



U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service

2003 Fire Weather Operating Plan

WFO Rapid City, South Dakota



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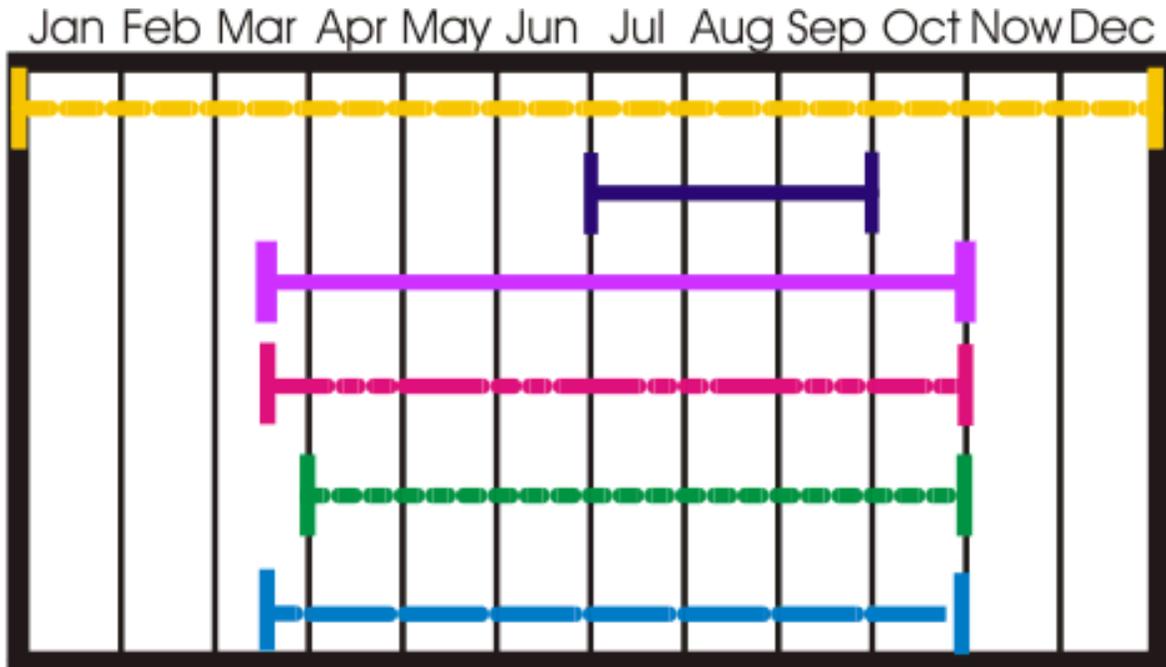
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I. Changes for Calender Year 2003

Coordination with various federal and state land management agencies, indicates an active fire weather season is anticipated for calender year 2003. Many agencies are at least planning numerous prescribed burn projects. With this in mind, WFO Rapid City will maintain the schedule of services modified in calender year 2002 to begin several services earlier than normal. Section *II. Schedule of Services* will detail these changes.

With the opening of the Northern Great Plains Interagency Dispatch Center, phone call notification of Fire Weather Watches and Red Flag Warnings will change. When these products are issued phone notification will be to the Rocky Mountain Coordination Center and the Northern Great Plains Interagency Dispatch Center. See part *C. Fire Weather Watches and Red Flag Warnings* in section *III. Basic Services* for complete details.

II. Schedule of Services Throughout the Year



Spot forecasts for wildfires issued as needed. For the best service for a prescribed burn, give at least 24 hours notice prior to requesting the spot forecast. The preferred times to request spot forecasts are 500 AM to 700 AM and 900 AM to Noon.



Morning narrative fire weather forecast issued by 700 AM.



Afternoon narrative fire weather forecast issued by 230 AM.



NFDRS trend forecasts issued for zones and observations provided to WFO Rapid City by 230 PM, issued by 330 PM.



Grassland Fire Danger Statement issued daily for western South Dakota by 700 AM.



Fire Weather Watches and Red Flag Warnings issued for the district as critical fire weather and fire danger dictates.

III. Basic Services

Basic meteorological services provided consist of narrative and spot forecasts, grassland fire danger statements and fire weather watches and red flag warnings.

The schedule for providing basic services is located in section 2. Schedule of services throughout the year.

A. Narrative Fire Weather Forecast

Narrative forecasts include a discussion/synopsis, forecasts for specific zones, extended forecasts and outlooks and stability/winds aloft forecasts. Fire weather watches and Red Flag Warnings will be highlighted in the discussion/synopsis of the narrative fire weather forecast and in the zone/s for which the watch or warning pertains.

Morning:

The morning narrative fire weather forecast (see appendix A) will be issued by 700 am. The forecast will be a detailed forecast of weather, including cloud cover, precipitation, temperature, relative humidity, including nighttime recovery, 20 foot wind, lightning activity level, and highlights for fire weather watches and red flag warnings for each fire weather zone. The fire weather zones may be broken down into subzones by counties and topography as needed to accurately depict expected weather conditions in enough detail to be a significant help in predicting fire behavior. The forecast will contain three 12 hour periods, today, tonight and the next day.

The forecast will also contain a weather discussion, a general 3 to 7 day extended forecast and a 8 to 10 day outlook. The forecast will also provide forecast Haines Indices, forecast of mixing heights and smoke dispersal for today and tonight, zone specific winds aloft forecasts for today and tonight, and a general wind forecast for period four through day five.

Afternoon:

The afternoon narrative fire weather forecast (see appendix A) will be issued by 230 PM. The forecast will be a detailed forecast of weather, including cloud cover, precipitation, temperature, relative humidity, including nighttime recovery, 20 foot wind, lightning activity level, and highlights for fire weather watches and red flag warnings for each fire weather zone. The fire weather zones may be broken down into subzones by counties and topography as needed to accurately depict expected weather conditions in enough detail to be a significant help in predicting fire

behavior. The forecast will contain three 12 hour periods, tonight, tomorrow, and tomorrow night.

The forecast will contain a weather discussion, the latest Haines indices from Rapid City S.D., a general 2 to 7 day extended forecast and a 8 to 10 day outlook. The forecast will also provide forecast Haines indices, forecast of mixing height and smoke dispersal for tonight and the next day, winds aloft forecasts for tonight and the next day, and a general wind forecast for days 2 through 5.

B. Spot Forecasts

General guidelines.

WFO Rapid City, S.D. will provide spot weather forecasts as described below for counties in their county warning area. If you request a spot weather forecast for a county not within the office's county warning area, you will be referred to the proper office to avoid further confusion.

A timely weather observation from near the fire location is required to receive a spot weather forecast. Without an observation you will be provided a general forecast for the area.

If at all possible, provide a record of the weather from the past 2 or 3 days from near the fire to allow the fire weather meteorologist to better tailor the spot weather forecast to the location.

Normally, a spot forecast will be provided to you within 30 minutes of the receipt of the request for wild fires and for prescribed burns when 24 hour notification has been provided. For prescribed burns without prior notification, significant delays may be experienced due to priority of duties and office staffing. Delays may also occur if severe weather or flash flood watches or warnings are in effect in the NWS Rapid City CWA..

Normally the request for a spot weather forecast will be made using the form found in appendix C. fire weather special forecast request. Complete blocks 1 through 12 and Fax the form to NWS Rapid City. *Be sure to include your fax number and a voice number with every request.* Follow up with a phone call to ensure receipt of the request since the fax machine is located in a different part of the building from the operational fire weather forecasters.

The spot forecast will be posted to the Internet and faxed back to you on request. Spot forecasts will not be read back to you over the phone, to avoid errors in communication.

Please provide feedback to the fire weather meteorologist, both positive and negative. If the spot forecast you receive does not appear to be verifying, call the fire weather meteorologist and discuss your concerns. An updated spot forecast can be issued upon your request.

Spot forecasts for wildfires: Spot forecasts will be available 24 hours a day for wildfires and receive the same priority as severe weather warnings.

Spot Forecasts for Prescribed Natural Fires: Initially spot forecasts will be issued under the same guidelines as spot forecasts for a declared wildfire. Provide the fire weather meteorologist with an idea of how long you expect the fire to burn, and what weather conditions are critical to the prescription.

Provide the fire weather meteorologist with as many observations from the fire as possible to help provide the detail in the spot forecasts which will aid you in your fire behavior predictions. **Current weather observations from the fire location are required with each request for a spot forecast.**

Spot Forecasts for Prescribed Burns: Spot forecasts will be issued as needed. If you require a spot forecast for a prescribed burn, notify the office the day before you will be requesting the forecast to ensure adequate staffing is available to issue the forecast. Failure to give 24 hour notification may delay the routine fire weather forecasts, including the morning or afternoon narrative forecasts, and the NFDRS forecasts. If an additional meteorologist must be called into the office to issue the spot forecast, the requesting agency may incur overtime costs.

The optimum times to request a spot forecast are 500 am to 700 am and 900 am to noon. Outside of these time periods, there may be delays in spot forecast production as staffing and workload constraints become more of a factor.

For the best service on spot forecasts for prescribed burns, coordinate the burn ahead of time with the NWS Rapid City. If possible, provide a copy of the burn plan. As a minimum provide the location, aspect, elevation, fuel type and the weather ranges in

your prescription a week or more before the burn. Providing a list of approved burns well in advance of the burns is highly recommended.

In order to provide the best quality service, your cooperation on requesting spot forecasts will be appreciated.

Spot Forecast Format and Information

The format for spot forecasts is shown in Appendix D. This format will be used for both prescribed burns and wildfires. A detailed forecast will cover the first and second burn period. An outlook, which includes a general forecast of expected weather and trends, will be issued for the third burn period.

The weather items that will be included in a spot forecast are:

- 1) Sky condition and weather.
- 2) Temperature.
- 3) Relative Humidity.
- 4) 20 foot winds.
- 5) Forecast Haines index
- 6) Mixed layer winds.
- 7) Mixing height.
- 8) Smoke Dispersal.

If additional weather information is required, notify the fire weather meteorologist when making the spot forecast request or ahead of time while coordinating during the planning stage of the prescribed burn.

C. Fire Weather Watches and Red Flag Warnings

Fire Weather Watches and Red Flag Warnings are issued to advise land management agencies of the possible development of or actual occurrence of Red Flag conditions. A Red Flag event occurs when critical weather patterns develop that could lead to large and dangerous fires. Conditions that warrant a Red Flag Watch or Warning are critically dry wildland fuels **and**, either alone or in combination, the expected or actual occurrence of:

1. General dry thunderstorm activity (LAL 6), i.e. considerable lightning but little or no measurable precipitation.
2. The combination of strong winds (usually 25 MPH or greater), low humidities (15% or lower), and high temperatures (usually 80 degrees and above).
3. Fire danger in the "very high" or "extreme" category.
4. In the judgement of the forecaster, weather conditions and fire danger combine to indicate a severe fire weather episode.

Fire Weather Watch - will be issued for an entire zone or groups of zones whenever the potential for Red Flag conditions exists. A watch will normally be issued 24 to 72 hours in advance of the expected onset of Red Flag conditions. If dry lightning is the only condition expected in the 0 to 24 hour time frame, a Fire Weather Watch may be issued or continued in place of a Red Flag Warning.

Red Flag Warning - will be issued for an entire zone or group of zones whenever Red Flag conditions are imminent or occurring. A warning will generally be issued within 24 hours of the expected onset of Red Flag conditions, or whenever the forecaster becomes aware of an ongoing Red Flag event.

Fire Weather Watches will usually be issued with the morning or afternoon narrative forecast. Red Flag Warnings may be issued at any time by updating the narrative forecast. The Watch or Warning will be headlined in the forecast with information on the affected area, the valid time of the watch or warning, and a description of the expected severe fire weather conditions included. Both Watches and Warnings will continue to be highlighted in the narrative fire weather forecast until threatening conditions cease.

Fire Weather Watches and Red Flag Warnings will be entered into WIMS and the affected agencies notified by telephone usually before, but always after they have been issued. A Watch or Warning will be canceled when Red Flag conditions are no longer expected to occur. During the off-season, if very warm, dry, and windy conditions are expected, the Rocky Mountain Area Coordination Center and Northern Great Plains Interagency Dispatch Center will be notified by phone as appropriate.

NOTE: The National Weather Service Fire Weather Watch and Red Flag Warning program is used to warn land management agencies of the onset or occurrence of critical fire weather conditions. The National Weather Service does not make any management decisions as a result of the Watch or Warning. Specific actions are determined by user agencies. Decisions made, as well as actions taken or not taken, are the sole responsibility of the user.

IV. Special Services

Special Meteorological Services are those services uniquely required by land management agencies which cannot be provided by the National Weather Service Forecast Office during normal working hours. Thus, services provided outside the commuting area of this office or on overtime are special services. User agencies assume the costs of these special services to include overtime directly related to the incident, per diem, and travel as required. Special reimbursement procedures have been established between the National Weather Service and participating agencies to meet the special service requirements.

A. Air Transportable Mobile Unit (ATMU)

An Air Transportable Meteorological Unit (ATMU) and Remote Environmental Monitoring System (REMS) are cached at the Rocky Mountain Area Coordination Center for use on fires in Wyoming, South Dakota and Nebraska. These units, along with a trained and certified Incident Response Meteorologist (IMET), can be dispatched to a fire on request of a land management agency. An ATMU and REMS must be requested, or already on the fire, when the IMET is dispatched to the fire.

The Rocky Mountain Area Coordination Center will handle dispatch procedures for the ATMU and REMS and the IMET. ATMU's and REMS other than those cached at the Rocky Mountain Area Coordination Center can be dispatched if needed by contacting the National Interagency Fire Center or the Rocky Mountain Area Coordination Center. When an ATMU, REMS and IMET are dispatched, the land management agency will notify NIFC, and provide for the transportation of the ATMU, REMS and the IMET to and from the fire.

The IMET comes equipped with a portable computer capable of receiving various meteorological alphanumeric and graphic data as well as satellite and radar data. Use of the unit provides the Incident Commander with 24 hour on site fire weather forecast service.

Besides transportation to and from the fire, the land use agency will also provide the IMET with electrical power and access to a clean and dry shelter. Phone lines are needed by the IMET, but do not necessarily have to be at the fire site.

The National Weather Service Incident Response Meteorologist cannot be reassigned to another fire without prior approval of NIFC. Once released from the

fire by the overhead team, the IMET should be sent directly to his/her home office unless the reassignment has been approved by NIFC. Under no circumstances will the IMET be held by the user agency for potential reassignment once released from the fire by the overhead team.

B. Training

The NWS Rapid City fire weather program leader is available to assist the user agencies with training at fire behavior and other weather related courses. A request should be forwarded in writing to the office as early as possible to help ensure the request can be satisfied. Every attempt will be made to meet training requests. However, staffing limitations will need to be considered, and consequently, each request will be reviewed on a case by case basis.

V. Fire Weather Observations

There are a total of 12 fire weather observation stations in the NWS Rapid City CWA. A complete station listing is shown in Appendix B.

Observations are the most important single effort the control agencies put into the Fire Weather Program because the product derived from these observations is the fire danger rating. Therefore, it is imperative that the observations are received on time and that the data is accurate. Observers should keep in mind that they "take the weather" as much for their own agency as they do for the National Weather Service, that the total effort is cooperative, and that the goal is to effectively manage a natural resource.

Observations should usually be taken between 1:00 and 2:00 PM MDT. They are then entered into WIMS according to the format in the WIMS USERS GUIDE no later than 2:30 PM MDT. If the forecaster finds no observation for a particular station at this time, then he or she will assume that none will be available and no forecast will be made for that day.

Fire Weather Station Operation, Inspection and Training - A mutual agreement between the Fire Control Agencies and National Weather Service exists as follows:

Operation - The fire control agency will provide sites and personnel for taking, recording and transmitting fire weather observational data for NFDRS and National Weather Service. Equipment and its maintenance will be provided by the fire control agency at all stations.

Inspection - The fire control agency is responsible for inspection and quality control of observational sites and data at all stations. They will be assisted by the NWS Rapid City fire weather program leader when resources are available and/or when requested. The fire weather meteorologist will monitor the observations and will notify the responsible agency when discrepancies are noted.

Training - Training is the responsibility of the fire control agency. However, the NWS Rapid City fire weather program leader will assist when and where possible.

Additional Observations and Reports of Significant Weather:

When significant weather takes place that is not reflected in the routine fire weather observations, a telephone call to the forecaster in Rapid City would be greatly appreciated. A report of any unusual weather event is always worth a phone call, and may help protect lives and property.

The National Weather Service in Rapid City requests the assistance of the land management agencies in northeast Wyoming and western and south central South Dakota to obtain reports of any significant weather events that occur in Colorado. These events may occur at any time of the year.

The following is a guideline of significant weather events that would be of value to forecasters and to further clarify follow-up storm reports outside of the normal fire weather observations:

- 1) tornadoes
- 2) hail, one-half inch or larger in diameter
- 3) snow accumulation of four inches or more with additional report for each two inch increase
- 4) total snow depth following a winter storm
- 5) water running bankfull or higher in streams or rivers
- 6) heavy snow, rain, or other natural phenomena which could make roads impassable

VI. Communications

Methods:

- 1. WIMS** - (Weather Information Management System).
- 2. FAX:** Rapid City number 605-341-9867
- 3. Telephone:** Rapid City number 605-341-7435
- 4) Internet** - Perhaps the best site for local weather is the NWS Rapid City home page, **<http://www.crh.noaa.gov/unr/>**. From this site, all of the latest fire weather forecasts can be obtained, as can the latest radar imagery, and a variety of other climatological and forecast information.

Also, to obtain recent spot forecasts, the following unpublished link will allow you to obtain the latest 15 spot forecasts:

<http://www.crh.noaa.gov/unr/products/fwslis.htm>

Observation Transmission:

WIMS - all observations are entered into WIMS by the fire control agencies by 2:30 PM MDT.

NATIONAL WEATHER SERVICE WEATHER FORECAST OFFICE, RAPID CITY	FIRE TELEPHONE NUMBERS COMMERCIAL 605-341-7435 FTS 605-341-7435		
ADDRESS: 300 E SIGNAL DRIVE RAPID CITY, SD 57701-3800	FAX Number 605-341-9867		
NAME/TITLE	AREA CODE	OFFICE COMM	E-mail
DAVID CARPENTER METEOROLOGIST IN CHARGE	605	341-9271	dave.carpenter@noaa.gov
PAT MURPHY FIRE WEATHER PROGRAM LEADER	605	341-7435	michael.pat.murphy@noaa.gov
SUSAN SANDERS WARNING COORDINATION METEOROLOGIST	605	341-9271	susan.sanders@noaa.gov
SPOT FORECASTS	605	341-7435	
SEVERE WEATHER	605	341-7435	

APPENDIX A

Fire Weather Forecast *Template*
National Weather Service Rapid City SD
Time Day Month Year

..Headline...(Fire Weather Problem of the Day of Fire Weather Watch/Red Flag
Warning Headline)

.Discussion...(Brief explanation of the current/forecasted weather with
emphasis on fire weather elements)

7:00 AM MDT...day...date
Fire Weather Zones...xxx...xxx...xxx...xxx including pertinent geographic
features

.Today
Sky/Weather...expected weather
Temperature...high temp range
Relative Humidity...minimum rh range
Wind 20 foot...wind speed and direction 20 feet above canopy
LAL...lightning activity level
QPF (instead of chance of wetting rain)...expected rainfall in inches

Transport Winds...average wind speed and direction through the mixed layer
Mixing height...mixing height
Smoke Dispersal...good
Haines Index...maximum afternoon index

.Tonight
Sky/Weather...expected weather
Temperature...low temp range
Relative Humidity...maximum rh range
Wind 20 ft...wind speed and direction 20 feet above canopy
LAL...lightning activity level
QPF (instead of chance of wetting rain)...expected rainfall in inches

Transport Winds...average wind speed and direction through the mixed layer
Mixing height...mixing height
Smoke Dispersal...good
Haines index trend

.Next Day
Sky/Weather...expected weather
Temperature...high temp range
Relative Humidity...minimum rh range
Wind 20 foot...wind speed and direction 20 feet above canopy
LAL...lightning activity level
QPF (instead of chance of wetting rain)...expected rainfall in inches

3 to 5 day general forecast

6 to 10 day forecast trend

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Next fire weather zone group etc.

Fire Weather Forecast *Example*
National Weather Service Rapid City SD
230 PM MDT WED FEB 28 2001

HIGH PRESSURE BUILDING IN TONIGHT WILL ALLOW WINDS TO WEAKEN
.DISCUSSION...HIGH PRESSURE WILL MOVE IN OVERNIGHT...ALLOWING WINDS TO BECOME EAST AND WEAKEN. LINGERING SHOWERS...LITTLE MORE THAN SPRINKLES WILL DIE WITH SUNSET THIS EVENING. AS THE HIGH MOVES EAST ON TUESDAY...READINGS WILL REMAIN AT OR BELOW NORMAL. A SERIES OF DISTURBANCES TOWARDS THE END OF THE WEEK WILL KEEP THE WEATHER UNSETTLED.

*****,
1100 AM MDT WED FEB 28 2001
FIRE WEATHER ZONES... 298 297N 297S LOWER ELEVATIONS OF CROOK AND WESTON COUNTIES NORTHERN CAMPBELL SOUTHERN CAMPBELL

.TONIGHT
SKY/WEATHER...MOSTLY CLOUDY
TEMPERATURE...LOWS 25 TO 30
RELATIVE HUMIDITY...MAXIMUMS 72 TO 88
WIND 20 FOOT...NORTHEAST 10 TO 20 MPH BECOMING LIGHT AND VARIABLE
LAL...1
QPF...ZERO

TRANSPORT WIND...NORTHEAST 15 MPH
MIXING HEIGHT...2000 FEET
SMOKE DISPERSAL...POOR
HAINES INDEX DECREASING TO 6

.TOMORROW
SKY/WEATHER...MOSTLY CLOUDY
TEMPERATURE...HIGHS 34 TO 38
RELATIVE HUMIDITY...MINIMUMS 54 TO 64
WIND 20 FOOT...VARIABLE LESS THAN 10 MPH
LAL...1
QPF...0.00

TRANSPORT WIND...EAST 15 MPH
MIXING HEIGHT...3000 FEET
SMOKE DISPERSAL...POOR
HAINES INDEX 6

.TOMORROW NIGHT
SKY/WEATHER...MOSTLY CLOUDY
TEMPERATURE...LOWS 15 TO 20
RELATIVE HUMIDITY...MAXIMUMS 78 TO 90
WIND 20 FOOT...VARIABLE LESS THAN 10 MPH
LAL...1
QPF...0.00

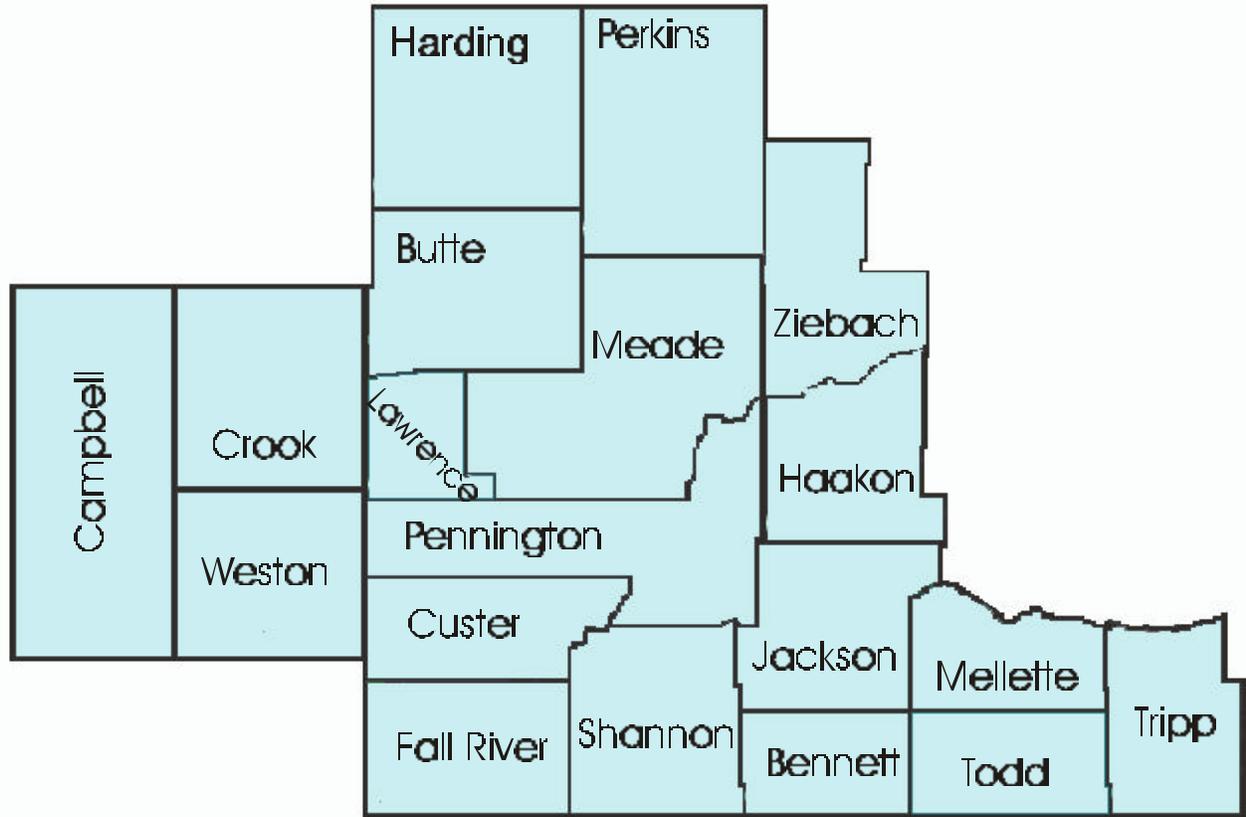
.EXTENDED FORECAST...
.THURSDAY...INCREASING CLOUDS NORTH TO SOUTH. HIGHS 35 TO 45...40S IN THE BLACK HILLS.
.FRIDAY THROUGH TUESDAY...DRY. LOWS 10 TO 25. HIGHS 30 TO 45.

.8 TO 10 DAY FORECAST TREND...
BELOW NORMAL TEMPERATURES AND NORMAL PRECIPITATION

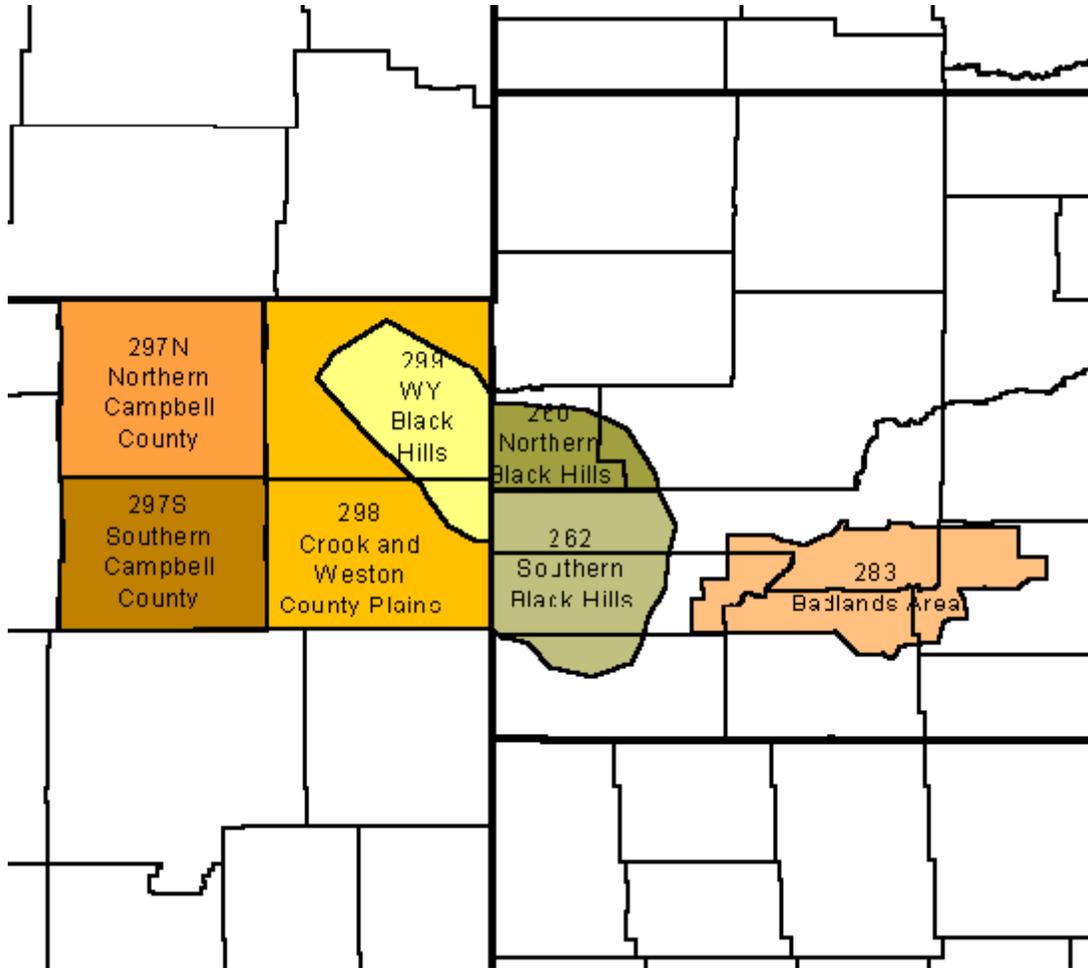
Next fire weather zone group etc.

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Appendix B. County Warning Area Map



Appendix B. Cont. Fire Weather Zone Configuration



Description of Fire Weather Zones

- ZONE 260 South Dakota, North Black Hills and North Foothills
- ZONE 262 South Dakota, Central and South Black Hills, Central and South Foothills
- ZONE 283 Badlands NP and adjacent lands
- ZONE 299 Wyoming Black Hills
- ZONE 297N North Campbell County
- ZONE 297S South Campbell County
- ZONE 298 Crook County Plains and all of Weston County

Appendix B. Cont. Fire Weather Station List

STN #/ NAME	ELEV. (FEET)	CNTY	LAT	LONG	TWP/RNGE	SEC
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BUREAU OF LAND MANAGEMENT- WYOMING

480501 (RAWS) Echeta	4320	Campbell	44.47	105.83	52N 75W	23
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U.S. FOREST SERVICE - BLACK HILLS NF

480605 (RAWS) Bearlodge	5200	Crook	44.60	104.43	53N 63W	09
393501 Custer	5480	Custer	43.80	103.60	3S 4E	23
393506 Custer	5200	Custer	43.46	103.36	3S 4E	21
392603 Nemo manual	4624	Lawrence	44.20	103.50	3N 5E	27
395104 Minnekahta	4070	Fall River	43.40	103.70	7S 3E	36
392506 (RAWS) Nemo	4675	Lawrence	44.19	103.51	3N 5E	27
395105 (RAWS) Red Canyon	4644	Fall River	43.39	103.76	7S 3E	21
392604 (RAWS) Baker Park	4674	Pennington	43.98	103.43	1S 6E	8

NATIONAL PARK SERVICE

394184 Cedar Pass	2442	Jackson	43.75	101.93	3S 39W	34
392602 Pinnacles	3080	Pennington	43.52	102.13	2S 16E	08

393505								
Wind Cave	4110	Custer	43.60	103.58	6S	5E	06	
392603								
Mt. Rushmore	5400	Pennington	43.88	103.46	2S	6W	18	
480606								
Devils Tower	4200	Crook	44.36	104.43	53N	66W	01	

U.S. FOREST SERVICE - MEDICINE BOW NF

480605 (RAWS)								
Rochelle Hills	5175	Campbell	43.55	105.09	41N	69W	01	

BUREAU OF INDIAN AFFAIRS

395201								
Pine Ridge	1122	Shannon	43.29	102.27	38N	42W	10	
395601								
Magpie Creek	2813	Todd	43.19	101.90	39N	32W		

APPENDIX D Spot Forecast template

Spot Forecast For.....Prescribed Burn/Wildfire
National Weather Service Rapid City SD
Time Month Date Year

VALID UNTIL <8 hours from issuance>

IF CONDITIONS BECOME UNREPRESENTATIVE, CONTACT THE NATIONAL WEATHER SERVICE

Headline (fire weather factor of the day)

Discussion...A brief discussion of the weather systems affecting the fire through the forecast period.

Forecast for the first burn period

Weather...Sky condition and chances of precipitation (Wetting Rain).
Temperature...Max Day time or Min Night time.
Relative Humidity...Max Night time with recovery or Min Day time.
20 Foot Wind...Speed and Direction (MPH) (Upslope / Downslope).
10,000 Foot AGL Wind...Speed and Direction.
Smoke Dispersal...Excellent, Very Good, Good, Fair or Poor.
Mixing Height...Height in feet AGL of maximum mixing in atmosphere.
Forecast haines index...
Lightning Activity Level (LAL)...

Forecast for second burn period

Weather...Sky condition and chances of precipitation (Wetting Rain)
Temperature...Max Day time or Min Night time
Relative Humidity...Max Night time with recovery or Min Day time
20 Foot Wind...Speed and Direction (MPH) (Upslope / Downslope).
10,000 Foot AGL Wind...Speed and Direction
Smoke Dispersal...Excellent, Very Good, Good, Fair or Poor
Mixing Height...Height in feet AGL of maximum mixing in atmosphere.
Forecast haines index...
Lightning Activity Level (LAL)...

Forecast for third burn period

Weather...Sky condition and chances of precipitation (Wetting Rain)
Temperature...Max Day time or Min Night time
Relative Humidity...Max Night time with recovery or Min Day time
20 Foot Wind...Speed and Direction (MPH) (Upslope / Downslope).
10,000 Foot AGL Wind...Speed and Direction
Smoke Dispersal...Excellent, Very Good, Good, Fair or Poor
Mixing Height...Height in feet AGL of maximum mixing in atmosphere.
Forecast haines index...
Lightning Activity Level (LAL)...

Spot Forecast Example

SPOT FORECAST FOR XXX XXXX XXXXX
NATIONAL WEATHER SERVICE RAPID CITY SD
939 AM MST MON FEB 26 2001

RAIN AND SNOW SHOWERS MOVING INTO THE AREA

.DISCUSSION...SKIES WILL BE CLOUDY THROUGH THE DAY. A BAND OF RAIN SHOWERS WILL MOVE INTO THE AREA AROUND NOON. THE RAIN WILL MIX WITH...THEN CHANGE TO SNOW. SNOW ACCUMULATIONS AROUND AN INCH IS POSSIBLE BY LATE AFTERNOON.

TODAY

WEATHER...RAIN SHOWERS...MIXING WITH AND CHANGING TO SNOW SHOWERS
CHANCE OF WETTING RAIN 15 PERCENT
MAX TEMP...43
MIN RH...47
20 FOOT WIND...WEST 4 TO 9 MPH
TRANSPORT WIND...WEST 10
MIXING HEIGHT...2000 FEET AGL
SMOKE DISPERSAL...POOR
HAINES INDEX...3
LAL...1

TONIGHT

WEATHER...CLOUDY WITH ISOLATED SNOW SHOWERS
CHANCE OF WETTING RAIN 0
MIN TEMP...22
MAX RH...88
WITH EXCELLENT RECOVERY.
20 FOOT WIND...WEST 6 TO 12 MPH
TRANSPORT WIND...NORTHWEST 15
MIXING HEIGHT...<500 FEET AGL
SMOKE DISPERSAL...POOR
HAINES INDEX...4
LAL...1

TOMORROW

WEATHER...DECREASING CLOUDS
CHANCE OF WETTING RAIN 0
MAX TEMP...42
MAX RH...38
20 FOOT WIND...NORTH 5 TO 8 MPH
TRANSPORT WIND...NORTHWEST 15
MIXING HEIGHT...<500 FEET AGL
SMOKE DISPERSAL...POOR
HAINES INDEX...3
LAL...1

...OUTLOOK...

A STRONG WINTER STORM WILL DEVELOP OVER THE CENTRAL ROCKIES LATE
TUESDAY. THIS WILL BRING MORE SNOW TO THE AREA...ALONG WITH MUCH COLDER
TEMPERATURES FOR THE MIDDLE PART OF THE WEEK.

APPENDIX E

GUIDE TO STATE OF WEATHER, PRECIPITATION DURATION AND LIGHTNING ACTIVITY LEVEL CODES

CODE	STATE OF WEATHER
0	Clear
1	Scattered Clouds
2	Broken Clouds
3	Overcast
4	Foggy
5	Drizzling
6	Raining
7	Snowing or Sleet
8	Showering
9	Thunderstorm (not more than 30 miles away)

QPF (Quantitative Precipitation Forecast)

The average amount of liquid precipitation expected over the entire zone. Some locations will see more, some less, or none.

LIGHTNING ACTIVITY LEVEL GUIDE (LAL)

LAL	Narrative Description	Areal Coverage
1	No thunderstorms	0%
2	Cumulus clouds are common but only a few reach the towering state. A single thunderstorm must be confirmed in the rating area. The clouds mostly produce virga but light rain will occasionally reach the ground. Lightning is very infrequent.	1-14%
3	Cumulus clouds are common. Swelling and towering cumulus cover less than 2/10 of the sky. Thunderstorms are few, but 2 or 3 must occur within the observation area. Light to moderate rain will reach the ground. Lightning is infrequent.	<25%
4	Swelling and towering cumulus cover 2 - 3/10 of the sky. Thunderstorms are scattered but more than 3 must occur within the observation area. Moderate rain is commonly produced. Lightning is frequent.	25-54%

- 5 Towering cumulus and thunderstorms are numerous. >54%
They cover more than 3/10 and occasionally obscure the sky.
Rain is moderate to heavy.
Lightning is frequent and intense.
- 6 Same as #3 but dry (little or no rain reaches the ground).

APPENDIX F

Fire Weather Terminology

- 1) Dry thunderstorm: A high based thunderstorm where lightning is observed, but little, if any, rainfall reaches the ground. Most of the rain produced by the thunderstorms evaporates in the dry air beneath the storm. This may also be referred to as dry lightning.
- 2) Eye level wind: The wind that is observed very near the surface. This wind is dependent on local terrain and vegetation. The wind is actually measured at eye level by using a hand held anemometer. This may also be referred to as the midflame wind.
- 3) Forecast periods:
 - A. Today - 600 AM to 600 PM.
 - B. This evening - 600 PM to sunset.
 - C. Tonight - 600 PM TO 600 AM.
 - D. Tomorrow -600 AM TO 600 PM TOMORROW.
- 4) Front: The boundary between two different air masses. This boundary is where temperature, relative humidity, wind and pressure are changing most rapidly with time and distance. Colder air replacing warmer air is referred to as a cold front and warmer air replacing colder air is called a warm front.
- 5) Haines Index: An index which combines instability and moisture of the air mass to help indicate the potential for large fire growth. Since wind is not a parameter, the Haines Index is best suited to plume-dominated fires. The index will not predict wind driven fires.

Haines Index Values (Potential For Large Fire Growth)

2 and 3.....	Very Low Potential
4.....	Low Potential
5.....	Moderate Potential
6.....	High Potential
- 6) High pressure: A large area of clockwise circulating air generally produced by large scale subsidence. The subsiding air is responsible for the typically warm and dry conditions and lack of cloudiness which is usually associated with high pressure systems. In the upper atmosphere this may be referred to as a ridge.
- 7) Humidity recovery: The change in relative humidity over a given period of time. Usually used in the nighttime forecast period. The moisture change

in the fine fuels during this period is directly related to the speed at which the humidity recovers.

Terms used for Humidity recovery at night

- 85% - 100%.....Excellent
- 70% - 85%.....Good
- 55% - 70%.....Fair
- Less than 55%.....Poor

- 8) Inversion: The condition where the temperature increases with height through a layer of the atmosphere. This is a stable situation in which the vertical motion of the air is greatly restricted. Inversions are common during the night and morning hours in the atmospheric layer near the ground. This type of inversion usually dissipates with daytime heating. Inversions aloft, caused by subsiding air, may persist for several days.
- 9) Low pressure: A large area of rising air through a deep layer of the atmosphere. The rising motion associated with this feature cools and condenses the water vapor into clouds and often leads to precipitation.
- 10) Mixing height: The height in the atmosphere to which pollutants and other particulate matter are equally dispersed due to action from the wind.
- 11) Precipitation probability terminology:
 - A. Isolated.....10% chance of precipitation
 - B. Slight chance.....20% chance of precipitation
 - C. Chance.....30-40% chance of precipitation
 - D. Good chance.....50% chance of precipitation
 - E. Likely.....60-70% chance of precipitation
 - F. No qualifier.....80% chance of precipitation or greater
- 12) Pressure gradient: The change in value of the atmospheric pressure over a certain distance. The greater the change over that distance, the greater the gradient and the stronger the winds.
- 13) Residual moisture: Atmospheric moisture which lingers over an area after the main weather system has departed.
- 14) Shower and thunderstorm terminology:
 - A. Isolated or a few.....less than 20% coverage of an area
 - B. Widely scattered.....20% coverage of an area
 - C. Scattered.....30-50% coverage of an area
 - D. Numerous or likely.....60-70% coverage of an area
 - E. No qualifier.....80% or greater coverage of an area

- 15) Sky cover terminology:
- A) Mostly clear - The prevailing condition is clear, but some clouds may be present either over a portion of the area or for a period of time over the entire area.
 - B) Partly cloudy - 30% to 60% of the sky will be covered by opaque clouds.
 - C) Mostly cloudy - Cloudiness will be subject to some variability in amount or location. 70% to 90% of the sky will be covered by opaque clouds.
 - D) Cloudy - The sky is covered with clouds throughout the forecast period.
 - E) Variable cloudiness - An irregular condition with an increase or decrease of cloudiness occurring several times during the forecast period.
- 16) Smoke dispersal: The ability of the air to ventilate smoke. This is dependent on the stability of the atmosphere and the winds in the lower atmospheric layer.
- 17) Stable conditions: A temperature/height relationship in the atmosphere that will tend to suppress vertical motion. This condition tends to minimize convective activity, including vertical development of cumulus clouds. An inversion is a stable situation which may trap smoke or fog in the lower layers of the atmosphere. Stable conditions are not favorable for gusty surface winds or erratic fire behavior.
- 18) Subsidence: Sinking air usually associated with surface or upper level high pressure systems. Strong subsidence leads to very dry and warm air which often appears at high elevations first, either at day or night. Relative humidity staying low at high elevations is a sign of strong subsidence.
- 19) Transport winds: The wind produced by the prevailing atmospheric pressure pattern, free from the effects of friction, terrain and vegetation. This is the mean wind from the top of the boundary layer to the mixing height. It is the mean wind that will transport the smoke from the fire.
- 20) Twenty foot winds: The air movement measured at 20 feet above the ground, or 20 feet above the vegetation or tree canopy. The wind speed is usually averaged over a 10 minute period.

- 21) Unstable conditions: A temperature / height relationship in the atmosphere that favors vertical motion and the development of cumulus clouds and possible shower or thunderstorm activity. Unstable conditions are favorable for gusty surface winds and erratic fire behavior. Smoke generally disperses well in an unstable situation.
- 22) Wetting rain: An appreciable amount of rainfall (at least a quarter / .25 / of an inch or more) over a large area.

APPENDIX G

Smoke Dispersal Terms

Category	Description
Very Poor	High smoke pollution potential. Usually occurs in very stable air (strong inversion) and light winds. Normally occurs late at night and early in the morning hours, but could occur during the daytime when a shallow pool of cold air intrudes into the area creating strong low level inversions. Burning is not advised under this category.
Poor	Moderate to High smoke potential. Burning not advised under this category. Most likely time of occurrence is from evening through the early morning.
Fair	Marginal smoke pollution potential. Dependent on trend of weather and local conditions. Generally acceptable for small burns of dry fuels.
Good	Moderate to Low smoke pollution potential. No inversion and gentle winds expected. Most likely to occur in the late morning and afternoon when surface heating usually breaks through the low level inversions.
Very Good	Low smoke pollution potential. Transport winds or mixing height lower than that for Excellent. Transport winds stronger than that for Good. Most likely to occur in the late morning and afternoon.
Excellent	Low smoke pollution potential. Unstable airmass and / or brisk winds. Best time to conduct burning operations if fire can be controlled. Most likely to occur in the late morning and afternoon or when a strong weather system affects the area, eliminating all low level inversions and generating moderate winds.

Breakdown of Ventilation

Based on Mixing Height multiplied by Transport Wind

Excellent	150,000 Knot Feet and Greater
Very Good	100,000 to 150,000 Knot Feet
Good	60,000 to 100,000 Knot Feet
Fair	40,000 to 60,000 Knot Feet
Poor	Less than 40,000 Knot Feet

NATIONAL AGREEMENT FOR METEOROLOGICAL SERVICES

<http://www.boi.noaa.gov/FIREWX/opsplan/2000/!natagree.htm>