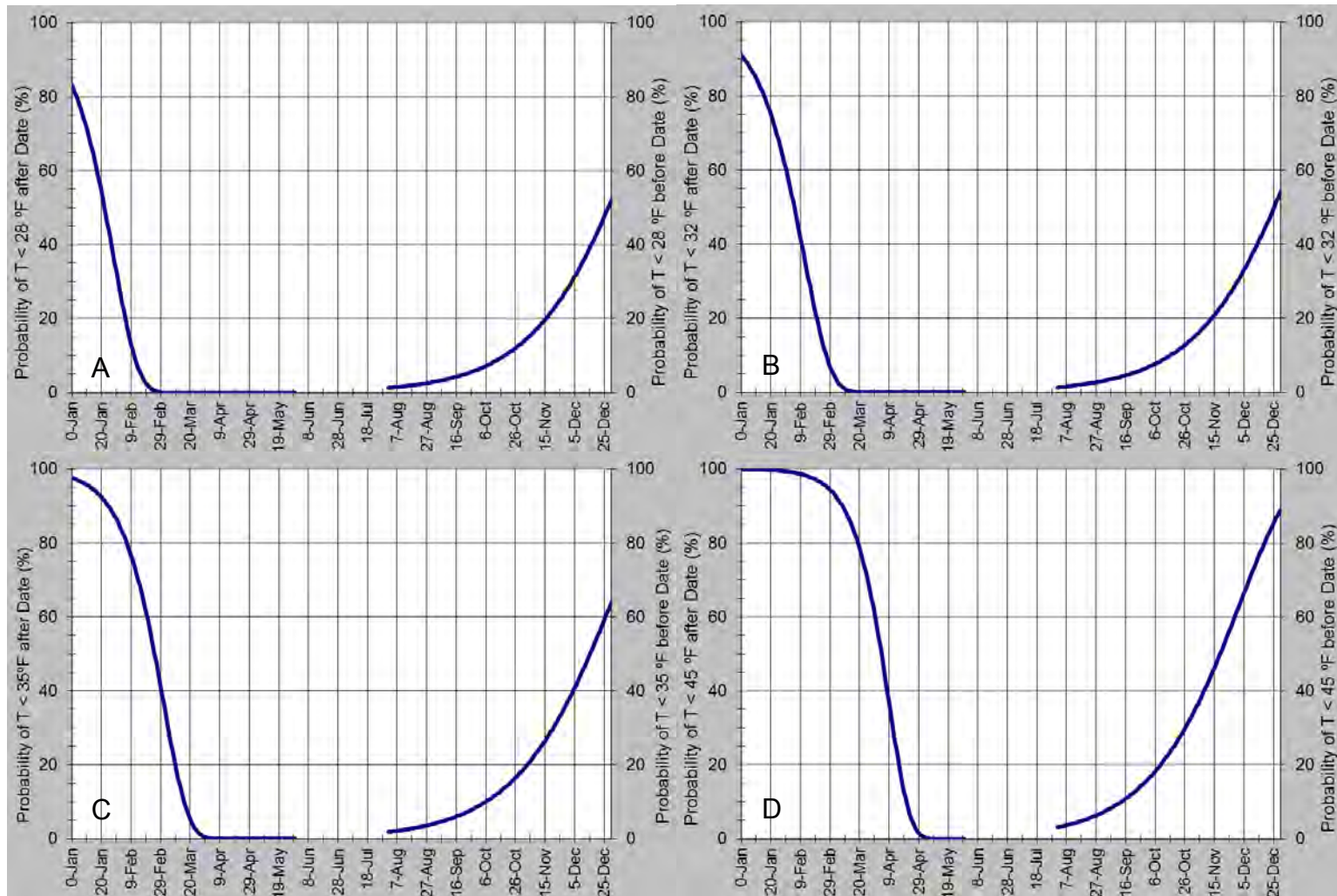


Figure 3. Spring and fall freeze hazard showing temperature probabilities after a given spring date and before a given fall date. Trend lines for temperature probabilities <28 °F (A), <32 °F (B), <35 °F (C), and <45 °F (D). Graphs were constructed using minimum temperature data from 1960 – 2010 using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