Part 6: Daily Emissions

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Introduction

Biomass burning is a major source of many atmospheric trace gases and aerosol particles (Crutzen and Andreae 1990). These compounds and particulates affect public health, regional air quality, air chemistry, and global climate. It is difficult to assess quantitatively the impact wildfires have on the environment because of the uncertainty in determining the size of burned areas and the amount of emitted pollutants and greenhouse gases. However, they can be estimated using data gathered daily from burned areas by MODIS satellite, experimental results of aboveground biomass burning, and the emission factors of different compounds. This technique was used to estimate the daily emissions of carbon monoxide (CO) and particles less than 2.5 μm (PM2.5) from the Hayman Fire from June 9 to June 27, 2002, when approximately 138,000 acres were burned.

Figure 107 shows satellite (MODIS) images of the Hayman Fire on June 19, 2002. About 60,000 acres had been burned up to that day with ponderosa pine and Douglas-fir being the dominant vegetation burned. Figure 107a is a true color image, figure 107b is a false color image, and figure 107c shows the perimeter of the fire mapped by the Forest Service and the burned area detected by the satellite. The MODIS-derived burn area corresponds well with the active fire perimeter. The major discrepancies of the two maps are along the edge of the fire perimeter and are caused by the differences of the time of observation. The overpass time of the satellite was near noon, while the Forest Service aircraft estimated the fire size about 12 hours later.

Carbon Monoxide Concentrations

Carbon monoxide (CO) is a major compound produced by fires. The less efficient the combustion process is, the larger the amount of carbon monoxide emitted (Hao and others 1996). Carbon monoxide is a reliable tracer of biomass burning because CO is not very reactive photochemically, and CO concentrations are low in clean atmosphere. The MOPITT (Measurements of Pollution in the Troposphere) data for the Western United States on June 19, 2002, was retrieved from the Web site of NASA Earth Observing System (EOS) Data Gateway.

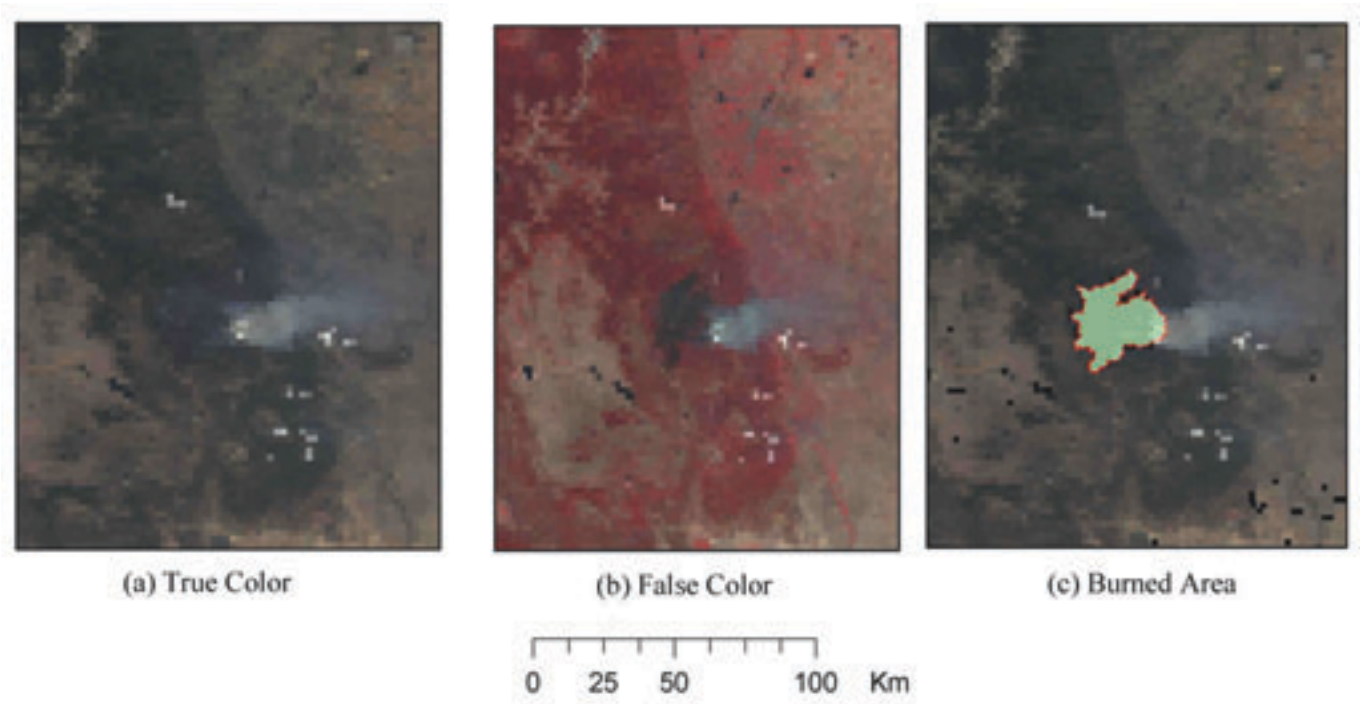

Figure 107—The satellite (Terra MODIS) images of the Hayman Fire in Colorado, on June 19, 2002: (a) visible band image; (b) near infrared band image; and (c) NIR band image with Forest Service burned area perimeter overlaid.

Figure 108 shows the CO concentrations at about 11,000 to 20,000 feet above sea level corresponding to approximately the height of the smoke plume. The missing CO concentrations in the MOPITT data set were interpolated, but CO concentrations were not interpolated over areas where data for the entire swath were missing. The spatial distribution of CO concentrations is similar to the plume pattern as shown in figure 107a. Carbon monoxide concentrations were above 150 parts per billion (ppb) in the center of the plume and dissipated to 100 to 125 ppb several miles downwind from the plume.

Daily Emissions

The amount of CO and PM2.5 (particles less than 2.5 μm), two major pollutants, emitted daily by the Hayman Fire were quantified. The burned areas used in the computation are based on MODIS images (fig. 107). Information on the amount of fuels burned, the combustion efficiency of each fuel type, and the emission factors of CO and PM2.5 was based on results of field experiments conducted by the Fire Sciences Laboratory, Rocky Mountain Research Station, Missoula, MT. The amount of CO and PM2.5 emitted daily is shown in figure 109. The majority of CO and PM2.5 was emitted during the period of June 9 through 13 and June 18 through 21 when most acres were burned. About 60 percent of the total emissions occurred during the first period, and about 31 percent occurred during the second period. Overall, approximately 2.3 x 10^5 tons of carbon monoxide and 2.9 x 10^4 tons of PM2.5 were emitted by the Hayman Fire. Approximately 4.3 x 10^4 tons of CO and 1.4 x 10^4 tons of PM2.5 were emitted by industrial sources in Colorado in 1999 (EPA 2003). Hence, the amount of CO emitted by the Hayman Fire is at least five times of the annual production of CO by industrial sources in Colorado. The amount of particles less than 2.5 μm emitted by the Hayman Fire is about twice of that produced by industries in Colorado.

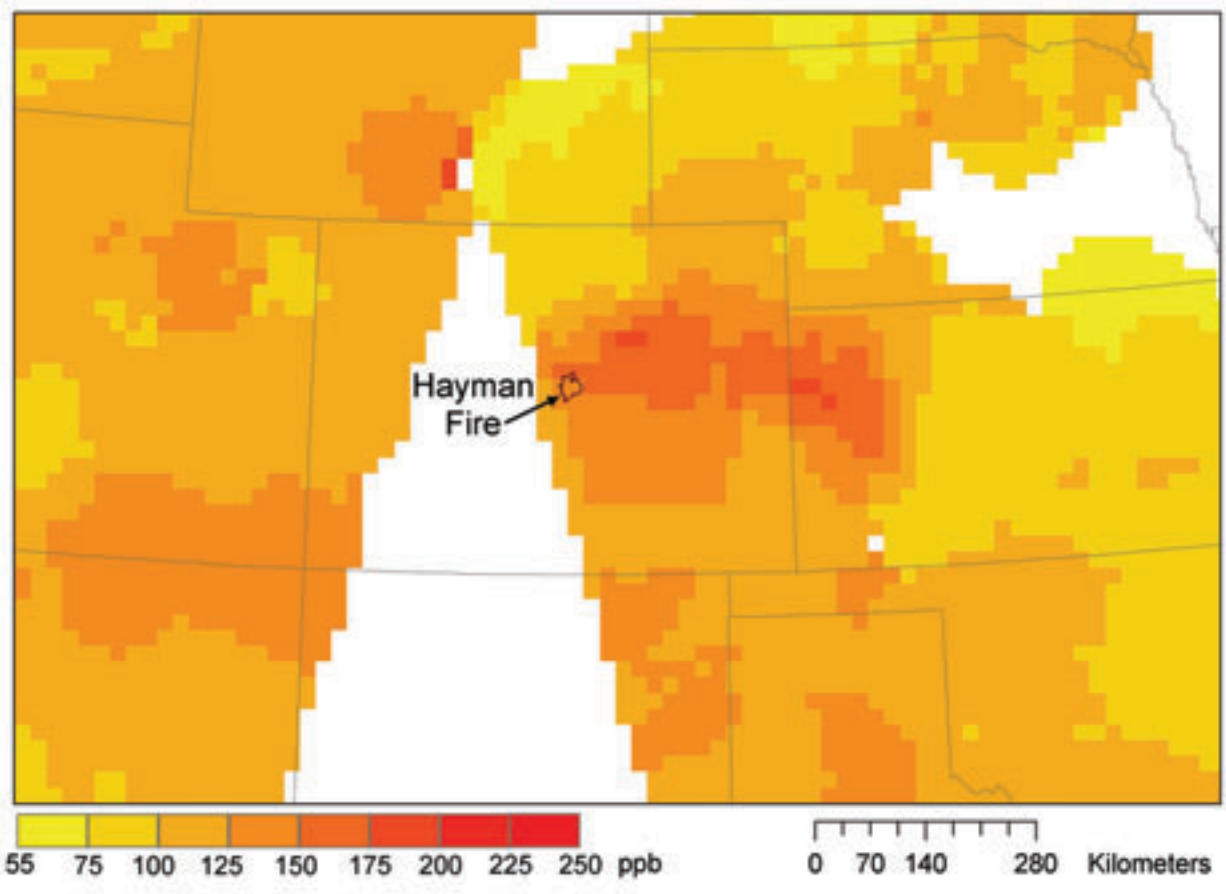

Figure 108—Carbon monoxide concentrations at about 11,000 to 20,000 feet above sea level corresponding to approximately the height of the smoke plume in the Central and Western United States on June 19, 2002.

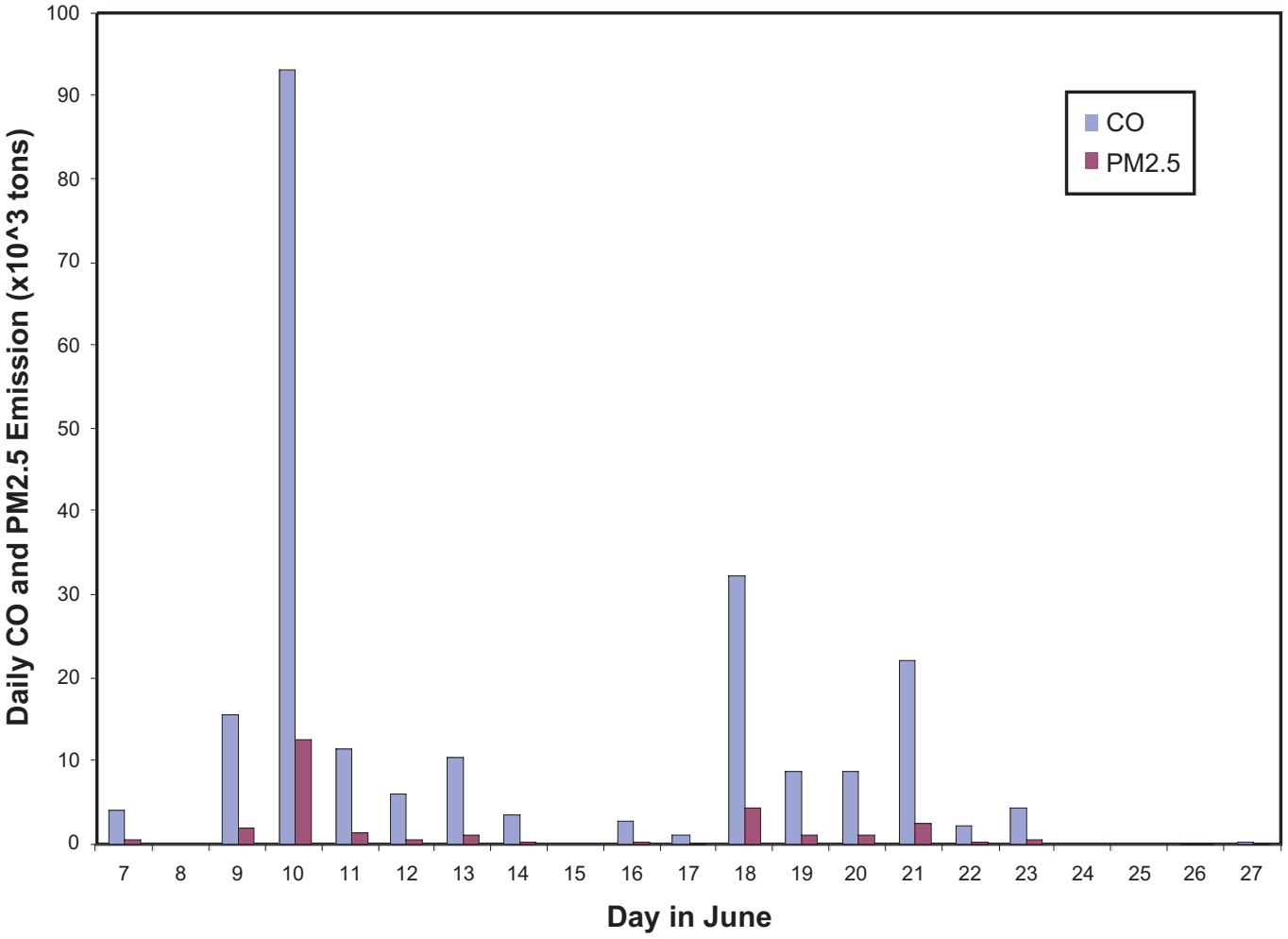

Figure 109—Daily emissions of CO and PM2.5 from the Hayman Fire from June 7 to June 27, 2002.

References

Crutzen, P.J.; Andreae, M.O. 1990. Biomass burning in the tropics: impact on atmospheric chemistry and biogeochemical cycles. Science 250: 1669-1678.

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Hao W.M.; Ward, D.E.; Olbu, G.; Baker, S.P. 1996. Emissions of CO_2, CO, and hydrocarbons from fires in diverse African savanna ecosystems. J Geophys Res 101:D19, 23577-23584.

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Appendix A: Weather Data

Data from the Cheesman and Lake George NFDRS Stations are transmitted via satellite at 53 minutes after the hour. Averaged weather readings (temperature, humidity, wind speed, and direction) are for the 10 minutes prior to that (from 43 to 53 minutes after the hour). Wind gusts data are maximum values at any time during the hour, and rain is totaled for the hour. Dew points were computed from temperature and relative humidity. Table rows are displayed to the nearest hour in Mountain Daylight Time (MDT) for ease of reading.

Data from the Manitou Station were recorded on a data logger, and all values are hour averages. The wind sensor at Manitou is on a short mast. No wind gust information was recorded. Dew points were computed from temperature and relative humidity.

Hourly weather observations from Cheesman RAWS from June 8 to June 22.

				10-min avg. wind		Max gust during hour		
Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	Speed mph	Direct deg.	Speed mph	Direct deg.	Rain inches
0608 0000	59	37	44	10	42	23	46	
0608 0100	56	37	48	6	52	14	27	
0608 0200	52	36	55	1	45	12	58	
0608 0300	51	36	57	4	146	6	152	
0608 0400	49	36	61	1	33	6	175	
0608 0500	48	36	63	2	223	6	200	
0608 0600	48	36	62	2	217	6	177	
0608 0700	53	34	49	2	206	8	194	
0608 0800	64	31	29	2	292	5	178	
0608 0900	72	22	15	10	207	20	199	
0608 1000	77	16	10	12	210	21	228	
0608 1100	79	15	9	16	213	34	229	
0608 1200	82	12	7	17	238	37	197	
0608 1300	83	13	7	17	224	36	223	
0608 1400	86	11	6	16	235	34	196	
0608 1500	83	16	8	13	209	29	219	
0608 1600	84	13	7	14	217	30	215	
0608 1700	86	11	6	14	211	32	192	
0608 1800	82	9	6	17	191	36	220	
0608 1900	81	8	6	13	199	36	190	
0608 2000	80	10	7	13	196	34	188	
0608 2100	77	8	7	13	189	26	179	
0608 2200	76	11	8	10	203	23	164	
0608 2300	74	12	9	8	202	16	195	
0609 0000	72	13	10	7	209	15	205	
0609 0100	73	13	10	10	169	19	222	
0609 0200	72	15	11	6	172	24	217	
0609 0300	71	14	11	10	196	22	198	
0609 0400	69	14	12	7	127	14	183	
0609 0500	70	13	11	8	207	18	197	
0609 0600	69	14	12	9	183	22	183	
0609 0700	70	15	12	10	198	21	175	
0609 0800	73	13	10	13	203	23	194	
0609 0900	76	11	8	17	226	40	227	
0609 1000	75	10	8	24	245	51	198	
0609 1100	77	11	8	15	241	37	246	
0609 1200	77	11	8	15	237	29	203	
0609 1300	78	12	8	14	223	30	225	
0609 1400	79	10	7	10	224	33	219	
0609 1500	81	8	6	10	206	29	269	
0609 1600	85	7	5	16	224	29	233	
0609 1700	84	6	5	13	201	34	201	
0609 1800	84	10	6	15	233	44	229	

Hourly weather observations from Cheesman RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0609 1900	96	14	5	30	183	84	199	0.01
0609 2000	85	7	5	21	143	47	331	
0609 2100	81	4	5	17	146	37	131	
0609 2200	78	6	6	15	154	31	125	
0609 2300	76	4	6	16	153	28	156	
0610 0000	75	7	7	13	158	31	172	
0610 0100	73	8	8	14	157	27	173	
0610 0200	71	7	8	11	152	24	171	
0610 0300	70	3	7	11	151	18	163	
0610 0400	68	5	8	9	145	19	171	
0610 0500	65	5	9	11	142	19	171	
0610 0600	64	6	10	8	126	16	108	
0610 0700	65	7	10	7	129	15	132	
0610 0800	68	5	8	11	187	21	193	
0610 0900	72	1	6	11	173	23	177	
0610 1000	74	-1	5	13	164	24	184	
0610 1100	76	0	5	10	159	25	211	
0610 1200	77	1	5	14	250	24	236	
0610 1300	79	2	5	17	232	34	196	
0610 1400	69	25	19	18	34	34	272	
0610 1500	66	29	25	14	20	30	34	
0610 1600	66	26	22	12	31	27	48	
0610 1700	64	28	25	13	33	24	270	
0610 1800	62	30	30	11	32	23	33	
0610 1900	61	30	31	13	36	24	43	
0610 2000	60	30	32	8	41	20	42	
0610 2100	59	31	34	5	45	11	36	
0610 2200	58	31	35	5	46	10	53	
0610 2300	56	31	38	7	32	9	38	
0611 0000	53	31	42	3	42	8	51	
0611 0100	52	31	44	1	75	5	0	
0611 0200	50	32	49	1	304	2	263	
0611 0300	48	32	53	1	69	3	85	
0611 0400	47	32	55	2	155	3	174	
0611 0500	48	31	52	1	126	3	58	
0611 0600	46	32	57	1	35	4	52	
0611 0700	45	32	61	1	327	5	20	
0611 0800	47	34	60	1	202	3	306	
0611 0900	54	33	45	1	190	3	226	
0611 1000	61	33	35	5	31	11	34	
0611 1100	65	34	31	9	5	17	15	
0611 1200	70	35	27	10	12	22	33	
0611 1300	66	35	31	13	29	25	41	
0611 1400	69	35	29	11	12	22	13	
0611 1500	72	34	25	10	9	23	38	
0611 1600	72	32	23	10	25	22	27	
0611 1700	70	35	27	11	31	23	39	
0611 1800	69	36	30	10	26	20	22	
0611 1900	68	36	31	10	32	21	25	
0611 2000	66	37	34	8	35	18	41	
0611 2100	65	36	34	9	44	15	39	
0611 2200	63	36	36	5	50	13	38	
0611 2300	61	36	39	2	73	7	52	
0612 0000	58	36	43	0	231	4	63	
0612 0100	56	37	48	0	149	3	103	
0612 0200	57	37	47	3	164	6	144	

Hourly weather observations from Cheesman RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0612 0300	54	37	53	3	240	5	163	
0612 0400	51	38	60	1	267	3	176	
0612 0500	50	39	66	1	269	2	24	
0612 0600	46	39	76	2	166	5	33	
0612 0700	48	40	74	2	168	6	163	
0612 0800	55	38	53	0	227	1	155	
0612 0900	58	37	45	1	276	3	276	
0612 1000	64	37	37	4	354	7	19	
0612 1100	73	33	23	5	339	9	341	
0612 1200	77	11	8	8	219	15	227	
0612 1300	78	19	11	10	33	25	228	
0612 1400	75	31	20	11	40	25	38	
0612 1500	74	34	23	12	63	24	81	
0612 1600	74	32	21	8	61	21	31	
0612 1700	74	29	19	5	41	18	28	
0612 1800	75	35	23	7	31	16	16	
0612 1900	74	35	24	8	24	16	39	
0612 2000	70	36	29	9	47	19	43	
0612 2100	66	39	37	6	81	13	50	
0612 2200	63	40	43	0	197	8	81	
0612 2300	61	40	46	2	56	3	62	
0613 0000	59	40	49	2	103	4	49	
0613 0100	59	38	46	6	34	9	31	
0613 0200	57	24	28	14	32	24	51	
0613 0300	53	24	32	11	39	24	48	
0613 0400	51	25	36	6	55	17	45	
0613 0500	49	25	39	3	45	9	43	
0613 0600	47	27	45	1	235	6	29	
0613 0700	51	28	40	0	62	2	85	
0613 0800	56	29	35	2	264	3	14	
0613 0900	58	28	31	4	351	7	315	
0613 1000	61	28	28	10	19	15	286	
0613 1100	61	32	33	13	29	21	39	
0613 1200	62	35	36	14	22	25	38	
0613 1300	65	37	35	15	21	24	24	
0613 1400	66	36	33	15	16	27	26	
0613 1500	67	37	33	13	12	28	11	
0613 1600	65	35	33	12	17	24	11	
0613 1700	67	36	32	12	12	24	15	
0613 1800	64	36	35	10	39	24	32	
0613 1900	63	35	35	8	33	20	31	
0613 2000	61	35	37	8	28	14	31	
0613 2100	60	34	37	5	38	15	60	
0613 2200	59	31	35	7	30	14	35	
0613 2300	58	32	37	7	39	14	48	
0614 0000	55	31	40	6	32	16	67	
0614 0100	52	31	44	5	40	11	33	
0614 0200	52	31	45	7	53	12	32	
0614 0300	49	31	50	1	124	10	80	
0614 0400	48	32	53	2	105	4	114	
0614 0500	47	33	57	2	118	3	106	
0614 0600	45	32	61	1	249	4	128	
0614 0700	47	33	59	0	358	2	50	
0614 0800	53	33	46	2	13	3	315	
0614 0900	60	34	37	3	359	6	358	
0614 1000	64	36	35	12	176	20	211	

Hourly weather observations from Cheesman RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0614 1100	68	35	29	12	201	20	179	
0614 1200	74	30	20	8	105	22	179	
0614 1300	74	32	21	9	45	16	144	
0614 1400	70	36	29	12	52	22	16	
0614 1500	70	40	33	8	69	23	36	
0614 1600	71	37	29	8	42	13	38	
0614 1700	69	31	24	8	42	29	42	
0614 1800	74	29	19	3	202	14	61	
0614 1900	72	23	16	9	35	13	37	
0614 2000	69	27	21	7	37	12	318	
0614 2100	65	34	32	6	34	10	43	
0614 2200	61	40	45	7	122	13	124	
0614 2300	59	41	52	6	152	13	158	
0615 0000	58	40	51	5	119	12	151	
0615 0100	59	42	53	6	181	9	190	
0615 0200	59	42	53	7	142	15	166	
0615 0300	57	40	52	1	168	11	146	
0615 0400	55	42	61	1	145	5	161	
0615 0500	54	41	61	3	162	5	142	
0615 0600	51	39	64	1	87	8	136	
0615 0700	56	40	54	2	210	6	189	
0615 0800	64	41	43	1	203	3	27	
0615 0900	71	40	32	1	159	4	249	
0615 1000	74	34	23	4	161	8	201	
0615 1100	77	11	8	7	190	14	179	
0615 1200	67	21	17	19	32	36	43	
0615 1300	69	25	19	14	36	28	35	
0615 1400	68	33	27	17	41	30	46	
0615 1500	70	27	20	14	35	25	39	
0615 1600	69	24	18	11	30	23	26	
0615 1700	70	26	19	11	7	28	47	
0615 1800	70	28	21	9	35	20	54	
0615 1900	65	30	27	9	35	23	37	
0615 2000	63	33	32	7	53	21	38	
0615 2100	62	33	33	6	30	9	34	
0615 2200	60	32	34	4	207	12	42	
0615 2300	59	33	37	3	90	13	63	
0616 0000	58	33	39	4	123	6	122	
0616 0100	56	37	48	1	138	9	163	
0616 0200	53	42	67	4	138	5	108	
0616 0300	53	43	68	4	133	10	155	
0616 0400	53	42	67	7	163	13	188	
0616 0500	52	41	67	8	152	16	179	
0616 0600	52	41	65	4	148	12	147	
0616 0700	58	42	55	0	296	6	158	
0616 0800	61	39	44	3	212	8	205	
0616 0900	70	36	29	2	221	6	233	
0616 1000	76	33	21	3	255	6	207	
0616 1100	77	21	12	4	122	12	83	
0616 1200	74	28	18	14	18	22	233	
0616 1300	75	26	16	13	31	26	36	
0616 1400	75	27	17	10	25	21	51	
0616 1500	72	28	19	11	36	23	235	
0616 1600	72	29	20	16	35	26	47	
0616 1700	73	28	19	5	284	28	43	
0616 1800	72	28	19	8	17	16	18	

Hourly weather observations from Cheesman RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0616 1900	68	28	22	10	46	23	39	
0616 2000	69	27	21	4	116	14	28	
0616 2100	64	31	29	4	122	7	155	
0616 2200	61	31	32	3	28	7	127	
0616 2300	59	31	34	5	140	8	132	
0617 0000	59	31	34	5	145	7	161	
0617 0100	59	31	35	5	146	10	185	
0617 0200	60	32	34	8	149	13	157	
0617 0300	60	32	34	10	155	15	154	
0617 0400								
0617 0500								
0617 0600								
0617 0700	59	31	35	1	180	3	166	
0617 0800	66	31	27	2	208	5	188	
0617 0900	73	31	21	2	209	4	213	
0617 1000	81	27	14	2	194	7	300	
0617 1100	83	9	6	7	290	20	241	
0617 1200	82	5	5	12	251	26	289	
0617 1300	84	6	5	9	256	26	291	
0617 1400	83	5	5	7	30	27	249	
0617 1500	85	7	5	8	325	29	315	
0617 1600	85	7	5	10	337	19	13	
0617 1700	88	9	5	8	259	25	344	
0617 1800	88	9	5	6	246	22	251	
0617 1900	86	7	5	7	262	19	255	
0617 2000	83	5	5	7	295	21	269	
0617 2100	76	0	5	4	10	11	295	
0617 2200	73	-2	5	2	44	7	299	
0617 2300	72	-3	5	1	275	6	70	
0618 0000	67	1	7	2	164	3	254	
0618 0100	64	2	8	2	195	7	175	
0618 0200	61	4	10	2	167	5	220	
0618 0300	59	7	12	1	113	5	89	
0618 0400	57	5	12	1	209	6	197	
0618 0500	56	6	13	2	198	7	152	
0618 0600	54	7	15	1	127	5	156	
0618 0700	56	8	14	1	323	7	156	
0618 0800	64	6	10	2	208	6	207	
0618 0900	74	3	6	3	224	6	216	
0618 1000	81	4	5	9	220	15	218	
0618 1100	83	5	5	6	313	18	224	
0618 1200	84	6	5	15	259	33	259	
0618 1300	84	6	5	14	219	27	231	
0618 1400	87	8	5	10	237	28	235	
0618 1500	85	7	5	8	223	24	251	
0618 1600	87	8	5	16	237	32	186	
0618 1700	87	8	5	5	197	27	228	
0618 1800	88	9	5	13	269	27	243	
0618 1900	85	7	5	10	230	27	262	
0618 2000	83	5	5	12	180	21	163	
0618 2100	81	4	5	9	177	30	179	
0618 2200	78	2	5	4	134	18	179	
0618 2300	75	0	5	4	192	18	130	
0619 0000	73	5	7	2	126	11	120	
0619 0100	70	3	7	4	180	7	207	
0619 0200	67	6	9	3	170	7	179	

Hourly weather observations from Cheesman RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0619 0300	62	7	11	1	264	5	175	
0619 0400	59	7	12	3	199	7	179	
0619 0500	57	7	13	0	110	5	144	
0619 0600	55	7	14	0	166	4	138	
0619 0700	57	8	14	0	185	3	171	
0619 0800	60	7	12	1	268	4	128	
0619 0900	65	7	10	3	216	4	261	
0619 1000	75	10	8	2	248	4	28	
0619 1100	76	20	12	6	311	10	253	
0619 1200	80	16	9	8	26	14	10	
0619 1300	79	24	13	14	42	23	39	
0619 1400	80	27	14	12	61	27	66	
0619 1500	81	24	12	9	65	21	61	
0619 1600	79	24	13	11	40	23	51	
0619 1700	78	23	13	11	45	22	45	
0619 1800	76	27	16	10	25	20	20	
0619 1900	75	30	19	12	26	21	29	
0619 2000	73	31	21	6	36	23	26	
0619 2100	63	38	40	13	49	33	31	
0619 2200	60	41	49	9	36	22	38	
0619 2300	59	40	50	11	37	20	44	
0620 0000	58	41	53	8	25	22	39	
0620 0100	56	42	59	5	38	15	50	
0620 0200	55	44	67	3	173	13	57	
0620 0300	55	45	69	1	353	4	244	
0620 0400	55	45	68	1	286	2	173	
0620 0500	55	44	67	2	122	4	52	
0620 0600	56	42	60	2	176	5	173	
0620 0700	58	43	58	3	152	6	170	
0620 0800	61	42	50	7	168	12	193	
0620 0900	64	43	46	11	165	22	152	
0620 1000	65	41	42	14	179	24	200	
0620 1100	66	41	40	12	170	24	172	
0620 1200	68	41	37	14	184	26	156	
0620 1300	71	40	32	12	172	24	179	
0620 1400	76	38	25	10	215	23	220	
0620 1500	82	28	14	12	222	23	209	
0620 1600	79	20	11	11	236	31	229	
0620 1700	74	26	17	6	341	20	248	
0620 1800	65	39	38	8	58	34	291	
0620 1900	67	43	42	1	338	7	39	
0620 2000	67	37	33	2	164	4	124	
0620 2100	65	45	48	2	303	16	152	
0620 2200	60	46	59	7	38	13	46	
0620 2300	58	48	69	4	49	15	90	
0621 0000	59	45	60	7	46	11	43	
0621 0100	59	46	62	6	153	10	35	
0621 0200	60	40	47	2	130	28	257	
0621 0300	58	42	55	5	207	14	152	
0621 0400	59	38	45	3	201	14	198	
0621 0500	62	35	37	7	215	13	187	
0621 0600	64	34	33	7	222	15	192	
0621 0700	65	35	33	11	201	20	206	
0621 0800	68	36	31	5	131	24	199	
0621 0900	72	33	24	6	207	12	206	

Hourly weather observations from Cheesman RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0621 1000	74	34	23	10	223	18	210	
0621 1100	78	30	17	12	231	19	229	
0621 1200	82	24	12	8	271	18	221	
0621 1300	85	20	9	9	206	20	241	
0621 1400	88	19	8	3	332	18	221	
0621 1500	82	18	9	8	8	14	236	
0621 1600	79	22	12	5	24	17	205	
0621 1700								
0621 1800	77	30	18	11	91	21	105	
0621 1900	69	39	34	7	25	21	23	
0621 2000	68	42	39	9	34	13	38	
0621 2100	66	42	42	6	305	14	26	
0621 2200	58	45	63	6	200	25	275	
0621 2300	58	46	64	1	143	9	62	
0622 0000	56	46	68	1	211	9	179	
0622 0100	58	45	61	3	200	9	168	
0622 0200	57	45	65	3	178	7	172	
0622 0300	57	45	63	1	178	5	209	
0622 0400	60	42	51	4	159	12	167	
0622 0500	62	40	44	8	218	20	208	
0622 0600	63	39	41	13	222	25	221	
0622 0700	62	39	42	10	185	26	209	
0622 0800	63	41	44	4	127	11	203	
0622 0900	65	39	38	12	221	20	227	
0622 1000	70	38	31	19	218	32	210	
0622 1100	75	39	27	9	255	31	224	
0622 1200	79	32	18	13	229	27	252	
0622 1300	79	32	18	10	266	28	214	
0622 1400	79	31	17	12	223	27	237	
0622 1500	81	29	15	10	223	26	225	
0622 1600	83	31	15	9	212	25	245	
0622 1700	85	27	12	9	280	28	252	
0622 1800	84	26	12	12	221	32	224	
0622 1900	82	24	12	10	238	26	239	
0622 2000	81	22	11	7	212	17	217	
0622 2100	77	19	11	6	210	15	201	
0622 2200	74	20	13	6	189	9	198	
0622 2300	70	22	16	1	27	7	179	

Hourly weather observations from Lake George RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0608 0000	50	20	30	6	132	10	146	
0608 0100	48	22	35	4	124	7	136	
0608 0200	44	23	43	3	134	6	138	
0608 0300	41	27	57	3	140	7	137	
0608 0400	39	30	70	3	122	6	139	
0608 0500	36	30	78	3	141	5	138	
0608 0600	35	30	83	1	127	6	150	
0608 0700	37	32	83	0	140	6	168	
0608 0800	55	38	52	2	143	6	106	
0608 0900	73	36	26	1	80	5	137	
0608 1000	77	22	13	8	248	19	237	
0608 1100	80	21	11	10	243	28	214	
0608 1200	81	17	9	16	198	36	192	
0608 1300	81	19	10	13	218	32	221	
0608 1400	83	21	10	16	179	32	90	
0608 1500	82	20	10	14	195	33	176	
0608 1600	84	19	9	18	167	36	179	
0608 1700	84	16	8	17	177	36	212	
0608 1800	83	16	8	15	163	33	197	
0608 1900	81	17	9	18	161	33	174	
0608 2000	78	15	9	15	160	31	163	
0608 2100	74	16	11	12	156	24	98	
0608 2200	72	17	12	8	158	19	181	
0608 2300	66	16	14	2	149	13	164	
0609 0000	68	17	14	3	179	11	171	
0609 0100	69	18	14	8	152	16	177	
0609 0200	68	19	15	7	139	13	134	
0609 0300	67	18	15	5	150	14	181	
0609 0400	67	18	15	8	149	16	173	
0609 0500	66	19	16	8	156	15	160	
0609 0600	60	18	19	6	125	18	195	
0609 0700	60	21	22	5	140	12	120	
0609 0800	73	19	13	7	174	11	144	
0609 0900	74	16	11	17	179	38	189	
0609 1000	77	19	11	14	219	35	227	
0609 1100	79	18	10	10	242	32	185	
0609 1200	81	19	10	11	194	28	232	
0609 1300	82	18	9	10	238	26	229	
0609 1400	83	18	9	12	209	28	71	
0609 1500	85	14	7	14	169	28	179	
0609 1600	87	16	7	13	177	24	198	
0609 1700	86	18	8	10	199	27	175	
0609 1800	84	19	9	14	198	27	124	
0609 1900	82	15	8	16	193	32	178	
0609 2000	78	17	10	14	177	30	180	
0609 2100	73	15	11	11	170	24	180	
0609 2200	70	15	12	6	144	14	163	
0609 2300	68	15	13	5	141	13	156	
0610 0000	65	16	15	4	122	10	105	
0610 0100	65	16	15	4	158	11	132	
0610 0200	57	16	20	2	192	5	276	
0610 0300	52	16	24	0	140	4	178	
0610 0400	52	16	24	3	86	5	130	
0610 0500	47	15	27	1	221	5	119	
0610 0600	45	15	30	4	140	7	168	
0610 0700	48	17	29	2	106	5	241	

Hourly weather observations from Lake George RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0610 0800	69	16	13	2	94	5	75	
0610 0900	71	12	10	12	179	24	186	
0610 1000	73	13	10	11	183	24	189	
0610 1100	76	13	9	12	210	32	182	
0610 1200	77	14	9	9	222	31	186	
0610 1300	79	13	8	7	269	29	161	
0610 1400	79	18	10	15	169	32	183	
0610 1500	79	22	12	16	192	30	165	
0610 1600	78	25	14	17	151	32	168	
0610 1700	73	28	19	11	1	28	182	
0610 1800	63	32	31	14	23	31	17	
0610 1900	61	33	35	5	36	23	39	
0610 2000	59	33	38	5	23	15	33	
0610 2100	58	33	39	5	0	14	18	
0610 2200	57	33	40	2	348	9	39	
0610 2300	54	32	43	1	13	5	36	
0611 0000	49	31	50	0	45	5	22	
0611 0100	44	29	56	3	141	5	135	
0611 0200	41	29	62	3	133	4	130	
0611 0300	39	29	67	1	144	7	132	
0611 0400	36	28	72	2	133	6	125	
0611 0500	34	27	75	0	154	5	171	
0611 0600	32	27	81	1	154	2	154	
0611 0700	36	30	78	1	153	3	152	
0611 0800	52	34	50	1	143	5	134	
0611 0900	66	39	37	1	310	4	300	
0611 1000	71	29	21	4	139	13	140	
0611 1100	74	18	12	8	266	23	156	
0611 1200	76	16	10	10	203	21	229	
0611 1300	78	12	8	12	239	24	218	
0611 1400	80	10	7	12	287	26	308	
0611 1500	82	9	6	9	283	32	322	
0611 1600	83	13	7	13	312	25	301	
0611 1700	78	34	20	5	72	24	355	
0611 1800	72	33	24	9	5	19	10	
0611 1900	69	39	33	6	29	18	1	
0611 2000	66	40	38	8	13	16	0	
0611 2100	64	40	41	1	45	14	1	
0611 2200	61	39	44	0	0	4	26	
0611 2300	58	38	47	2	210	4	125	
0612 0000	53	46	78	2	310	7	119	
0612 0100	51	50	95	1	340	3	338	
0612 0200	47	46	95	0	340	2	340	
0612 0300	43	43	99	0	340	2	341	
0612 0400	41	41	100	1	129	5	128	
0612 0500	39	39	100	1	117	4	129	
0612 0600	37	37	100	2	118	3	117	
0612 0700	39	39	100	1	30	3	122	
0612 0800	50	39	67	0	336	4	348	
0612 0900	62	44	52	7	161	11	160	0.01
0612 1000	69	42	37	6	150	15	176	
0612 1100	73	15	11	8	231	31	276	
0612 1200	76	13	9	9	287	25	315	
0612 1300	78	9	7	9	285	23	277	
0612 1400	80	3	5	10	284	24	290	
0612 1500	82	0	4	10	269	24	268	

Hourly weather observations from Lake George RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0612 1600	75	37	25	8	46	24	343	
0612 1700	73	38	28	7	28	20	26	
0612 1800	73	35	25	6	7	15	119	
0612 1900	71	38	30	10	7	19	0	
0612 2000	68	40	36	6	90	19	17	
0612 2100	65	43	45	5	76	16	87	
0612 2200	62	43	49	1	160	11	65	
0612 2300	60	43	53	0	85	3	110	
0613 0000	57	41	56	1	135	4	142	
0613 0100	56	42	59	1	167	5	203	
0613 0200	58	36	43	8	22	18	22	
0613 0300	54	28	36	3	59	16	43	
0613 0400	49	27	42	2	15	14	44	
0613 0500	47	27	46	0	140	6	337	
0613 0600	42	27	54	0	140	2	140	
0613 0700	44	29	56	2	42	3	53	
0613 0800	52	30	42	4	131	7	134	
0613 0900	61	33	35	5	125	9	137	
0613 1000	69	30	23	7	190	16	186	
0613 1100	74	20	13	8	306	21	348	
0613 1200	73	24	16	9	1	19	19	
0613 1300	74	29	19	11	8	18	15	
0613 1400	74	34	23	8	27	23	18	
0613 1500	69	40	35	6	52	18	11	
0613 1600	70	41	35	8	24	23	16	
0613 1700	68	40	36	9	22	18	0	
0613 1800	66	40	39	5	95	16	0	
0613 1900	63	40	43	6	29	13	90	
0613 2000	60	40	47	3	82	11	108	
0613 2100	57	38	49	2	67	12	105	
0613 2200	56	39	53	4	90	8	91	
0613 2300	55	39	55	2	99	6	76	
0614 0000	54	36	51	3	39	11	24	
0614 0100								
0614 0200	50	34	54	1	1	11	30	
0614 0300	45	34	65	2	126	7	133	
0614 0400	42	33	70	3	131	5	131	
0614 0500	41	33	72	3	141	8	169	
0614 0600	41	33	73	1	214	5	164	
0614 0700	43	34	70	0	271	3	270	
0614 0800	52	36	55	4	157	9	135	
0614 0900	58	43	58	8	222	13	228	
0614 1000	63	42	46	6	196	14	206	
0614 1100	67	42	40	8	148	16	215	
0614 1200	71	43	36	9	137	20	171	
0614 1300	70	42	36	12	133	24	173	
0614 1400	71	42	35	13	163	28	186	
0614 1500	73	44	35	7	147	20	82	
0614 1600	70	44	39	7	128	19	178	
0614 1700	69	42	37	8	29	14	22	
0614 1800	67	43	41	6	127	16	42	
0614 1900	68	42	39	6	164	11	138	
0614 2000	66	39	37	2	127	10	162	
0614 2100	63	42	47	6	160	14	186	
0614 2200	60	41	50	5	137	15	177	
0614 2300	57	42	57	3	138	9	153	

Hourly weather observations from Lake George RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0615 0000	53	43	68	4	110	7	138	
0615 0100	50	42	75	3	133	7	128	
0615 0200	46	40	80	0	108	5	122	
0615 0300	44	40	85	1	137	5	173	
0615 0400	42	39	90	3	124	7	147	
0615 0500	40	38	93	2	134	6	128	
0615 0600	38	37	97	1	127	5	133	
0615 0700	41	40	98	0	126	6	139	
0615 0800	58	45	63	2	170	6	132	
0615 0900	67	44	44	5	143	8	125	
0615 1000	74	40	29	3	29	8	173	
0615 1100	77	32	19	3	112	8	343	
0615 1200	79	20	11	10	309	21	332	
0615 1300	72	28	19	4	247	31	22	
0615 1400	71	29	21	12	24	28	25	
0615 1500	70	35	27	10	22	26	33	
0615 1600	68	29	23	3	136	26	331	
0615 1700	70	29	22	6	26	14	36	
0615 1800	69	32	25	9	26	19	347	
0615 1900	66	31	27	6	28	19	37	
0615 2000	62	35	36	5	105	17	16	
0615 2100	60	37	42	2	53	12	102	
0615 2200	57	36	45	3	173	5	110	
0615 2300	56	37	49	6	147	9	146	
0616 0000	53	44	72	5	135	15	154	
0616 0100	51	45	79	4	137	10	108	
0616 0200	47	43	86	2	134	6	136	
0616 0300	45	43	92	2	122	4	126	
0616 0400	42	41	97	2	140	5	147	
0616 0500	40	40	99	1	165	6	194	
0616 0600	38	38	100	0	157	2	157	
0616 0700	42	42	100	1	229	3	155	
0616 0800	56	43	62	7	178	12	177	
0616 0900	62	44	51	5	140	13	249	
0616 1000	70	42	36	4	191	12	183	
0616 1100	74	30	20	7	319	18	308	
0616 1200	76	28	17	7	211	18	299	
0616 1300	77	21	12	5	295	16	342	
0616 1400	74	32	21	7	29	18	298	
0616 1500	78	34	20	6	110	18	21	
0616 1600	76	32	20	10	347	18	14	
0616 1700	69	35	28	8	8	21	16	
0616 1800	71	27	19	6	342	21	330	
0616 1900	69	31	24	3	24	19	21	
0616 2000	67	32	27	5	83	13	338	
0616 2100	61	35	38	2	98	9	128	
0616 2200	54	34	46	1	87	4	87	
0616 2300	49	32	52	2	284	5	196	
0617 0000	47	32	56	2	92	6	303	
0617 0100	44	33	64	1	111	3	137	
0617 0200	41	32	69	0	136	2	133	
0617 0300	39	32	75	3	130	5	143	
0617 0400								
0617 0500								
0617 0600								
0617 0700	38	33	81	3	131	5	127	

Hourly weather observations from Lake George RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0617 0800	55	36	49	1	281	5	134	
0617 0900	67	36	32	2	141	6	159	
0617 1000	74	32	21	4	141	10	135	
0617 1100	79	18	10	8	308	14	307	
0617 1200	81	17	9	10	309	25	307	
0617 1300	82	15	8	10	310	22	319	
0617 1400	82	12	7	5	347	21	211	
0617 1500	85	7	5	13	303	28	311	
0617 1600	83	9	6	7	260	26	258	
0617 1700	81	11	7	6	270	28	205	
0617 1800	80	13	8	8	228	57	269	
0617 1900	84	13	7	9	304	21	210	
0617 2000	80	10	7	7	317	17	261	
0617 2100	70	9	9	1	343	13	349	
0617 2200	61	12	14	0	0	2	343	
0617 2300	53	12	19	3	153	7	113	
0618 0000	49	12	22	4	142	7	147	
0618 0100	45	12	26	2	137	4	117	
0618 0200	41	10	28	1	106	6	117	
0618 0300	39	11	31	3	151	6	135	
0618 0400	37	11	34	2	72	6	128	
0618 0500	35	11	36	2	129	6	135	
0618 0600	32	10	40	1	135	3	124	
0618 0700	36	12	37	1	125	3	126	
0618 0800	55	16	21	1	137	4	145	
0618 0900	68	19	15	1	342	4	290	
0618 1000								
0618 1100	81	4	5	7	292	18	286	
0618 1200	84	6	5	7	236	16	231	
0618 1300	85	2	4	9	265	24	233	
0618 1400	88	4	4	6	295	24	342	
0618 1500	88	4	4	11	274	27	316	
0618 1600	89	5	4	10	248	25	307	
0618 1700	87	3	4	11	207	22	124	
0618 1800	85	2	4	12	151	37	186	
0618 1900	83	5	5	11	141	26	168	
0618 2000	79	2	5	9	163	23	154	
0618 2100	77	8	7	11	147	28	152	
0618 2200	70	9	9	6	146	17	171	
0618 2300	60	11	14	2	140	7	127	
0619 0000	54	13	19	3	122	7	218	
0619 0100	49	15	25	5	129	7	143	
0619 0200	46	15	28	1	119	7	113	
0619 0300	41	13	32	1	118	6	115	
0619 0400	38	13	35	0	117	2	117	
0619 0500	36	12	37	2	115	3	117	
0619 0600	34	12	40	0	150	3	111	
0619 0700	36	12	37	2	134	3	147	
0619 0800	47	16	29	0	250	5	127	
0619 0900	59	17	19	0	287	2	251	
0619 1000	73	15	11	2	321	3	302	
0619 1100	84	1	4	4	130	11	215	
0619 1200	85	2	4	7	227	17	232	
0619 1300	86	2	4	6	305	21	332	
0619 1400	88	4	4	7	223	18	269	
0619 1500	81	31	16	11	1	24	86	

Hourly weather observations from Lake George RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0619 1600	80	25	13	7	83	24	348	
0619 1700	78	30	17	8	30	18	15	
0619 1800	77	30	18	5	60	21	15	
0619 1900	74	34	23	6	0	22	56	
0619 2000	71	35	27	7	337	14	15	
0619 2100	69	39	33	6	116	15	105	
0619 2200	61	43	52	8	17	22	8	
0619 2300	57	43	59	8	358	17	37	
0620 0000	56	44	63	5	11	21	335	
0620 0100								
0620 0200	54	44	69	1	342	10	332	
0620 0300	53	44	71	3	349	8	27	
0620 0400	53	43	70	0	123	5	7	
0620 0500	54	44	68	3	349	5	343	
0620 0600	53	43	69	0	330	4	7	
0620 0700	55	44	67	1	125	4	99	
0620 0800	59	46	62	7	179	16	173	
0620 0900	60	46	60	12	167	21	167	
0620 1000	61	47	59	9	171	19	195	
0620 1100	61	46	58	14	170	21	170	
0620 1200	64	45	50	10	178	19	183	
0620 1300	68	45	43	12	186	20	179	
0620 1400	74	45	35	10	154	20	171	
0620 1500	78	44	30	10	162	22	143	
0620 1600	77	42	29	13	169	22	174	
0620 1700	75	46	36	17	143	28	203	
0620 1800	73	41	32	10	344	30	22	
0620 1900	73	41	31	2	46	10	336	
0620 2000	67	45	45	10	140	19	177	
0620 2100	66	46	48	4	161	21	160	
0620 2200	61	47	60	1	167	14	187	0.01
0620 2300	61	45	55	6	161	13	150	
0621 0000	59	42	54	1	98	7	148	
0621 0100	59	48	68	2	339	6	25	
0621 0200	56	45	66	3	350	14	1	
0621 0300	50	43	77	2	96	4	89	
0621 0400	46	41	82	2	127	5	140	
0621 0500	44	41	88	4	127	7	110	
0621 0600	43	40	90	1	36	11	137	
0621 0700	48	43	82	2	108	5	120	
0621 0800	56	44	64	4	146	7	146	
0621 0900	66	43	44	3	221	9	137	
0621 1000	72	41	32	6	250	15	220	
0621 1100	76	37	24	8	304	18	262	
0621 1200	81	37	21	5	168	16	260	
0621 1300	84	35	17	6	310	13	282	
0621 1400	83	31	15	7	164	15	241	
0621 1500	79	31	17	6	359	28	132	
0621 1600	76	37	24	4	106	15	269	0.02
0621 1700								
0621 1800	78	35	21	12	164	22	179	
0621 1900	73	35	25	12	111	29	133	
0621 2000	71	31	23	3	50	41	173	
0621 2100	68	38	33	4	295	12	341	
0621 2200	59	45	59	10	334	22	171	
0621 2300	55	48	76	5	328	20	324	

Hourly weather observations from Lake George RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	Dew point °F	RH %	10-min avg. wind Speed mph	10-min avg. wind Direct deg.	Max gust during hour Speed mph	Max gust during hour Direct deg.	Rain inches
0622 0000	53	47	81	0	330	8	339	
0622 0100	51	47	86	2	0	3	357	
0622 0200	50	47	89	3	139	5	146	
0622 0300	53	47	80	2	129	4	138	
0622 0400	52	47	84	3	146	8	121	
0622 0500	54	46	74	4	126	8	141	
0622 0600	52	47	82	3	139	5	146	
0622 0700	52	46	80	4	126	8	127	
0622 0800	58	46	65	4	136	6	140	
0622 0900	62	45	53	5	210	8	215	
0622 1000	71	43	37	6	207	15	165	
0622 1100	75	43	32	7	153	22	176	
0622 1200	77	34	21	16	197	29	187	
0622 1300	77	35	22	9	195	23	206	
0622 1400	78	36	22	6	254	21	169	
0622 1500	78	36	22	6	235	20	196	
0622 1600	82	36	19	9	211	21	115	
0622 1700	82	31	16	10	213	22	206	
0622 1800	83	32	16	10	214	23	202	
0622 1900	80	30	16	7	202	24	217	
0622 2000	76	27	16	7	51	19	38	
0622 2100	68	25	20	0	117	10	62	
0622 2200	62	27	26	2	113	5	105	
0622 2300	58	28	31	4	136	10	125	
0623 0000	54	28	36	356	145	0	7	

Hourly weather observations from Manitou Experimental Forest RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	RH %	Dew point °F	Hour averaged wind Speed mph	Hour averaged wind Direct Deg.	Hour rain Inch
0608 0100	41	72	32	4	171	
0608 0200	39	81	34	5	179	
0608 0300	40	83	35	4	169	
0608 0400	37	90	34	3	175	
0608 0500	34	93	32	2	147	
0608 0600	36	92	34	2	154	
0608 0700	54	56	38	5	169	
0608 0800	72	17	25	9	201	
0608 0900	75	15	23	10	210	
0608 1000	77	13	23	12	199	
0608 1100	79	12	22	15	209	
0608 1200	80	11	20	13	221	
0608 1300	82	11	21	14	199	
0608 1400	82	11	23	16	194	
0608 1500	82	11	23	15	197	
0608 1600	83	11	22	16	191	
0608 1700	83	10	21	16	198	
0608 1800	82	10	20	16	194	
0608 1900	79	11	20	13	187	
0608 2000	75	12	19	10	175	
0608 2100	72	13	19	7	159	
0608 2200	64	19	22	5	183	
0608 2300	58	25	22	4	147	
0608 2400	59	24	23	3	162	
0609 0100	57	27	23	7	178	

Hourly weather observations from Manitou Experimental Forest RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	RH %	Dew point °F	Hour averaged wind Speed mph	Hour averaged wind Direct Deg.	Hour rain Inch
0609 0200	54	30	24	7	179	
0609 0300	53	31	24	8	184	
0609 0400	51	33	23	6	176	
0609 0500	53	32	24	6	174	
0609 0600	58	28	25	5	168	
0609 0700	70	17	23	7	192	
0609 0800	74	13	21	14	215	
0609 0900	77	12	20	13	228	
0609 1000	79	11	20	15	228	
0609 1100	80	10	19	16	234	
0609 1200	81	10	21	14	224	
0609 1300	83	10	21	13	226	
0609 1400	84	9	20	12	215	
0609 1500	86	8	18	13	183	
0609 1600	85	9	20	13	187	
0609 1700	85	10	21	14	198	
0609 1800	82	11	23	15	191	
0609 1900	78	12	21	15	183	
0609 2000	75	13	20	11	175	
0609 2100	72	13	19	9	171	
0609 2200	68	15	19	7	178	
0609 2300	66	17	20	5	178	
0609 2400	59	24	22	4	166	
0610 0100	52	32	23	5	172	
0610 0200	48	38	24	6	174	
0610 0300	46	41	23	6	178	
0610 0400	42	48	24	6	177	
0610 0500	39	53	23	6	181	
0610 0600	44	43	23	5	168	
0610 0700	60	24	23	6	185	
0610 0800	71	13	17	11	192	
0610 0900	73	12	17	14	192	
0610 1000	75	11	17	13	205	
0610 1100	76	11	17	14	210	
0610 1200	77	13	22	13	182	
0610 1300	76	18	29	11	148	
0610 1400	77	19	32	11	151	
0610 1500	75	21	32	11	169	
0610 1600	67	30	34	7	354	
0610 1700	64	36	36	5	331	
0610 1800	61	40	37	7	344	
0610 1900	59	43	36	5	356	
0610 2000	57	45	36	4	4	
0610 2100	54	49	35	2	80	
0610 2200	48	59	35	2	159	
0610 2300	43	70	34	4	182	
0610 2400	41	72	33	3	170	
0611 0100	38	77	32	4	170	
0611 0200	40	74	32	4	152	
0611 0300	36	82	31	2	168	
0611 0400	34	87	30	3	185	
0611 0500	32	91	29	2	173	
0611 0600	34	89	31	2	166	
0611 0700	48	66	37	2	167	
0611 0800	60	46	39	4	8	
0611 0900	64	38	38	6	7	

Hourly weather observations from Manitou Experimental Forest RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	RH %	Dew point °F	Hour averaged wind Speed mph	Hour averaged wind Direct Deg.	Hour rain Inch
0611 1000	66	34	37	6	2	
0611 1100	70	31	38	6	77	
0611 1200	69	32	37	6	100	
0611 1300	70	29	37	6	84	
0611 1400	72	29	37	7	106	
0611 1500	71	28	36	7	123	
0611 1600	71	26	35	5	99	
0611 1700	71	28	36	5	10	
0611 1800	70	31	38	4	4	
0611 1900	67	36	40	5	13	
0611 2000	63	45	41	4	5	
0611 2100	59	54	42	2	24	
0611 2200	53	62	40	3	156	
0611 2300	51	66	40	2	160	
0611 2400	48	90	45	3	118	0.03
0612 0100	46	96	45	2	175	
0612 0200	43	98	42	3	184	
0612 0300	42	98	41	4	172	
0612 0400	39	99	39	3	161	0.01
0612 0500	37	99	37	2	172	
0612 0600	39	99	38	3	167	
0612 0700	48	93	46	1	337	
0612 0800	56	77	49	2	356	
0612 0900	64	49	44	3	171	
0612 1000	69	25	31	5	265	
0612 1100	72	17	25	6	262	
0612 1200	75	10	15	10	250	
0612 1300	75	19	30	10	155	
0612 1400	72	32	40	7	81	
0612 1500	71	32	39	5	88	
0612 1600	72	30	39	5	98	
0612 1700	74	28	39	5	69	
0612 1800	69	36	41	7	54	
0612 1900	66	44	44	4	48	
0612 2000	62	53	45	3	279	
0612 2100	56	64	44	2	155	
0612 2200	53	72	44	2	156	
0612 2300	51	75	44	2	168	
0612 2400	51	95	49	4	178	0.03
0613 0100	50	96	48	2	49	
0613 0200	43	93	41	3	141	
0613 0300	40	95	38	2	140	
0613 0400	38	96	37	2	153	
0613 0500	36	97	36	2	154	
0613 0600	37	96	36	3	172	
0613 0700	44	83	39	3	186	
0613 0800	53	57	38	3	232	
0613 0900	62	43	39	3	30	
0613 1000	66	36	38	7	12	
0613 1100	67	34	38	7	5	
0613 1200	67	39	42	8	25	
0613 1300	66	43	43	7	49	
0613 1400	64	46	43	8	37	
0613 1500	64	47	43	6	59	
0613 1600	63	47	43	8	33	
0613 1700	63	48	43	6	52	

Hourly weather observations from Manitou Experimental Forest RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	RH %	Dew point °F	Hour averaged wind Speed mph	Hour averaged wind Direct Deg.	Hour rain Inch
0613 1800	60	51	42	5	48	
0613 1900	59	51	41	4	45	
0613 2000	57	55	42	3	55	
0613 2100	54	63	42	2	159	
0613 2200	51	67	41	2	103	
0613 2300	51	58	37	3	213	
0613 2400	46	71	37	2	145	
0614 0100	43	78	36	2	135	
0614 0200	38	88	35	3	178	
0614 0300	36	92	34	3	178	
0614 0400	35	95	34	3	180	
0614 0500	36	94	34	1	224	
0614 0600	38	91	35	1	159	
0614 0700	47	76	40	2	159	
0614 0800	57	60	44	7	183	
0614 0900	61	50	42	10	206	
0614 1000	65	41	41	7	215	
0614 1100	69	34	39	9	197	
0614 1200	71	30	38	7	170	
0614 1300	66	46	45	6	105	
0614 1400	65	54	48	8	141	
0614 1500	67	51	49	9	188	
0614 1600	66	50	47	7	126	
0614 1700	66	47	45	7	168	
0614 1800	65	50	47	8	173	
0614 1900	64	54	47	6	189	
0614 2000	59	64	47	6	175	
0614 2100	57	64	45	7	184	
0614 2200	50	88	47	6	172	
0614 2300	47	94	46	4	167	
0614 2400	46	96	44	3	167	
0615 0100	44	97	43	3	170	
0615 0200	42	97	42	3	146	
0615 0300	41	98	41	3	146	
0615 0400	39	98	39	4	172	
0615 0500	40	98	40	7	173	
0615 0600	43	96	42	7	178	
0615 0700	53	84	48	6	183	
0615 0800	64	53	47	5	174	
0615 0900	71	32	40	5	183	
0615 1000	75	16	26	5	326	
0615 1100	72	20	29	10	356	
0615 1200	68	24	30	7	15	
0615 1300	69	29	35	12	6	
0615 1400	68	30	36	11	29	
0615 1500	69	26	33	9	15	
0615 1600	70	24	32	8	12	
0615 1700	68	28	34	10	11	
0615 1800	65	37	38	9	29	
0615 1900	62	43	39	7	36	
0615 2000	60	42	37	4	84	
0615 2100	58	48	39	4	316	
0615 2200	56	61	43	5	149	
0615 2300	52	78	46	4	153	
0615 2400	47	85	43	2	155	
0616 0100	44	92	42	4	169	

Hourly weather observations from Manitou Experimental Forest RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	RH %	Dew point °F	Hour averaged wind Speed mph	Hour averaged wind Direct Deg.	Hour rain Inch
0616 0200	43	94	41	3	169	
0616 0300	41	97	41	4	181	
0616 0400	41	98	40	3	173	
0616 0500	40	98	40	2	176	
0616 0600	42	98	42	4	163	
0616 0700	54	75	46	5	160	
0616 0800	61	55	45	6	157	
0616 0900	67	37	40	5	147	
0616 1000	71	27	35	6	63	
0616 1100	72	26	35	8	35	
0616 1200	72	26	36	10	23	
0616 1300	73	25	35	7	42	
0616 1400	71	26	35	7	38	
0616 1500	70	27	35	8	26	
0616 1600	71	25	33	8	44	
0616 1700	71	23	31	5	234	
0616 1800	69	26	33	7	32	
0616 1900	65	32	35	5	137	
0616 2000	60	44	38	4	169	
0616 2100	51	60	38	4	170	
0616 2200	47	68	37	4	174	
0616 2300	47	70	38	4	169	
0616 2400	45	71	37	4	169	
0617 0100	42	78	35	2	147	
0617 0200	38	84	34	2	145	
0617 0300	37	88	34	4	167	
0617 0400	36	89	34	4	166	
0617 0500	36	91	33	4	174	
0617 0600	38	87	35	4	178	
0617 0700	53	60	40	2	162	
0617 0800	68	31	36	5	163	
0617 0900	74	21	31	6	204	
0617 1000	77	15	26	5	22	
0617 1100	78	11	20	8	289	
0617 1200	81	10	19	9	282	
0617 1300	81	9	18	7	306	
0617 1400	78	10	16	4	319	
0617 1500	75	11	18	3	134	
0617 1600	74	12	19	3	136	
0617 1700	76	12	19	4	156	
0617 1800	77	11	19	3	121	
0617 1900	74	13	20	5	185	
0617 2000	68	18	23	3	144	
0617 2100	59	27	25	4	153	
0617 2200	54	35	27	4	161	
0617 2300	48	42	26	4	179	
0617 2400	47	41	24	4	175	
0618 0100	46	41	24	3	157	
0618 0200	43	46	24	4	165	
0618 0300	44	40	21	4	161	
0618 0400	39	52	23	5	179	
0618 0500	42	42	20	6	173	
0618 0600	44	37	20	4	150	
0618 0700	55	29	24	2	168	
0618 0800	70	19	25	2	349	

Hourly weather observations from Manitou Experimental Forest RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	RH %	Dew point °F	Hour averaged wind Speed mph	Hour averaged wind Direct Deg.	Hour rain Inch
0618 0900	78	9	15	5	297	
0618 1000	79	8	13	6	265	
0618 1100	78	8	12	9	234	
0618 1200	78	8	11	5	260	
0618 1300	80	7	11	6	170	
0618 1400	79	9	14	6	90	
0618 1500	78	9	16	5	54	
0618 1600	79	9	15	5	100	
0618 1700	78	9	14	6	151	
0618 1800	80	8	14	13	190	
0618 1900	78	9	15	9	178	
0618 2000	73	11	15	5	161	
0618 2100	63	15	15	3	156	
0618 2200	55	25	20	5	171	
0618 2300	51	29	21	4	160	
0618 2400	49	36	23	6	182	
0619 0100	49	38	24	6	179	
0619 0200	46	42	24	6	177	
0619 0300	41	49	24	5	177	
0619 0400	40	47	21	3	165	
0619 0500	36	57	22	5	175	
0619 0600	38	54	23	5	183	
0619 0700	46	43	25	4	180	
0619 0800	56	30	25	2	181	
0619 0900	69	19	25	2	50	
0619 1000	74	17	26	4	359	
0619 1100	79	12	22	5	3	
0619 1200	76	21	33	8	41	
0619 1300	77	21	34	10	32	
0619 1400	79	19	33	7	73	
0619 1500	78	19	32	7	36	
0619 1600	77	20	32	8	36	
0619 1700	77	21	34	9	28	
0619 1800	74	24	35	8	24	
0619 1900	72	29	38	7	26	
0619 2000	66	47	45	8	8	0.05
0619 2100	54	89	50	5	25	0.25
0619 2200	53	88	50	3	1	
0619 2300	51	94	50	2	124	
0619 2400	50	97	49	1	118	
0620 0100	49	99	48	3	176	
0620 0200	49	98	49	2	153	
0620 0300	50	97	49	3	169	
0620 0400	50	97	49	2	138	
0620 0500	49	97	49	1	87	
0620 0600	49	97	48	1	155	
0620 0700	56	81	50	5	175	
0620 0800	59	72	50	9	182	
0620 0900	61	65	49	8	171	
0620 1000	60	66	49	10	172	
0620 1100	63	57	48	10	197	
0620 1200	66	49	47	11	226	
0620 1300	72	42	47	7	176	
0620 1400	77	31	44	9	177	
0620 1500	76	37	48	14	184	
0620 1600	76	36	47	11	166	

Hourly weather observations from Manitou Experimental Forest RAWS from June 8 to June 22.

Mmdd hhmm (MDT)	Dry bulb °F	RH %	Dew point °F	Hour averaged wind Speed mph	Hour averaged wind Direct Deg.	Hour rain Inch
0620 1700	73	37	45	7	200	
0620 1800	71	31	39	6	29	
0620 1900	66	55	49	7	163	
0620 2000	63	63	50	3	169	
0620 2100	62	67	51	3	75	
0620 2200	61	70	51	3	115	
0620 2300	63	45	41	5	170	
0620 2400	58	57	43	3	157	
0621 0100	54	70	44	3	138	
0621 0200	50	75	43	5	169	
0621 0300	50	76	43	5	168	
0621 0400	48	83	43	4	176	
0621 0500	45	88	42	4	168	
0621 0600	47	83	42	4	152	
0621 0700	58	58	43	6	167	
0621 0800	65	44	42	7	166	
0621 0900	69	35	41	7	174	
0621 1000	74	27	38	7	224	
0621 1100	79	20	34	7	228	
0621 1200	81	16	30	5	247	
0621 1300	82	14	29	6	221	
0621 1400	79	20	35	5	108	
0621 1500	76	25	38	9	162	
0621 1600	78	24	38	8	151	
0621 1700	74	32	42	7	133	
0621 1800	70	40	45	6	146	
0621 1900	70	36	42	4	134	
0621 2000	66	45	45	4	16	
0621 2100	59	76	51	6	191	0.04
0621 2200	55	85	50	4	85	0.01
0621 2300	52	93	50	3	171	
0621 2400	50	94	49	3	160	
0622 0100	51	91	48	4	172	
0622 0200	52	86	48	5	161	
0622 0300	52	88	48	3	159	
0622 0400	51	91	48	3	175	
0622 0500	51	92	48	2	19	
0622 0600	51	86	47	3	146	
0622 0700	56	75	48	4	168	
0622 0800	61	58	47	5	175	
0622 0900	65	50	46	8	201	
0622 1000	72	34	42	11	225	
0622 1100	75	28	40	9	232	
0622 1200	75	23	35	10	227	
0622 1300	76	24	36	9	217	
0622 1400	78	23	37	10	206	
0622 1500	80	22	37	10	220	
0622 1600	79	20	35	10	216	
0622 1700	78	20	34	9	202	
0622 1800	80	18	32	10	213	
0622 1900	77	19	32	7	190	
0622 2000	66	32	35	3	138	
0622 2100	58	43	36	4	171	
0622 2200	54	51	36	4	144	
0622 2300	52	54	36	2	125	
0622 2400	50	62	37	4	153	

Haines Index computations from Denver Soundings, June 7 to July 7.

Hour (GMT)	Day GMT	700mb-500mb temp °C	Stability term	700 mb dew point depression °C	Moisture term	Haines Index
00Z	7-Jun-02	24.7	3	18	2	5
12Z	7-Jun-02	25.3	3	22	3	6
00Z	8-Jun-02	26.1	3	25	3	6
12Z	8-Jun-02	25.3	3	27	3	6
00Z	9-Jun-02	27.1	3	24	3	6
12Z	9-Jun-02	21.1	3	26	3	6
15Z	9-Jun-02	20.7	2	27	3	5
18Z	9-Jun-02	20.9	2	25	3	5
21Z	9-Jun-02	23.7	3	28	3	6
00Z	10-Jun-02	26.5	3	30	3	6
12Z	10-Jun-02	20.7	2	24	3	5
15Z	10-Jun-02	18.5	2	22	3	5
18Z	10-Jun-02	20.5	2	23	3	5
21Z	10-Jun-02	18.3	2	11	1	3
00Z	11-Jun-02	17.5	2	8	1	3
12Z	11-Jun-02	16.1	1	3.2	1	2
15Z	11-Jun-02	13.3	1	1.5	1	2
18Z	11-Jun-02	15.1	1	6	1	2
21Z	11-Jun-02	19.1	2	6	1	3
00Z	12-Jun-02	21.3	3	7	1	4
12Z	12-Jun-02	17.7	2	6	1	3
15Z	12-Jun-02	17.5	2	20	2	4
18Z	12-Jun-02	19.3	2	23	3	5
21Z	12-Jun-02	22.9	3	20	2	5
00Z	13-Jun-02	23.1	3	16	2	5
12Z	13-Jun-02	15.5	1	7	1	2
00Z	14-Jun-02	18.9	2	6	1	3
12Z	14-Jun-02	15.1	1	4.7	1	2
00Z	15-Jun-02	23.1	3	12	1	4
12Z	15-Jun-02	24.5	3	21	3	6
15Z	15-Jun-02	24.7	3	21	3	6
18Z	15-Jun-02	24.5	3	21	3	6
21Z	15-Jun-02	22.3	3	13	1	4
00Z	16-Jun-02	19.9	2	9	1	3
12Z	16-Jun-02	21.1	3	9	1	4
00Z	17-Jun-02	22.7	3	15	2	5
12Z	17-Jun-02	25.1	3	20	2	5
00Z	18-Jun-02	25.5	3	25	3	6
12Z	18-Jun-02	24.1	3	27	3	6
00Z	19-Jun-02	26.7	3	31	3	6
12Z	19-Jun-02	26.9	3	31	3	6
18Z	19-Jun-02	21.3	3	15	2	5
21Z	19-Jun-02	21.7	3	14	1	4
00Z	20-Jun-02	23.7	3	14	1	4
03Z	20-Jun-02	19.9	2	6	1	3
12Z	20-Jun-02	17.1	2	4.9	1	3
00Z	21-Jun-02	23.5	3	15	2	5
12Z	21-Jun-02	23.3	3	19	2	5
00Z	22-Jun-02	24.9	3	18	2	5
12Z	22-Jun-02	22.1	3	13	1	4
00Z	23-Jun-02	25.1	3	17	2	5
12Z	23-Jun-02	20.7	2	13	1	3
00Z	24-Jun-02	25.5	3	22	3	6
12Z	24-Jun-02	25.1	3	20	2	5
15Z	24-Jun-02	25.5	3	22	3	6
18Z	24-Jun-02	25.7	3	24	3	6
21Z	24-Jun-02	25.1	3	22	3	6

Haines Index computations from Denver Soundings, June 7 to July 7.

Hour (GMT)	Day GMT	700mb-500mb temp °C	Stability term	700 mb dew point depression °C	Moisture term	Haines Index
00Z	25-Jun-02	25.7	3	21	3	6
03Z	25-Jun-02	24.7	3	18	2	5
12Z	25-Jun-02	23.9	3	17	2	5
00Z	26-Jun-02	22.3	3	15	2	5
12Z	26-Jun-02	22.1	3	12	1	4
00Z	27-Jun-02	24.9	3	17	2	5
12Z	27-Jun-02	23.5	3	16	2	5
00Z	28-Jun-02	24.3	3	18	2	5
12Z	28-Jun-02	22.3	3	15	2	5
00Z	29-Jun-02	23.5	3	16	2	5
12Z	29-Jun-02	24.1	3	20	2	5
00Z	30-Jun-02	25.9	3	23	3	6
12Z	30-Jun-02	25.1	3	29	3	6
00Z	1-Jul-02	24.3	3	23	3	6
12Z	1-Jul-02	26.3	3	25	3	6
00Z	2-Jul-02	26.7	3	27	3	6
12Z	2-Jul-02	25.1	3	24	3	6
00Z	3-Jul-02	24.5	3	21	3	6
12Z	3-Jul-02	24.9	3	18	2	5
00Z	4-Jul-02	23.5	3	16	2	5
12Z	4-Jul-02	17.9	2	6	1	3
00Z	5-Jul-02	21.3	3	10	1	4
12Z	5-Jul-02	18.9	2	9	1	3
00Z	6-Jul-02	22.1	3	9	1	4
12Z	6-Jul-02	14.5	1	0.8	1	2
00Z	7-Jul-02	19.3	2	9	1	3
12Z	7-Jul-02	19.5	2	10	1	3
00Z	8-Jul-02	20.9	2	11	1	3
00Z	7-Jun-02	24.7	3	18	2	5
12Z	7-Jun-02	25.3	3	22	3	6

Appendix B: Fuels classification for fuel map (Kelly Close)

Reclassification of DOQs

The mosaic of DOQs was re-classified to represent standardized fuel types represented in the area, per the 13 stylized fuel models used for fire behavior modeling (Anderson 1982):

1 - Short Grass
2 - Grass with litter, understory (<30% overstory cover)
5 - Short brush
6 - Dormant brush
8 - Closed timber litter (lodgepole pine an aspen stands)
9 - Hardwood/long-needle pine litter (ponderosa pine stands, greater than 30 percent overstory cover)
10 - Timber (litter and understory)

The classification used, which provided reasonable results, was as follows:

DOQ values	Fuel Model
0 - 45	8
46 - 80	10
81 - 125	9
126 - 130	6
131 - 135	5
136 - 155	2
156 - 215	1
216 - 300	99 (barren, rock)

These classifications were developed by comparison with aerial photos, ground verification, and comparison with the vegetation data layer provided by the USDA Forest Service.

Adding Past Burns

There are burned areas from three major wildfires (Buffalo Creek, Hi Meadows, and Schoonover) and one prescribed burn (Polhemus) that changed the stand structure and fuel type over large areas. These necessarily needed to be accounted for in the fire spread simulations, so were incorporated into the FARSITE fuels layer. First, the area of these burns was clipped from the fuels layer into a separate layer. Then, the fuel types were reclassified to represent the effects of the burns on the fuel types now in the area. Time since the burns occurred was also factored into this, as the Buffalo Creek burn (1996) has much more grass and forb growth than the others.

Burn/Fire	Date	Burn type	Fuel re-classification
Buffalo Creek	May 1996	Stand replacement	1 to 1
			2 to 2
			5 to 5
			6 to 5
			8 to 99
			9 to 1
			10 to 99
Hi Meadow	June 2000	Stand replacement	1 to 1
			2 to 1
			5 to 99
			6 to 99
			8 to 99
			9 to 1
			10 to 99
Polhemus	Sept. 2001	Understory burn	1 to 1
			2 to 99
			5 to 2
			6 to 2
			8 to 99
			9 to 99
			10 to 2
			99 to 99
Schoonover	May 2002	Stand replacement	All to 99

This clipped/reclassified layer was then combined with the resampled fuels layer to provide a fuels layer with modifications within each burn.

The other factor affecting fire spread pertains to large bodies of water and large areas devoid of vegetation. These were derived from the vegetation layer provided by the USDA Forest Service. “WATER” was classified as fuel model 98, and “BARREN/OTHER” was classified as fuel model 99. This was then added to the fuels layer. The final layer accounted for previously burned areas, water, and rocky/barren areas.

Appendix C: Hayman Fire fact sheet from Ted Moore, Pike-San Isabelle National Forest fire management officer

Hayman Fire Fact Sheet

The Hayman Fire was reported on June 8, 2002, at 1655 hours, to the Pueblo Interagency Dispatch Center (PDC), Pueblo, Colorado, by USDA Forest Service, Pike National Forest employee, Terry Barton. The fire is currently under investigation and not all dispatch logs are available for public review.

1. Initially the fire was reported to be less than 1 acre, burning in ponderosa pine with a grass understory. The fire was burning on level ground in the South Fork of the Platte River drainage. The initial reported fire behavior was intermittent crowning and spotting, with 20-foot flame lengths. The weather conditions were reported to be winds from the S, SW at 15 to 20 miles per hour.
2. At 1700 hours Mike Hessler, the South Park Ranger District Fire Management Officer, radioed PDC and requested two Type I airtankers, the District's 5-person handcrew Squad 10, a Type III helicopter, engine 2431, and engine 941 to respond to the fire.
3. At 1706 hours Mike Hessler radioed PDC and confirmed the airtanker order, and ordered the Type 1 helitanker 707 that had been pre-positioned at Lake George. This helitanker, which holds 2,000 gallons of water in its belly tank, was on the fire scene dropping water within 20 minutes. The turn-around time for reloads from Lake George was 6 minutes a load. Mike Hessler also ordered Engines 1061 and 1071, and Pikes Peak Ranger District Squad 9 (a 5-person crew based at Woodland Park), to respond to the fire, with a 30-minute ETA.
4. At 1708 hours, the smokejumper ship at Fremont airport called. They were told by Pueblo Dispatch to stay on late and stage at the airport, for either a dispatch to Hayman Fire or to be held as a reserve for another initial attack, considering the increasing resource needs of the Hayman Fire.
5. At 1709 hours, Mike Hessler radioed Terry Barton, who was on the scene. Terry told Mike Hessler the fire was "no longer torching in the trees but creeping in the grass," which indicated that the fire might be burning at a lower intensity.
6. At 1713 hours Engine 1061 was on scene.
7. At 1714 hours the Lake George Fire Department was sending two wildland-fire- qualified engines and two wildland-fire-qualified water tenders to the Hayman Fire.
8. At 1718 hours Hayman air attack reported to PDC; his ETA was 19 minutes to the fire.
9. At 1728 hours Mike Hessler radioed PDC. He ordered two more airtankers and a hotshot crew that had been staged at Salida. Mike also asked about the status of four additional handcrews that had been planned to be pre-positioned at Woodland Park. Two of these crews had been diverted from Woodland Park that afternoon to go to the Coal Seam Fire near Glenwood Springs. Mike Hessler also ordered a law enforcement officer to conduct a fire investigation.
10. At 1745 hours Mike Hessler ordered a division group supervisor and a safety officer. There was already a Type II safety officer on scene that had been brought into the area days before to aid in initial and extended attack fires due to the extreme fire conditions.
11. At 1828 hours Mike Hessler ordered another division group supervisor, 2 additional Type II handcrews, a strike team leader with crews, and a task force leader. Mike also ordered a second Type III helicopter.
12. At 1831 hours Mike Hessler radioed dispatch and asked PDC to notify Park County Dispatch that the fire had spotted across and to the east of Highway 77.
13. At 1855 hours Park County Dispatch was again notified of houses at risk.
14. At 1930 hours Teller County Dispatch was notified and updated on the fire.
15. At 1934 hours Park County Dispatch was notified of one possible lost structure, (later determined to be a false report). At this time the fire was estimated to be 200 + acres.
16. At 2024 hours the Jefferson County Type III Incident Management Team (composed of wildland-fire-qualified technical specialists from Denver Metro Fire Departments and adjacent community fire departments) was requested to be at Lake George Work Center by 0600 on June 9 — until a Type I or Type II Incident Management Team could be mobilized. Joe Hartman's Regional Type II Incident Management Team was discussed, but they had been mobilized to the Coal Seam Fire earlier that evening. There were no other local Type I or Type II incident management teams in Forest Service Region 2.

17. Kim Martin's National Type I Incident Management Team was closing out the Iron Mountain Fire with the BLM at 1000 on June 9 in Canon City. Martin's team was ordered to be at Lake George by 1800 on June 9. The members of Martin's team trickled in throughout the late morning and early afternoon, and the team in-briefing was conducted by the Forest and State at 1900 on that day in Lake George Community Center. Martin's team was in place within 21 hours. There were no night operations so Martin agreed to begin managing the fire at 0600 on June 10.
18. At 2058 hours Teller County Dispatch was notified again of threats to structures. Teller County Sheriff's Dispatch was notified 3 or 4 times throughout the evening of June 8 and into the morning of June 9.
19. By 2230 hours the main fire to the west of Highway 77 was being managed with on-scene crews and engines. The new spot fires east of the highway were burning intensely on timbered slopes above two homes on the east side of the South Platte River The fires were now inaccessible to engines and crews.

Since 1831 hours there had been a dramatic increase in extreme fire activity. There were continued crown fire runs from the main fire; they ran of 5 to 15 acres at a time. With 15- to 25-mile-an-hour winds and a Haines Index of 6 (the worst conditions for a plume-dominated fire), torching trees were lofting fire brands up to 1 mile ahead of the main fire to the east northeast. By 2030 new spot fires to the east of Highway 77 had grown in size to 100 to 150 acres total. The intensity of the spot fires was high (estimated at 500 to 800 BTUs or greater); flame lengths were 3 to 7 feet on the ground and 40 to 50 feet or more when crowning; short- and long-range spotting continued to be a problem. The current strategy was to hold the main fire to the west of Highway 77 with engines, crews and air support. The strategy for the spot fires on the east of Highway 77 and on the east of the river was to use air support: the airtankers, the Type I helitanker, and the Type III helicopters with buckets would try to hold these spots until dark when air operations would shut down. Once the sun set no tactical operations using firefighters or mechanical fire equipment was possible because of rapid fire spread, high flame lengths, inaccessible terrain, spotting, and the unpredictable and volatile nature of the fire. Firefighter safety was a primary objective.

Fire weather and fire behavior were predicted to be the same or worse on June 9 and 10: red flag warnings, winds at 30 – 40 mph with gusts to 50+ mph, and Haines indices of 5 and 6. Weather conditions were predicted to be hot and dry, with continued high temperatures and very low relative humidity. With these forecasts, direct line construction was impossible as a safe tactic on June 9 and even on June 10.

The smoke column from running spot fires and residual burning in the main fire was laying low over the forest to the east and northeast. Air attack and lookouts could not see into or ahead of the spot fires nor see the current fire behavior of the spot fires. Without good intelligence on the status of these spot fires, Incident Commander Mike Hessler used firefighters to secure the main fire. This would maintain an anchor point to work the fire the next morning. Holding the south end of the fire would serve as a foundation for management teams to build on in the future, and reduce the probability of southern spread of the fire. During the late evening of June 8 and early morning of June 9, Mike Hessler, along with the South Park District Ranger and the Park County Sheriff, began identifying values at risk ahead of the fire with the forecasted conditions over the next few days. These individuals and the Jefferson County Type III Incident Management Team should be credited with devising a safe, thorough, and complete strategy for trigger points and evacuations considering these forecasted fire behavior and fire weather conditions.

No fire departments with qualified and trained wildfire firefighters were turned back during initial attack by Pueblo Dispatch or Mike Hessler. The Pueblo Dispatch Center does not dispatch volunteer and rural fire departments; the State of Colorado has not yet developed a system to list status of fire departments on a daily basis. Many times on fires, fire departments just show up; then we determine qualifications and need, and decide whether to use the resources or not. In the case of the Hayman Fire, the main fire was not fully accessible to be tactically worked by engines. Parts of the fire could be safely worked by engines, but handcrews and air support were needed to contain this fire. Any engines in addition to those already working the fire would have had to be staged or turned around. The engines on scene were worked efficiently, either on the fireline where access was available, or in protecting the two structures on the west side of the road and the two on the east side of the road.

During the first two plus hours of initial attack there were four air tankers, one Type I helitanker, two Type III helicopters with crews, Type I hotshot crew, two Type II handcrews, two 5-person handcrews, seven fire engines, two water tenders, and up to twelve miscellaneous fire overhead on scene – a total of 110 ground personnel, not counting aviators.

The Hayman Fire is a good example of a fire burning under the influence of all the extreme factors that affect fire behavior. Fuels were flashy, dry from a 3-year drought, and at all-time live and dead fuel moisture lows; fuels were abundant and continuous. Terrain was very steep once the fire crossed Highway 77 and the South Fork of the Platte River, and the terrain was on a west aspect (very dry), oriented to a south and southwest wind direction. The area was prime for the large fire event that occurred on June 8, 9 and 10. The homes in the area were in a poor position from a fire behavior standpoint and many were minimally defensible under these conditions.

Decision by South Park Ranger District Fire Management Officer Mike Hessler to use wildland-fire-trained and -qualified firefighters from the Forest and local cooperators, and to implement LCES, Thirty-mile Abatement Items and hazard/risk analysis mitigations played a critical role providing for firefighter and public safety in the initial attack and early extended attack on the Hayman Fire.

Throughout the course of the winter and early spring a fire danger assessment was conducted of precipitation and snowpack deficiencies. Precipitation and snowpack were 30 percent of normal. The ground fuels were very dry, as demonstrated by the lack of fuel moisture in live and dead vegetation, and extreme energy release components and burning indices. Early in March all indicators pointed to a severe fire season. On April 1 the Pike and San Isabel National Forest (PSICC) requested a substantial increase in severity funds to purposefully stage and preposition severity firefighting resources. The PSICC strategically staged additional severity crews, engines, and aircraft in areas of potentially high fire occurrence and high risks and hazards. On most days throughout this period the PSICC managed three to five 20-person crews deployed throughout the two forests. We had up to twelve extra engines from outside of the geographic area to bolster our fire resources; they were available not just for federal land fires but for our State and private partners. The PSICC used severity funds throughout the spring to stage a Type I airtanker at JEFFCO or Pueblo. This airtanker flew on many State and private fire; it was the first resource on many of these fires. On many days we had three to four helicopters staged throughout the PSICC for rapid initial attack. The BLM aided the Zone with staging smokejumpers at Fremont County Airport. The State had one single-engine airtanker based at the Pueblo Airtanker reload base to support the cause. On many days the PSICC staged up to three air attack ships and supervisors for multiple initial attacks. With these forces we managed initial attacks on federal lands and provided more support to fires on private lands than ever before. The Cascade Fire west of Colorado Springs was an example of quick and efficient initial attack. This was partly due to the airtankers at Pueblo, the helicopters staged throughout the Pike NF, the three 20-person handcrews on the Pike NF, and seven extra engines to support initial attack. The crews we had staged not only bolstered the Cascade Fire initial attack but also stayed for two days after initial attack and mopped up the fire for containment and control. The same applied earlier in the year to the Black Forest Fire north of Colorado Springs and the Spatz Fire near Monument. These are just a few incidences where all agencies worked together to preposition severity wildland-fire- qualfified resources in anticipation of an extreme fire season. If not for this foresight and strategic planning by all agencies, more catastrophic fire stories would have unfolded.

Communities and federal and state agencies associated with and affected by the Hayman Fire are thankful for the proactive planning and coordination of all of the fire services in this dispatch zone.

Ted Moore
Pike and San Isabel National Forests
Cimarron and Comanche National Grasslands
Fire Management Officer

Appendix D: Transcription of Pueblo Dispatch Log as included in fire behavior narrative by fire behavior analysts Greg Morris, Henry Goehle, Kelly Close, and Incident Meteorologists Makoto Moore Rob Crone

June 8

1658 Initial fire report. Fire origin is Located at T115N, R72W, Sec. 35; Tarryall, Rd. 77. It's currently less than one acre, and is torching.
1709 Fire is no longer torching, now creeping; in grass sheltered from wind (Mike Hessler, IC)
1714 On-scene size up: 3-4 acres / 40 acres. Wind S-SW, 15 mph with gusts to 26mph. Fire is burning in ponderosa pine. Flame lengths up to 20 ft., torching, intermittent crowning. Multiple spots to head and flanks.
1715 A second smoke is reported.
1723 2 Columns are visible from Divide, fairly close to each other.
1928 Retardant line in west flank tied to dirt road, not completely through. Crews working both flanks. Have picked up a _ acre spot east of Road 77, trying to get retardant on spot (Hessler).
1939 The spot east of Road 77 has grown to 3-4 acres (Hessler)
2059 May want to evacuate Wildcat Cyn., don't know where fire is headed by morning (Hessler)
2131 Not much [RH] recovery, will stay warm. Breezes may die down. Same for tomorrow. Cheeseman is at 7% (Eric, Denver Wx).
2220 Trying to get line tied in to Rd. 77 around original fire, not quite there. Spot is bigger than the main (original) fire. Fire estimated at 100 acres. Head of spot fire is 1 mi. past Tarryall Rd., on back side of Tappan Mtn.
2229 Martin's Team ETA 1800 6/9.

June 9

0016 Size-up of situation. Fire is on east side of 77, has gone about 3 miles. Not very wide. Presently several hundred acres. Line all around it on the west side. Will take work to hold it tomorrow. There is a second smaller spot fire on the east side of CR77. If weather continues tomorrow, fire could go to 3000-4000 acres (Hessler)
0730 Left flank of fire is down near a paved road. Legal is T115N, R72W, sec 24. Spot fire about 1/4 acre, active, within 100 yards of a cabin. Lat/Long 39:04.42, 105:23.96.
0754 Multiple evacuations in place, no WFSA yet.
0806 Fire is about 1000-1200 acres (Air Attack).
0854 RH 9%, winds gusting to 20 mp h. Advising to look at evacuating area up to 100,000 acres ahead of fire (Hessler).
1004 Active fire behavior.
1047 Smoke seen in Parker, CO. Running crownfire, up in the river. Tracking toward Cheeseman. No idea where head of fire is because of smoke.
1135 Fire has crossed the river, front is at Custer Cabins. Tracking up toward Cheeseman Reservoir.
1308 Fire has blown up. More air tankers requested.
1331 60 mph winds, spot fire flaring back up.
1334 Fire is 5000 acres, more active than Hi Meadows. Smoke is shooting into Denver.
1612 Fire has topped over the ridge, creeping down into the Thunder Butte drainage (Bill at Devil's Head).
1650 Flames on north Sheep Rock, moving around the mountain. Passed Turkey Creek. North end is on both sides of Cheeseman Reservoir.
1657 Fire boundaries - west on Sheep Rock, east on Thunder Butte, north at Cheeseman Reservoir.
1712 Four engines at Lost Valley Ranch are surrounded, fire all around them. They have a safe zone.
1841 Two heads on fire; right head is at T105 R70 Sec. 16.
2137 News is reporting column is 21,000 ft., producing thunder and lightning.
2217 Fire has crossed 126 (confirmed via recon from 6 mile hill).
2253 Fire not at Buffalo Creek. From Kelsey Creek overlook, fire is 1-1/2 miles past Trumbull, still making really good runs. Running parallel to Buffalo Creek.
2304 Head of fire is now about Bridge Crossing and Platter River (seen from Kelsey Creek Overlook).

Appendix E: Committed Resources

Committed Resources reported in the Historical Incident Status Summary (ICS-209) forms for the Hayman Fire for the period June 8, 2002 through August 11, 2002 (http://famweb.nwcg.gov/pls/his_209).

Date	Type 1 Crews	Type 2 Crews	Type 1 Helis	Type 2 Helis	Type 3 Helis	Engines	ST[1] Engines	Overhead	Dozers	Water-tenders	Camp Crews	Total Personnel
6/8/02	1	1	1	0	1	10	0	15	0	1	0	71
6/9/02	2	8	0	0	0	6	0	41	0	0	1	269
6/10/02	4	11	0	0	0	11	0	111	0	4	1	400
6/11/02	2	14	0	0	0	14	0	156	0	5	2	546
6/12/02	3	21	5	0	1	57	2	248	2	15	2	931
6/13/02	6	45	5	0	2	85	6	227	5	18	3	1740
6/14/02	6	43	9	2	2	78	2	375	8	14	7	1781
6/15/02	12	43	11	2	1	116	2	467	9	15	7	2183
6/16/02	12	44	11	2	3	97	0	415	9	13	7	1969
6/17/02	10	44	13	3	3	114	2	594	11	21	17	2325
6/18/02	10	48	14	3	3	119	0	648	11	13	8	2228
6/19/02	10	47	14	3	2	136	0	703	12	13	8	2340
6/20/02	11	47	14	3	2	141	0	761	10	13	8	2508
6/21/02	11	44	14	3	2	156	0	772	11	17	10	2564
6/22/02	12	51	14	2	5	145	0	691	9	21	10	2424
6/23/02	12	48	14	2	4	122	0	574	4	18	10	2264
6/24/02	11	39	13	2	4	107	0	591	3	15	7	2285
6/25/02	10	24	8	1	2	85	0	525	1	10	10	1664
6/26/02	9	19	6	2	4	69	0	392	2	4	6	1160
6/27/02	7	16	4	2	4	54	0	393	2	3	8	1091
6/28/02	7	14	3	2	2	41	0	341	1	3	4	881
6/29/02	4	12	2	2	3	41	0	267	1	3	4	738
6/30/02	3	12	2	2	3	41	0	247	1	3	4	698
7/1/02	1	12	2	2	2	28	0	223	1	13	5	613
7/2/02	1	11	2	2	2	25	0	214	1	11	5	577
7/3/02	1	11	2	2	2	20	0	194	1	11	5	556
7/4/02	0	10	1	1	2	18	0	184	2	8	4	501
7/5/02	0	10	1	1	2	12	0	170	2	7	5	464
7/6/02	0	8	1	1	2	11	0	182	2	7	6	434
7/7/02	0	6	1	1	2	6	0	159	4	7	2	352
7/8/02	0	10	1	1	2	5	0	148	3	5	5	427
7/9/02	0	10	1	1	2	4	0	152	4	6	5	421
7/10/02	0	10	1	1	2	1	0	163	4	4	5	422
7/11/02												
7/12/02	0	10	1	1	2	1	0	168	4	4	3	417
7/13/02	0	9	1	1	2	1	0	168	4	4	3	397
7/14/02	0	9	1	1	2	1	0	170	4	5	3	397
7/15/02	0	7	1	1	2	2	0	152	0	4	2	330
7/16/02	0	7	1	1	2	2	0	169	0	4	1	327
7/17/02	0	7	1	1	2	2	0	173	0	4	1	335
7/18/02	0	7	1	1	2	1	0	171	0	5	1	328
7/19/02	0	6	0	0	1	1	0	211	0	5	2	355
7/20/02	0	6	0	0	1	1	0	170	0	6	2	317
7/21/02	0	4	0	0	1	1	0	162	0	5	2	290
7/22/02	0	3	0	0	1	0	0	166	0	4	2	252
7/23/02	0	7	0	0	1	0	0	172	2	5	2	339
7/24/02	0	8	0	0	1	0	0	159	2	5	2	330
7/25/02	0	8	0	0	1	0	0	159	2	5	2	330
7/26/02	0	8	0	0	1	0	0	166	2	6	2	337
7/27/02	0	8	0	0	1	0	0	168	2	4	3	337
7/28/02	0	8	0	0	1	0	0	176	2	4	2	348
7/29/02	0	8	6	0	0	1	0	179	2	4	2	414
7/30/02	0	8	6	0	0	1	0	183	2	4	2	420
7/31/02	0	7	5	0	0	1	0	167	1	4	3	380
8/1/02	0	7	5	0	0	1	0	168	1	4	3	382
8/2/02	0	4	6	0	0	1	0	161	1	4	2	310
8/3/02												
8/4/02	0	6	0	0	0	0	0	142	0	0	2	264
8/5/02	0	6	0	0	0	0	0	139	0	0	2	243
8/6/02	0	4	0	0	0	0	0	134	0	4	2	234
8/7/02	0	6	0	0	0	0	0	151	2	4	2	186
8/8/02	0	6	0	0	0	0	0	130	1	4	2	222
8/9/02												
8/10/02												
8/11/02	0	6	0	0	0	0	0	0	0	0	0	120

[1] ST: Strike Team

Orange: Date in ICS-209 that fire was 100% contained.
Grey: ICS-209's were missing in the ICS-209 Historical Database.
Green: Date in ICS-209 that fire was controlled.

Appendix F: Data on Fixed Wing Aircraft

This appendix F contains data for numbers of fixed wing aircraft assigned to the Hayman Fire from June 9, 2002, through July 15, 2002. Information in this appendix was obtained from a review of the Air Operations Summary ICS Form 220 within the specific daily Incident Action Plan (IAP).

For June 9 through June 11 the fire was managed under one Incident Management Team.
From June 12 through June 24 the fire was zoned and split between two Type 1 Incident Management Teams.
From June 25 through July 15 the fire was managed under one Type 1 Incident Management Team.

From June 12 through 24, air tankers were a shared resource. As such, the number of air tankers represents the total number assigned for that day; for example on 6/12 only four air tankers total were assigned to the fire and on 6/18 only six air tankers were available.

From June 12 through 14 a total of two air attack were shared between the two zones after these dates separate air attacks were available for each zone. On June 12 and June 13 one of the two lead planes on the Hayman South Zone was shared with the Hayman North Zone.

For those dates identified as "No Data Available," photocopies of those respective dates IAP were not available or ICS-220 form was missing from the photocopy of the IAP used in this analysis.

	Hayman North			Hayman South		
Date	Air tankers	Lead planes	Air attack	Air tankers	Lead planes	Air attack
06/09		4	0	2		
06/10		4	2	2		
06/11		4	2	2		
06/12	4	0	2	4	2	2
06/13	4	0	2	4	2	2
06/14	4	1	2	4	2	2
06/15	6	1	2	4	2	2
06/16	6	1	2	4	2	2
06/17	6	1	2	No data available		
06/18	6	1	2	6	2	2
06/19	6	1	2	No data available		
06/20	6	1	2	6	2	2
06/21	No data available		6	2	2	
06/22	6	1	2	6	2	2
06/23	6	1	2	6	2	2
06/24	6	1	2	6	2	2
06/25		0	0	2		
06/26		0	0	3		
06/27		No data available				
06/28		0	0	3		
06/29		0	0	3		
06/30		0	0	0		
07/01		No data available				
07/02		0	0	1		
07/03		0	0	1		
07/04		0	0	0		
07/05		0	0	1		
07/06		0	0	1		
07/07		0	0	1		
07/08		0	0	1		
07/09		0	0	1		
07/10		No data available				
07/11		0	0	1		
07/12		0	0	1		
07/13		0	0	1		
07/14		0	0	0		

Appendix G: Fire Behavior Narrative Summary

Hayman Fire
June 24, 2002

The Hayman Fire began as a person caused fire that was detected on Saturday, June 8th, 2002 in the protection area of the Pike National Forest. The fire started on level ground in the valley of the South Fork of the Platte River drainage. It immediately displayed very active fire behavior and escaped initial attack efforts.

Following is a review of the fuels, weather, and topography and how these factors affected the fire behavior of the Hayman Fire.

Fuels

There was a variety of fuel types that the fire burned through, but primarily it burned in ponderosa pine fuels. There was some areas of short grass mixed among some areas of the pine. This is a very flashy fuel type which leads to rapid rates of spread and can easily outrun suppression crews. Abundant ladder fuels were present and led to abundant torching, crowning and spotting. These fuel types would model out as 9 and 1.

There were inclusions of mixed conifer timber that consisted of Douglas fir, lodgepole, and ponderosa pine at the lower elevations. These stands were primarily on the northerly aspects. At the higher elevations limber pine and bristlecone pine were present. These fuel types would model out as both 8 where ground fuels were light and 10 where downed fuels were heavy.

The ground fuels were very dry for all size classes. Smaller fuels (1, 10, and 100 hour) were in the 2-3% range, while the larger fuels (1000 hour) were in the 5-7% range in the lower elevations. These fuel moisture ranges are very dry for the time of year and elevation. Energy Release Component levels were above the 97th percentile. Live fuel moistures were also low for this time of year (85-95%).

There were very few natural fuel breaks for the fire to slow down or for the suppression crews to take advantage of. The Schoonover fire and the Polhemus prescribed burn did significantly slow the spread of the fire on the northeast head.

There was evidence of an older fire in the wilderness, approximately 40-50 years ago. Fire in this area basically stopped and went out on its own once the wind quit and humidity came up. There is also a lot of rocky ground in the wilderness that breaks up the continuity of the fuel, and fire eventually went out in most areas once the major run was over.

Weather

Many factors of weather played a part in the fire behavior of this fire. Precipitation amounts were well below normal. The area typically receives 7 inches of rain From January to June, whereas only 2.5 inches had fallen in that time period this year. There was also very little if any snowfall during the winter. This led to abnormally low 1000 hour fuel moistures. The low precipitation amounts also led to very dry live fuel moistures.

During the first two days of the fire temperatures were well above normal with temperatures in the 90's at the lower elevations and 80's at the higher elevations. Relative humidities were very low, with single digits common. Humidity recoveries were also very poor the first two nights, with recoveries only to the mid teens. When temperatures and humidities reach these levels, fine fuel moistures are extremely dry and flammable. Fires climb ladders more easily, resulting in torching and crowning. Spot fires start more readily with ignition potentials being very high.

Wind was also a strong factor that affected the fire. Strong southwesterly winds hit the fire on September June 8th, pushing the fire to the northeast during the day, and then making another push to the northeast the next day. Winds were reported at 30-40 mph with gusts to 50 mph at many weather stations. The Cheeseman RAWS showed a peak gust of 84 mph, but this was likely influenced by the fire front as it passed by.

Strong winds and low humidities again hit the fire area on June 17th and 18th. On June 17th the winds were out of the NW, probably influenced somewhat by the orientation of the drainages, and blew 15-20 with gusts to 30 mph. On the 18th, the winds blew from the southwest at approximately the same speed. Relative humidities dropped into the single digits both days, with poor humidity recoveries both nights as well.

On June 19th, the winds switched to the northeast but were not as strong. Relative humidities moderated into the low 20's. Fire remained active on the south end, but spread was slowed on the northeast side of the fire. The weather during the days between the two fronts and after the second front was relatively quiet. Humidities were above critical ranges and winds were mainly diurnal.

Some light precipitation did fall on the fire, but not enough to affect fuel moistures significantly. It did give the suppression crews enough of a break to at least get a foothold on some sections of the line.

Topography

Terrain on the fire varied from gentle to extremely steep (50-60%). The more gentle terrain allowed road access along much of the east flank. The fire started in gentle terrain that is exposed to strong prevailing southwest winds.

The South Fork of the Platte River drainage is oriented to a southwest wind. This drainage is a natural funnel with the high elevation Lost Creek Wilderness to the west and the Rampart Range to the east.

Most of the steeper terrain is in the wilderness on the west side and in the Trout Creek area to the Rampart Range on the east side. However, much of the S.F. Platte river drainage is dissected by smaller steep side drainages.

The terrain on the east flank of the fire was more gentle with rolling terrain. This feature did not provide any breaks to slow the wind down at all, no matter which direction it happened to be blowing. The fire on this plateau moved southeast, northeast, and south-southwest. The gentle terrain did proved good road access where crews were able to contain the fire once the winds died down and humidities rose. Another downside to the gentle terrain were all the homes that were in the area.

Summary

The Hayman fire is a good example of a fire burning under the influence of all the extreme factors that affect fire behavior. Fuels were flashy, abundant, and continuous. Terrain was very steep in places and oriented to the wind direction. The weather was unseasonable warm and dry and there was a wind event to push the fire. The area was prime for the large fire event that occurred on June 8th and 9th. The homes in the area were in a poor position from a fire behavior standpoint

The fire started on a gentle terrain in a ponderosa pine stand that had extremely dry fuels. It was easy for the fire to climb into the crowns on June 8th due to the warm temperatures, low humidities strong winds. The drought conditions led to low fuel moistures in the crowns. On June 9th the fire was pushed by strong winds that pushed the fire down the S.F. Platte River. The fire moved approximately 19 miles in an 8 hour period.

On June 17th, the fire spread in two heads from Turkey Rock and Shrewsbury Gulch. The fire spread southeast toward Woodland Park approximately 6 miles in 6 hours, with active crown fire and spotting up to _ mile. Many homes were burned during these runs.

On June 18th, a red flag warning was issued for strong southwest winds with low humidities. The two heads came together in a push to the northeast with the heads coming together on the ridge between West Creek and Highway 67. Once the interior between the two heads came together, the intensity was strong enough to overcome the wind and the power of the fire overcame the power of the wind, essentially slowing down the northeastward spread. Then when the energy from the interior burnout started to cool down, the power of the wind took over once again and started pushing the fire to the northeast. The fire crossed Highway 67 just north of the Rainbow Falls camp turnoff. It then proceeded to cross Trout Creek late in the day. Numerous houses burned this day as well. The fire in the wilderness was also active on the steep southerly aspects north of Hankins Gulch.

On June 19th, a frontal passage was forecast to bring northeast winds with slightly higher humidities early in the afternoon. The front did come as forecast and actually hit the east side of the fire around midmorning. By 1100 the winds were out of the east with humidities in the 20's on the east side of the fire, moderating fire activity. Crews were able to take advantage of the moderating conditions and use direct attack at the top of the slopovers east of Trail Creek. At the same time, humidities were down to 5% on the south side of the fire along with southwest winds, and fire the fire was very active with abundant torching and short crowning runs. As the front passed through the south part of the fire, it pushed the south end of the fire south across Trail Creek with spotting over Phantom Creek. Several houses burned during this run. The fire in the wilderness was very active as well, with a run in Hankins Gulch burning up over the top of South Tarryall Peak. It also burned out a bowl on the ridge south of Wigwam Creek.

Starting on June 20th, humidities again started moderating to the 20's and 30's early in the afternoons. Crews were able to utilize direct attack methods and contain the fire. A minor section of line utilized indirect attack to burn out an area that had numerous spotfires on a north slope. By June 24th, all containment lines were in on the non-wilderness portion and holding well. The lines were tested on June 23rd with hot dry winds from the southwest again, but everything held.

Most of the fire area burned very intense and clean with high mortality, especially in the ponderosa pine stands. Aspen stands and Douglas fir stands with brush in the understory burned on the drier aspects, but not as well on the northerly aspects

The effects of prescribed fire was evident when the fire burned into the Polhemus burn as the fire remained on the ground and burned slowly, even under dry, windy conditions. There was another prescribed burn in the Phantom Creek area that reduced the intensity of the fire as it burned through the stand, with only a low intensity ground fire going through the area.

One other factor that aided in the suppression of the fire was the access provided by the road system on the east side of the fire. Roads provided control lines as well as good escape routes for the crews.

While the drought and wind played a big part in the spread of this fire, it seems that the overriding factor that helped spread the fire was the low humidities. Once the humidity got below 12%, the fire became very active. When it got below 8%, it became explosive. Moderate burning conditions were experienced when the humidity was between 12-30%. Above 30% and the fire was not very active, even with moderate wind speeds.

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