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Determining Suitable Weather Windows for Prescribed Fire Planning

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Determining Suitable Weather Windows for Prescribed Fire Planning

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An important issue to address when managing a prescribed fire program is temporal planning: when will it be both appropriate and possible to burn safely and effectively? The most important issues in planning a suitable time period or window for a prescribed burn are weather, fuel, season, and time. Time and season are easily chosen and fuel management techniques exist, but weather is beyond the control of the fire manager. Thus, managers must wait for suitable weather conditions to arrive. Conducting a prescribed burn may involve a diverse group of participants, so being able to schedule a burn with at least some degree of certainty would be beneficial to fire managers. Poor planning can be a waste of time, money, and personnel. In light of these issues, long-range forecasting of prescribed burn weather opportunities has become an issue of interest. Knowing when weather conditions might meet those criteria necessary for burning to meet land management goals would be beneficial to the planners.

Given the importance of weather in prescribed burning and its variability, predicting weather conditions is an important issue. After the 1988 fires at Yellowstone National Park, the Secretary of Agriculture and the Secretary of the Interior organized a team to investigate fire policies and management; among the recommendations of this council was more research into forecasting long-term weather conditions (Fujioka 1991). In 1989, the Forest Service declared a need for long-range weather forecasting to assist in prescribed burning, information that would allow fire managers to forecast weather-related burn potential in advance.

Historic weather data for Denton, Wise, Collin, and Hunt Counties of north Texas was collected from the National Weather Service for the time frame of December 1996 to March 2003 to obtain information on potential prescribed burn windows. Detailed weather records (i.e., hourly records) are unavailable prior to 1996. This information was used to predict opportunities to conduct prescribed burns based on historic probabilities, and to allow burn managers to plan around adverse weather conditions and perhaps avoid unnecessary expenditures on cancellations of planned prescribed burns. Historic weather was organized into a database, and then queries were used to extract data that meet the criteria for effective prescribed burning.

A successful prescribed burn requires that aspects of weather—particularly air temperature, wind direction and speed, relative humidity, and precipitation—be within strict parameters. The following weather prescription (Table 1) was derived from Scifres and Hamilton (1993), Wright and Bailey (1982), and the experience of LLELA burn personnel for use at the Lewisville Lake Environmental Learning Area (LLELA):

Table 1: Weather prescription used for the development of this research note.

Parameter	***Minimum***	***Maximum***
Temperature (°F)	35 (4°C)	70 (21°C)
Relative Humidity (%)	30	60
Wind Speed (mph)	4 (6 km/h)	15 (24 km/h)

In order to qualify as a burn day, the day could have no precipitation and the weather had to be within prescription for at least four consecutive hours. Data were collected from December through March to cover the winter burn season in north Texas. Preferred wind direction at LLELA is south to southeast, but in general is site specific and relies on directing smoke away from smoke sensitive areas. Thus, wind direction was not included in the prescription in order to make the results more applicable to areas across north Texas. Also, conditions outside of this prescription (Table 1) are often used in the region, but LLELA has slightly more stringent requirements due to its presence within the Lewisville City Limits.

Caution should be used when interpreting results of weather data analysis, for several reasons. First, the data only covers a span of seven years; the focus of meteorology is forecasting and the availability of detailed, archived data is limited. Second, the forecasting of potential burn windows means extrapolating from existing data, something that should always be taken, like weather forecasts in general, with several grains of salt.

December—Over the course of seven years, 60% of burn opportunities in December occurred as single days and 35% occurred as two to four consecutive days. Twice, or 5% of the time, the window for burning was six days long, but both six-day windows occurred in one year. There were seven days that in the last seven years were acceptable for burning more than 50% of the time: December 7, 13, 14, 17, 26, 27, and 28. Only two days never occurred as burn opportunities, based on weather conditions in these seven years: December 3 and 11.

January—For the month of January, there were three days that were acceptable burn days more than 50% of the time: January 6, 22, and 23. January 1, 2, 12, 13, and 28 never occurred as burn days over the last seven years. Of the 38 burn windows in January, 21 occurred as single days, 12 as two-day windows, and five as three- to five-day windows.

February—For February there were 36 burn windows, twenty-two windows occurred as single days, ten as two-day windows, and four as three- to four-day windows. February 15, 24, and 28 were never good burn days, based on weather records. February 2, 3, 5, and 22 were acceptable for burning more than 50% of the time in the last seven years.

March—In March there were four days that more than 50% of the time were acceptable burn days: March 6, 9, 12, and 26. There were also four days that were not acceptable burn days over the years that the data covers: March 14, 18, 28, and 29. In March, 54% of burn days occurred singly, and 46% occurred in groups of two to four consecutive days.

Table 2: Mean number of burn days per month (December 1996- March 2003).

Month	***Mean (days/month)***	***Range (days/month)***
December	11	7-15
January	9	5-15
February	8	5-10
March	8	5-13

Overall—December had the most burn windows, days or consecutive days that had acceptable weather conditions for burning. January had the second most burn windows, then February, and then March, which is expected as burn season winds down (Tables 2 and 3). In January, the days that have a 0% occurrence for meeting prescribed burn weather criteria occur primarily in the beginning of the month. Two of the three days that met prescribed burn weather criteria with more than 50% occurrence occurred late in the month. In February, the days that were most likely to be burn days occur in the first half of the month, and the days that did not meet burn criteria as often occur in the latter half of the month. Based on the data, the end of January and the beginning of February seem to have a high potential for good burn weather. During March, days that were most likely to meet the criteria for burning occurred primarily in the first half of the month, and days that never meet the criteria occurred primarily in the last half of the month. Since March is the end of burn season, this is a reasonable expectation. March is also the beginning of spring rains in the area and a time of rapid weather change.

Table 3: Monthly overview of burn window frequency data.

December

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

January

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

February

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29						

March

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Key

	0% occurrence
	0-50% occurrence
	51-70% occurrence
	71-100% occurrence

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