Appendix: Weather

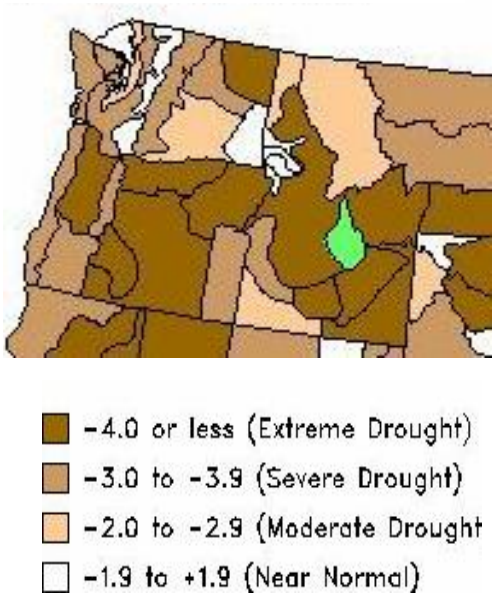
Prior Conditions

Persistent high pressure over the eastern Pacific during the winter of 2000-2001 resulted in low snow pack and record low precipitation amounts over the Pacific Northwest. The winter of 2000-2001 was the second lowest precipitation producer in the past 30 years.

The precipitation amount at Winthrop, Washington, for the period of October 1, 2000 through June 30, 2001, was 6.87 inches or 57% of normal. In addition, the east slopes of the Cascades were in the third year of deficient precipitation.

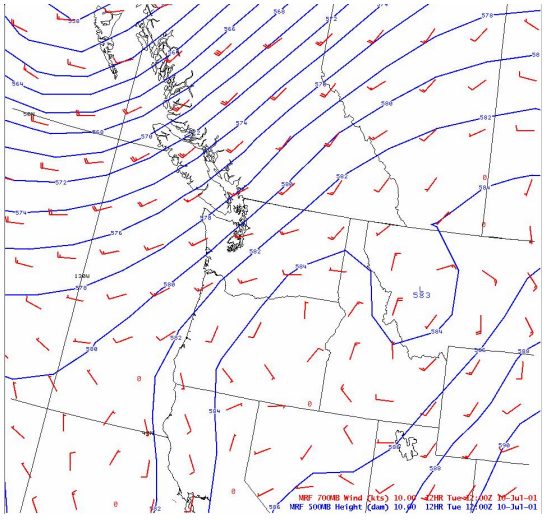
Shown below are the precipitation values for the Winthrop area for the period October 2000 through June 2001.

Palmer Drought Index issued 7/14/01



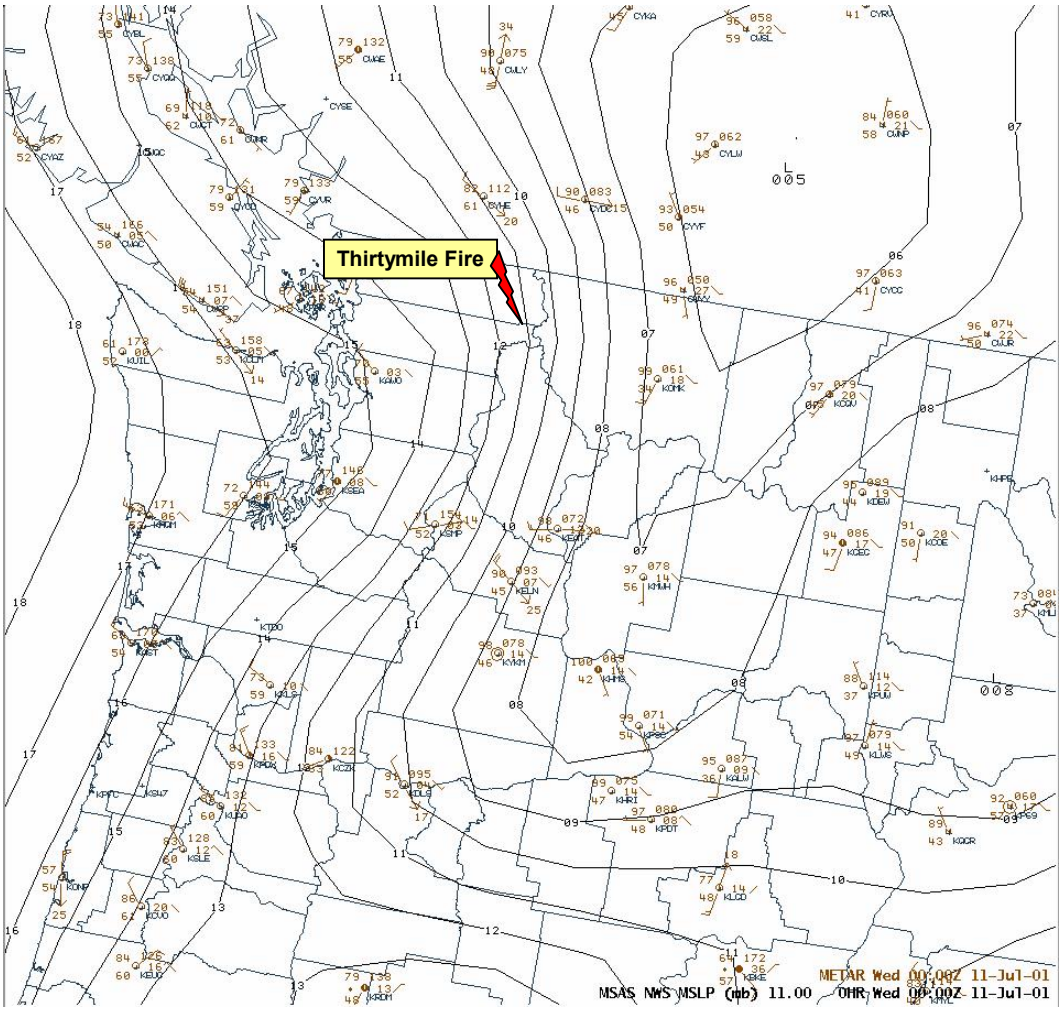
Inches	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Actual	1.04	1.18	1.12	0.49	0.71	1.02	0.39	0.12	0.80
Normal	0.83	1.86	2.44	1.99	1.40	0.89	0.72	0.96	1.01
Departure	0.21	-0.68	-1.32	-1.50	-0.69	0.13	-0.33	-0.84	-0.21

Afternoon temperatures at First Butte RAWS ranged from 73° to 87°F with minimum humidities from 9 to 20% the 5 days prior to the fire. The North Cascades Smokejumper Base was near 100° F with a minimum relative humidity of 9% the afternoon of July 9th. (See Weather: Attachment 1)



Tuesday July 10, 2001

On July 10th, a persistent upper level trough remained over the off shore waters of the Pacific Northwest, while an upper level ridge continued over the south central United states. These features were producing south to southwest flow of air aloft over the Pacific Northwest. Embedded in this



southwest flow were weak disturbances moving northward from off the southern California coast and out of the desert southwest. These weak weather systems were responsible for the scattered thunderstorms that occurred as far north as central Oregon the afternoon of July 9th. During the afternoon of July 10th, infra-red satellite imagery showed that one disturbance, moving north from central Oregon out of an area of thunderstorm debris from the previous afternoon, had arrived over the area of the Thirtymile Fire.

At the surface, a thermally induced trough of low pressure had pushed northward into eastern Oregon and Washington. This hot and dry air mass was responsible for the 101° F high temperature and the minimum relative humidity of 4% at the North Cascades Smoke Jumper Base the afternoon of July 10th. Early morning observations from the fire site reported by the Entiat IHC indicated an overnight low temperature of 61° F and a maximum humidity recovery of 54%. Winds were calm overnight in the Chewuch River canyon floor. The 8:30 a.m. (PDT) observation from the Entiat IHC was 68° F, relative humidity 48%, and calm wind. The first observation from the NWR #6 Crew, taken at 12:20 p.m. (PDT) showed that the temperature had already climbed to 91° F and the relative humidity had dropped to 10%. The wind speeds had risen to 2-4 mph at that time. The last observation recorded by the NWR #6 crew was taken at

2:00 p.m. (PDT) with a temperature of 94°F, relative humidity 8%, and a wind speed of 2 mph. As the fire developed and smoke began to obscure the sun, later observations again taken by the Entiat IHC showed temperatures ranging from 86° to 90°F, with relative humidity 12 to 19%, and wind speeds from calm to 2-4 mph. (See Weather: Attachment 2)

The radiosonde upper air sounding from Spokane for the morning of July 10th indicated a surfaced based inversion extending to near 5000 feet mean sea level (MSL). The temperature for the atmosphere to become unstable and support convection was 95°F with a top to the lift near 40,000 feet MSL. To the north, at Kelowna, British Columbia, the convective temperature was 100°F with a top also near 40,000 feet MSL. Afternoon temperatures were forecast to be in the upper 80s to mid 90s (88°- 95°F) in Fire Weather Zone 685. Haines Indices generated from the Spokane morning sounding on July 10th indicated a mid-level value of 6 and a high level value of a 3 and 4. A mid level Haines Index of a 6 is very common for the months of July and August in eastern Washington. (See Attachment 3)

The Haines Index was devised by Donald Haines in the late 1980s as a national index for large fire growth based on the stability and moisture content of the lower atmosphere. The actual Haines Index is derived from twice-daily upper air soundings taken over the continental United States and Canada. Indices range from a 2, which indicates moist and stable air, to a 6, indicating dry and unstable air. Elevations range from a Low Level, approximately 2,000 to 5,000 feet above MSL, to a High Level at approximately 10,000 to 18,000 feet MSL. In resent years, computer models have been developed to generate forecast Haines Index values from several available weather computer models.

While winds along the Chewuch River canyon bottom remained light, ridge top 20 foot, 10 minute average winds at First Butte weather station (RAWS) were steady at 5 to 7 mph from the southwest to west with occasional winds from the south and northwest. Gusts reported by the RAWS site of 14 to 20 mph are 1 second instantaneous winds and not considered a true wind gust. Comparable 1 minute winds would be in the 9 to 11 mph range with possible gusts of 15 to 17 mph as derived from Wind Conversion Charts. These wind speeds correspond to those observed manually by lookouts at First Butte and Goat Peak during the afternoon of July 10th.

As the afternoon of July 10th progressed, the atmosphere over the area became unstable enough to support large column development. The morning upper air soundings from nearby Spokane, Washington, and Kelowna, British Columbia, indicated that the day was going to be unstable. During the afternoon, fair weather cumulus developed over the hills to the south and east of the fire and over the plains of southeast British Columbia as shown on visual satellite photos. The same time the smoke column from the Thirtymile Fire showed a marked increase in size and enhanced development, the fair weather cumulus over southeast British Columbia also enhanced. (See Figure 1 - Visual Satellite Image 11/0030z or 10/1730 PDT). Ten minutes later, two distinct plumes became evident from the fire. (See Figure 2 - Visual Satellite Image 11/0040Z or 10/1740 PDT). From individual testimony and video of the column it should be noted that two distinct counter-rotating columns were observed on the fire late in the afternoon. As previously

mentioned, infra-red satellite images showed the movement of a weak weather disturbance northward from central Oregon to over the Thirtymile fire during the afternoon of the July 10th.

This is evident from the observed northward movement of the debris clouds from the previous day's convection over central Oregon. Wind speeds over the fire site between 20,000 and 30,000 feet MSL increased by 20 to 30 knots as verified by the 11/00Z and 11/12Z sounding from Kelowna, British Columbia. The coincidental arrival of the weak weather disturbance from Oregon and the significant increase in the afternoon and evening wind speeds near the top of the column contributed to the already unstable air mass and possibly aided the fire's column development. (See Weather: Attachments 4 and 5.)

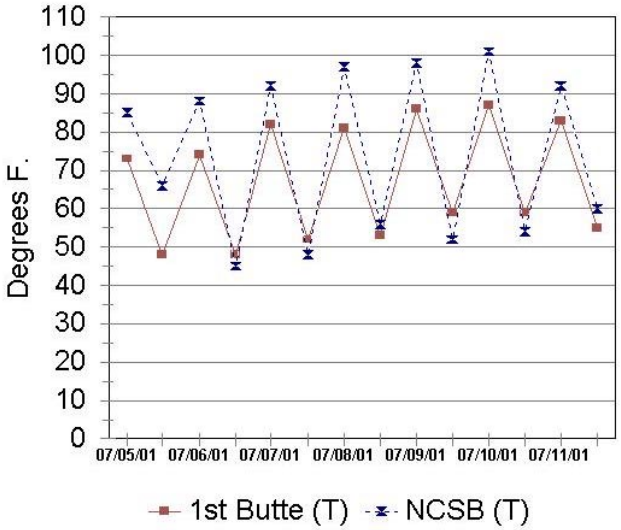
Summary

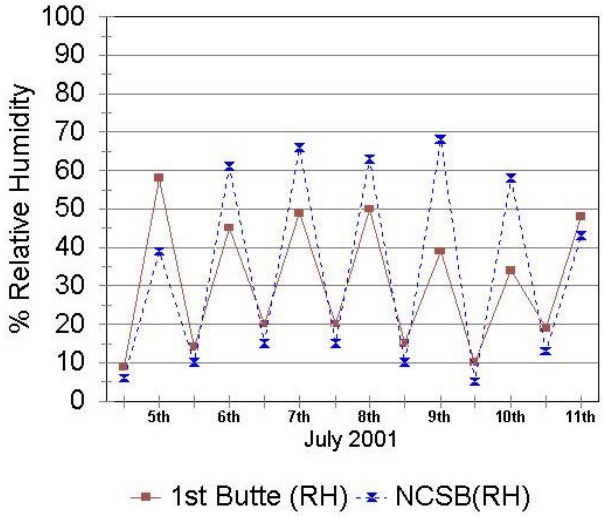
The combination of near record low snow pack and lack of precipitation during the winter of 2000/2001 contributed significantly to the very dry fuel conditions present this year in the Chewuch River. By the 10th of July, near record temperatures, the long, dry days, an unstable atmosphere and a receptive fuel bed all combined to produce a plume dominated fire.

Photo by Sandor A. Feher, Winthrop, WA

The Thirtymile Fire in the late afternoon (~ 5:30 p.m. PDT), July 10, 2001

Weather Appendix Attachment 1.
RAWS Observations for First Butte and NCSB Sites





NOTE:

- NCSB is a Remote Automatic Weather Station at the North Cascade's Smoke Jumper Base, to the east of the town of Winthrop, WA.

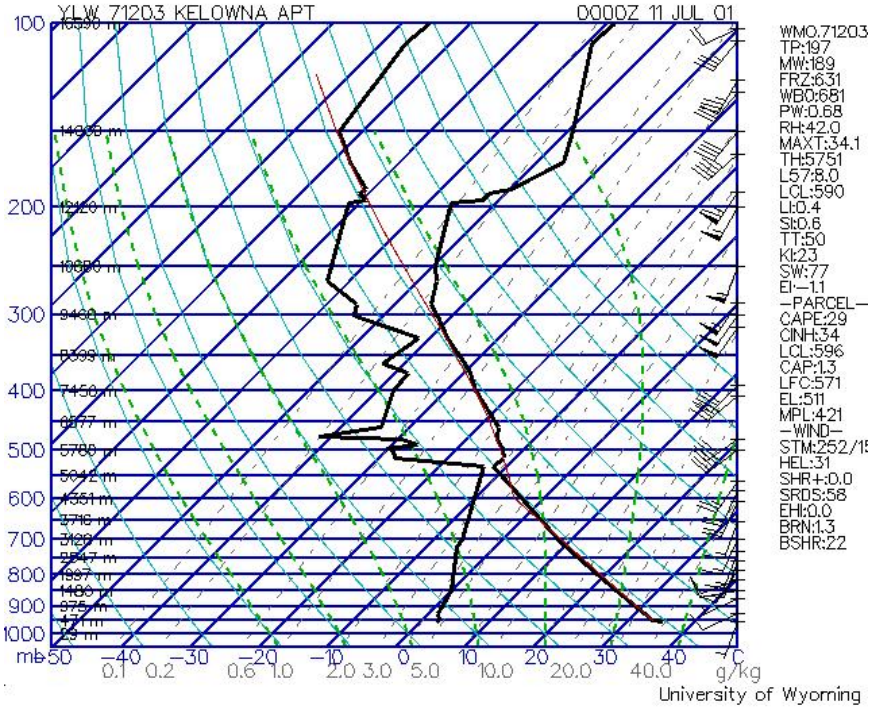
- 1st Butte is a Remote Automated Weather Station near the 1st Butte Lookout to the southeast of the Fire Site.

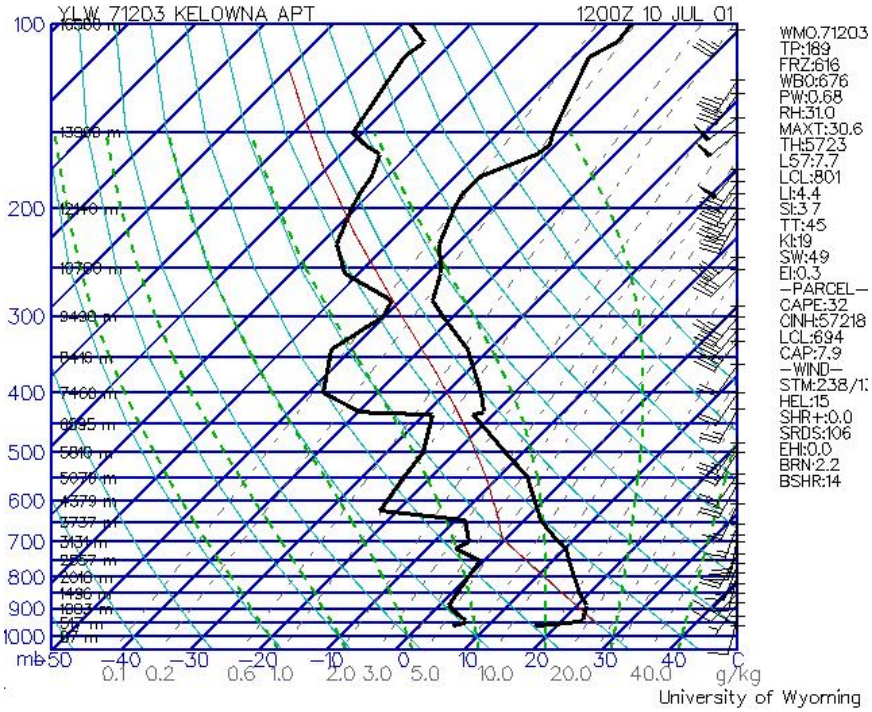
Weather Appendix Attachment 2. Observations taken by the Entiat IHC and the NWR #6 Crews

Date/Time	Temperature	Relative Humidity	Eye Level Wind
Entiat IHC 10/0130	61	54%	Calm
10/0230	66	49%	Calm
10/0330	65	44%	Calm
10/0430	63	43%	Light Down Canyon
10/0630	62	48%	Calm
10/0730	65	42%	Calm
10/0830	68	48%	Calm
NWR#6 10/1220	91	10%	2-4G8 mph
10/1250	89	9%	2G8 mph
10/1400	94	8%	2G5 mph
Entiat IHC 10/1445	87	17%	Winds Missing
10/1515	86	16%	Southwest 1-2 mph
10/1545	88	12%	Northwest 2-4G6 mph
10/1615	87	13%	Northwest 2-4 mph Gust to 17 mph in River
10/1645	89	15%	Calm
10/1715	90	13%	Calm
10/1900	81	19%	Calm

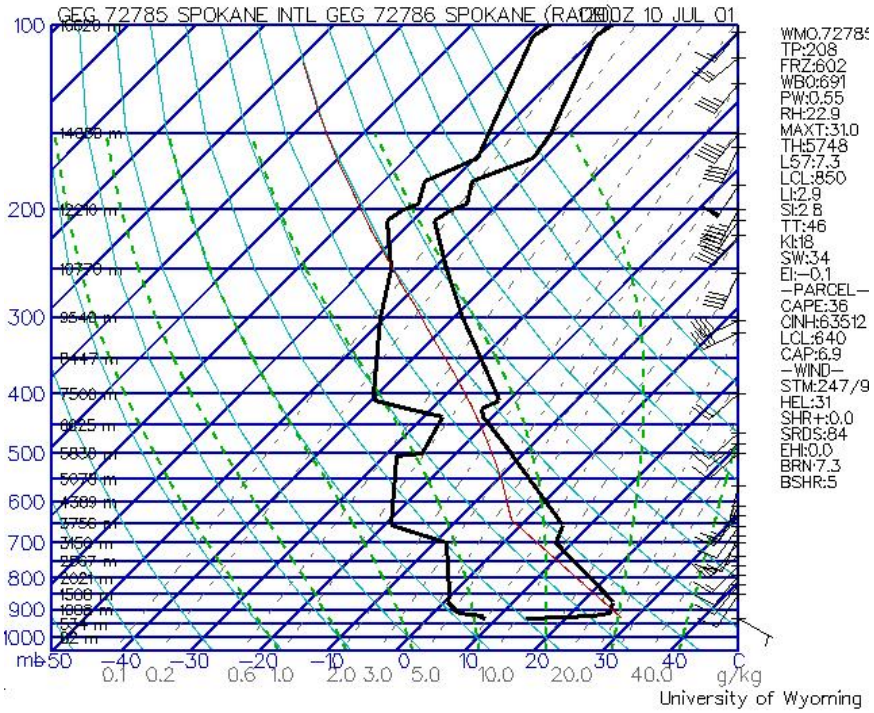
- G = Gust

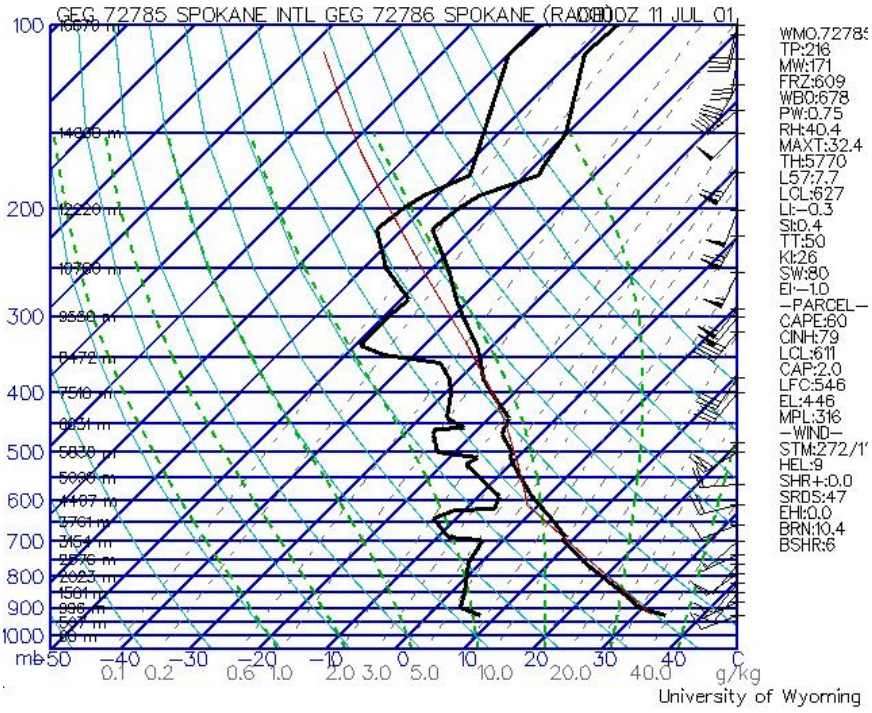
Weather Appendix Attachment 3
Kelowna B. C. and Spokane, WA Upper Air Soundings



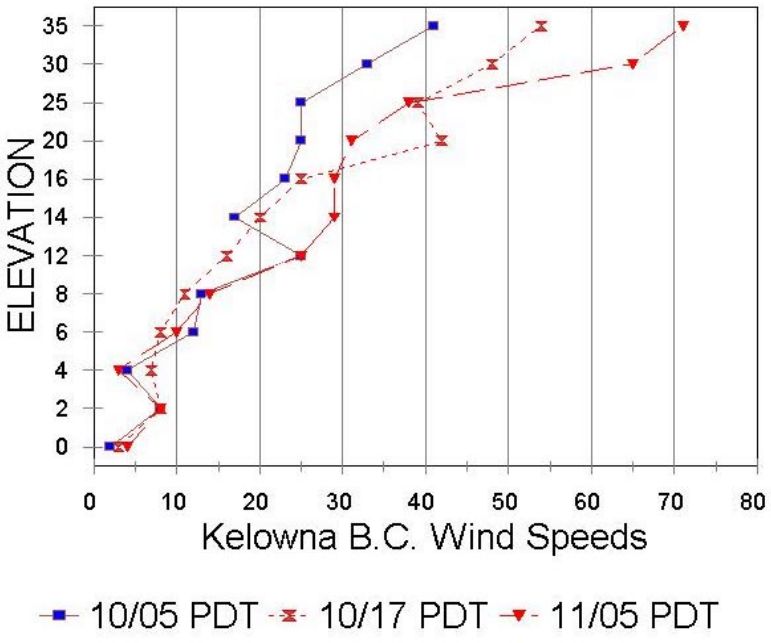


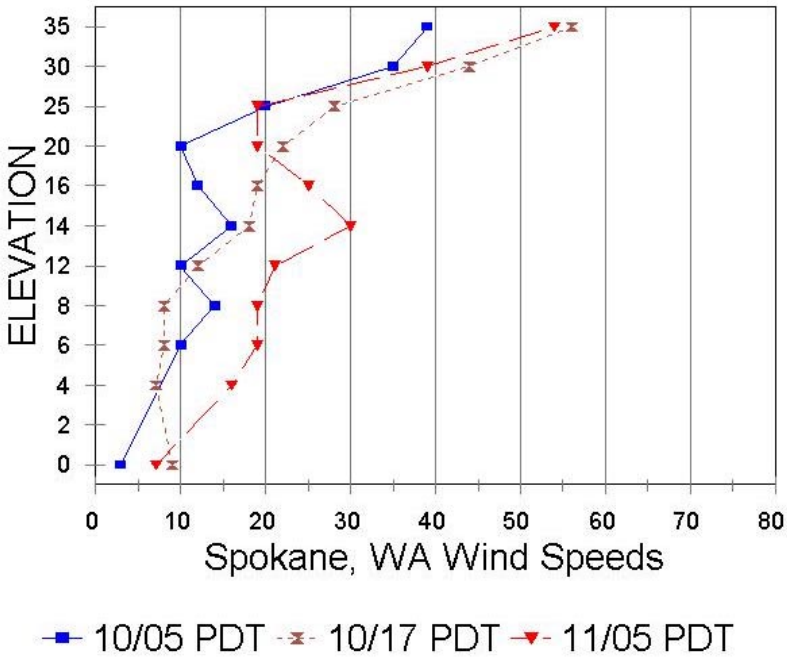
Weather Appendix Attachment 3 (continued)





Weather Appendix Attachment 4
Upper Level Wind Speed Plot Kelowna, British Columbia, and Spokane, WA





Weather Appendix Attachment 5
Visual Satellite Images

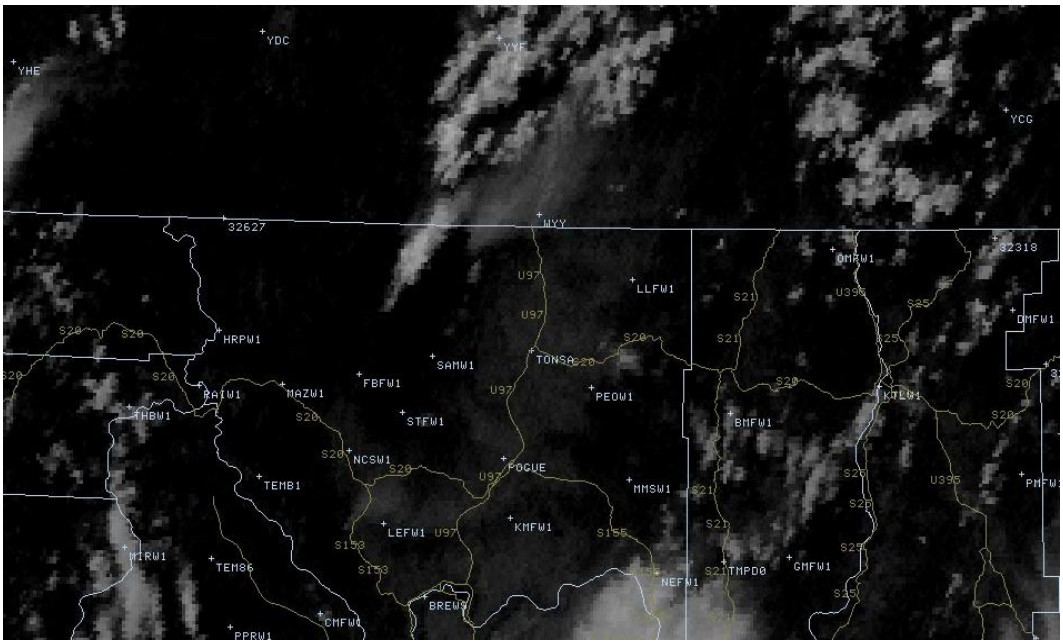


Figure 1 - 07/11/0030Z or 07/10/1730 PDT

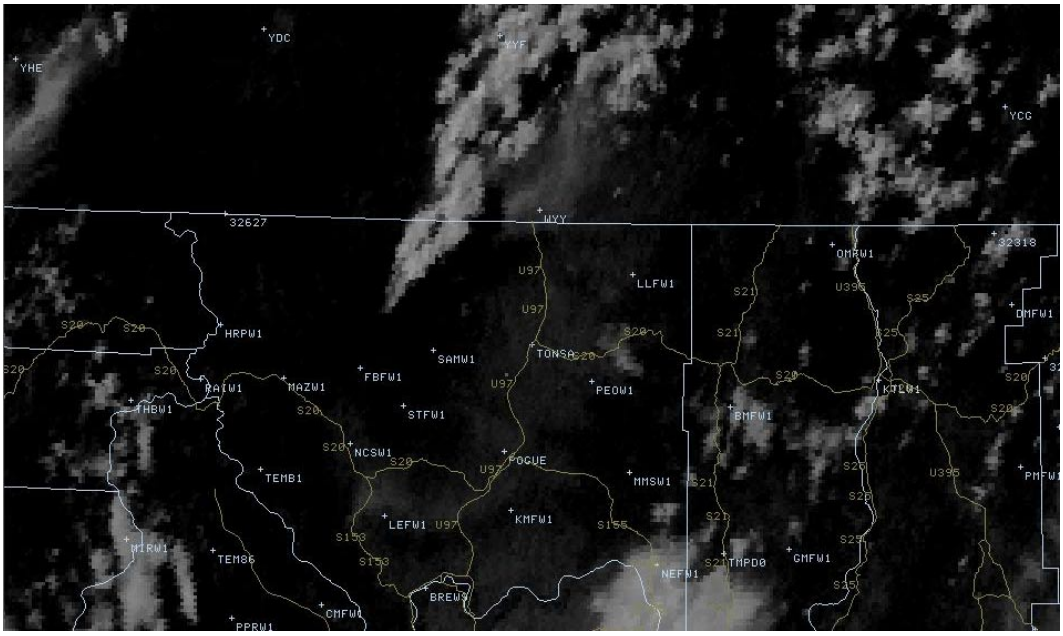


Figure 2 - 07/11/0040Z or 07/10/1740 PDT

Weather Appendix Attachment 6
Spot Forecast for Libby South Fire

SPOT FORECAST FOR LIBBY SOUTH FIRE.....DNR - NE
ISSUED BY NATIONAL WEATHER SERVICE SPOKANE
736 PM PDT MON JUL 9 2001

DISCUSSION...DRY WEATHER PATTERN WITH HOT AFTERNOON TEMPS AND LOW RELATIVE HUMIDITY WILL STAY PUT ACROSS THE BURN AREA THROUGH TUESDAY. EXPECT GUSTY AFTERNOON UPSLOPE-UPVALLEY WINDS FOLLOWED BY SOMEWHAT LIGHTER DOWNSLOPE-DOWNVALLEY WINDS AT NIGHT. POOR TO FAIR RELATIVE HUMIDITY RECOVERY CAN ALSO BE EXPECTED AT NIGHT.

FOR THIS EVENING

WEATHER.....PARTLY CLOUDY.
CWR.....0%
TEMPERATURE.....88-92
HUMIDITY.....4%
WIND...EYE LEVEL..SOUTH WIND 10 MPH GUSTS TO 17 MPH.

FOR OVERNIGHT

WEATHER.....MOSTLY CLEAR
CWR.....0%
TEMPERATURE.....MIN 57
HUMIDITY.....MAX 55%
WIND...EYE LEVEL..BECOMING NORTH 4-9 MPH AROUND 9PM.

OUTLOOK FOR TOMORROW

WEATHER.....PARTLY SUNNY.
CWR.....0%
TEMPERATURE.....MAX 98
HUMIDITY.....MIN 10%
WIND...EYE LEVEL..NORTH WIND 5-9 MPH BECOMING SOUTH 9-13 MPH
BY AROUND10AM WITH GUSTS IN THE AFTERNOON TO 17
MPH.

Weather Appendix Attachment 7
Spokane Fire Weather Forecasts for Zone 685

FIRE WEATHER FORECAST
NATIONAL WEATHER SERVICE SPOKANE WA
830 AM PDT TUE JUL 10 2001

DISCUSSION...WILL BE ANOTHER HOT DAY TODAY WITH TEMPERATURE VERY SIMILAR TO YESTERDAY OR POSSIBLY A DEGREE OR TWO WARMER. CONTINUED DRY WITH MIN RELATIVE HUMIDITIES DOWN IN THE SINGLE DIGITS IN NUMEROUS LOCATIONS. MOISTURE OVER OREGON STILL WORKING ITS WAY NORTH AND THERE IS A QUESTION AS TO WHICH SIDE OF THE CASCADES IT WILL MOVE OVER. WILL KEEP A SLIGHT CHANCE IN THE SOUTHERN CASCADES FOR LATER THIS AFTERNOON. ANOTHER WAVE WILL MOVE NORTHEAST OVER EASTERN WASHINGTON AND THE IDAHO PANHANDLE TONIGHT AND WEDNESDAY MORNING. AGAIN ONLY SLIGHT CHANCES IN THE NORTHEAST AND NORTHERN IDAHO. THUNDERSTORMS AT THIS TIME LOOK WET AND SHOULD BE ACCOMPANIED WITH SOME GUSTY WINDS.

****
WIND FORECASTS ARE FOR 20 FOOT WIND SPEEDS (VALLEYS AND RIDGE TOPS) AND ARE 10 MINUTE AVERAGES REFLECTING RAWS WINDS.
****

WAZ025>027-038-041>043-041530-
SOUTHERN (Zones 675 and 680) CENTRAL (Zones 677 and 682) AND NORTHERN (Zones 684 and 685) DISTRICTS.

.TODAY...
SKY/WEATHER.....PARTLY SUNNY WITH A SLIGHT CHANCE OF SHOWERS OR THUNDERSTORMS SOUTH...ZONES 680 AND 675 BY AFTERNOON.
TEMPERATURE.....MAX...88-95 VALLEYS AND 71-85 MOUNTAINS.
HUMIDITY.....LITTLE CHANGE. MIN...8-20% VALLEYS AND 10-30% MOUNTAINS.
WIND - 20 FOOT...
SLOPE/VALLEY..SOUTHWEST TO NORTHWEST 5-15 MPH WITH GUSTS TO 20 MPH.
RIDGE TOPS.....WEST WIND 6-12 MPH.
CWR.....00%.
LAL.....1/2
HAINES INDEX.....3-4 LOW.

.TONIGHT...
SKY/WEATHER.....PARTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS OR THUNDERSTORMS...ZONES 675, 677, 680 AND 682.
TEMPERATURE.....MINS...54-64 VALLEYS AND 45-55 MOUNTAINS.
HUMIDITY.....POOR TO FAIR RECOVERY. MAX...40-60% VALLEYS AND MOUNTAINS.
WIND - 20 FOOT...
SLOPE/VALLEY..NORTHWEST TO SOUTHWEST 5-15 MPH WITH LOCAL GUSTS TO 20 MPH.
RIDGE TOPS.....WEST 8-15 MPH.
CWR.....00%.
LAL.....1/2
HAINES INDEX.....3-4 LOW.

.WEDNESDAY...
SKY/WEATHER.....PARTLY SUNNY WITH A SLIGHT CHANCE OF SHOWERS OR THUNDERSTORMS...ZONES 675, 677, 680, AND 682.
TEMPERATURE.....DOWN 2-4. MAX...84-93 VALLEYS AND 70-83 MOUNTAINS.
HUMIDITY.....LITTLE CHANGE. MIN...8-20% VALLEYS AND 10-30% MOUNTAINS.
WIND - 20 FOOT...
SLOPE/VALLEY..SOUTHWEST TO NORTHWEST 5-15 MPH WITH GUST TO 20 MPH.
RIDGE TOPS.....SOUTHWEST WIND 6-12 MPH.
CWR.....00%.
LAL.....1/2
HAINES INDEX.....3-4 LOW.

3-5 DAY EXTENDED FORECAST...THURSDAY THROUGH SATURDAY- ALL DISTRICTS: PARTLY CLOUDY EACH DAY. A SLIGHT CHANCE OF SHOWERS OR THUNDERSTORMS OVER THE CASCADES AND BASIN THURSDAY. OVER THE NORTHEAST AND IDAHO A CHANCE OF SHOWERS AND THUNDERSTORMS EACH DAY. LOWS IN THE 40S AND 50S. HIGHS 75-95. DIURNAL WINDS WITH BREEZY DOWNVALLEY EVENING WINDS IN THE CASCADE DISTRICTS.

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6 TO 10 DAY OUTLOOK: SUNDAY JULY 15 THROUGH THURSDAY JULY 19: NEAR NORMAL TEMPERATURES AND ABOVE NORMAL PRECIPITATION.

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