

# Guide to South Texas Fire Weather



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## Importance of Weather to Fire Behavior

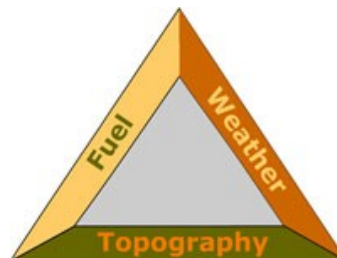
Success in prescribed burns is directly related to how well you understand and are able to predict fire behavior. The *safety* of all personnel also depends on fire behavior knowledge.

Topography, fuels and weather are the elements that most affect fire behavior. All three elements can influence each other.

Weather is the most variable of these elements in both space and time. Therefore it is critical that you have an understanding of what the weather will do

before you ignite a prescribed fire.

This guide is designed to give you a basic understanding of many important weather elements to be



**Wildland Fire Behavior Triangle**  
Weather is the most variable in space and time.

aware of, including wind, relative humidity, mixing

height and transport winds. This guide will also introduce you to critical fire weather patterns to be on the look out for before you conduct a prescribed burn.

Finally, this guide will introduce you to the products and services the National Weather Service provides to the fire community.

It can not be overemphasized: A basic knowledge and awareness of weather is *essential* for making critical fire management decisions.

## Effects of Wind on Fire Behavior

Predicting wind speed and direction is a must so that fire will burn in a predetermined manner. Wind can have several effects on wildland fire behavior:

- Carries away moisture-laden air and thus hastens the drying of wildland fuels
- Aids combustion by increasing the supply of oxygen
- Increases fire spread by carrying heat and burning embers to new fuels – Spotting

- Bends the flames closer to the unburned fuels, preheating the fuels ahead of the fire front
- The direction of the fire spread is determined mostly by direction of the wind
- Influences the amount of fuel consumed by affecting the residence time of the flaming front of the fire. The stronger the wind, the shorter the residence time and the less fuel is consumed

Wind Tips

*Light and variable winds create poor burning conditions and an unpredictable direction of spread*

*High wind speeds may reduce fuel consumption, increase chances of escape, and increase risk of spotting*

*Conducting burns when winds are forecasted to change direction is not advised*

*A stable/consistent wind direction throughout the burn will avoid unpredictable fire behavior*

RH Tips

*Fine fuels such as grass will burn with the same intensity when the RH is 45-60%*

*Cooler fires result when the RH is 45-60%*

*Northwest winds typically produce low RH values across South Texas*

*Gusty winds will promote mixing of drier air aloft, resulting in decreasing RH values*

# More on Wind

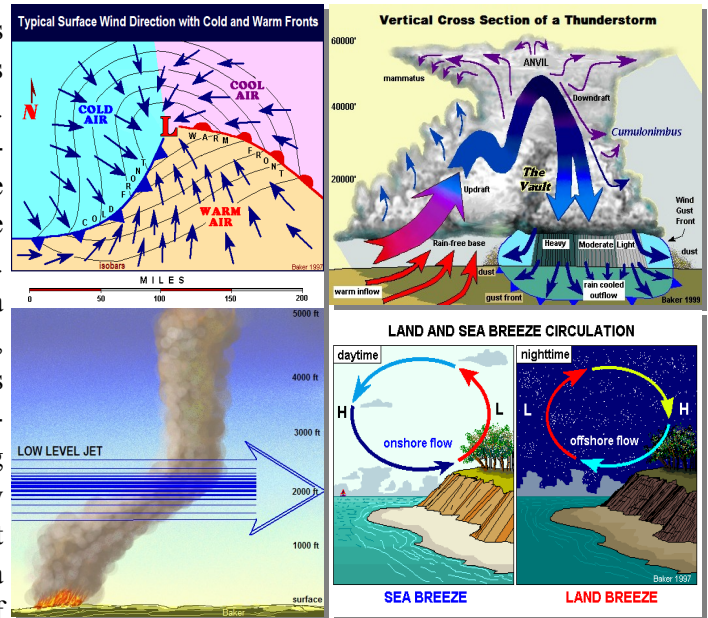
The general wind subscription for a successful burn is:

**5 - 15 mph**

**And**

**A steady wind direction**

Be aware of: Gusty winds ahead of fronts as well as winds shifts behind them. Erratic winds near thunderstorms that can produce extreme winds and pose problems during a burn. Local winds, such as the sea breeze in South Texas, which can cause wind shifts during the early to mid afternoon during the spring and summer months. Low level jets are streams of fast moving air that develop a few hundred to a couple of thousand feet off the surface ahead of cold fronts in the Spring. These winds can surface mid morning and significantly increase rates of spread.



# Basics on Relative Humidity

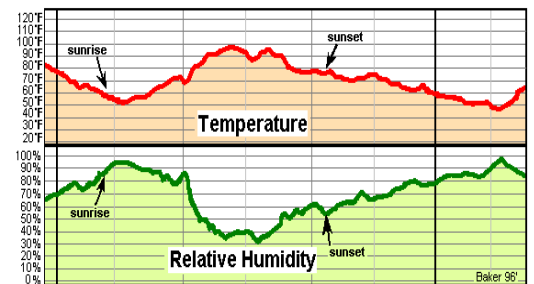
Relative humidity can effect both fuels and fire behavior in several ways:

- As RH increases, fuel moisture increases
- Affects rate of spread. (as RH decreases rate of spread can increase)
- Some fuels will not burn adequately if RH is too high
- Fire becomes difficult to control if RH is too low
- Fires of different intensity can be achieved by selecting different times of day or night for a certain RH

The general relative humidity prescription for a successful burn is:

**25 - 60%**

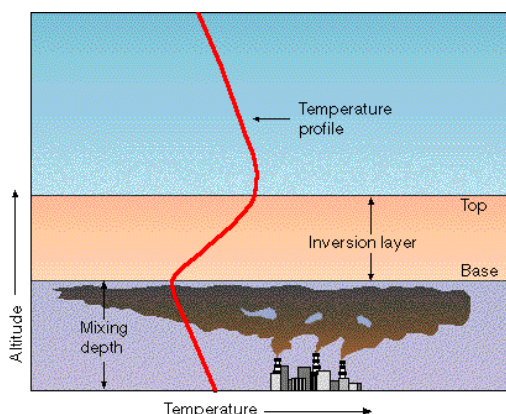
Thermograph depicting 24 hours of temperature and relative humidity.



Note the diurnal relationship between temperature and relative humidity.

Above: Minimum RH values are typically achieved during the mid to late afternoon, when max temperatures occur.

## What is the Mixing Height?



Mixing height is defined as the maximum height in which rapid vertical mixing takes place in the atmosphere. It is the top of the mixing layer, which usually extends from the surface upward to a layer where the temperature begins to increase with height. There are visual clues you can observe to tell whether the mixing height is high and an indication of unstable conditions or low and an indication of stable conditions.



The image on the top left is an example of higher mixing heights (unstable). Clouds and smoke columns will rise to great heights. Gusty winds may be occurring at the surface as well as good visibilities. The image on the top right is an example of lower mixing heights (stable). Low clouds may be observed during these conditions. Smoke columns will be low (usually less than 1500 feet). Winds at the surface may be light and steady. In addition, poor visibilities in haze or fog may be observed.

## The Transport Wind

The transport wind is simply the average wind between the surface and the mixing height. In other words it is the average wind of the mixing layer, and the wind that will influence where the smoke column will go and how it will disperse.



Above: Smoke column spreads out at the mixing height and the transport wind spreads the smoke downwind

### Mixing Height Tips

*Preferred mixing heights for prescribed burns are 1700-6000 feet.*

*Mixing heights will be lowest in the morning (sometimes only a few hundred feet), but will typically rise during the mid to late morning of an average day.*

*Mixing heights behind shallow cold fronts in South Texas can be less than 1000 feet.*

### Transport Wind Tips

*Lighter transport winds will allow smoke to achieve heights closer to the mixing height, while stronger winds will spread the smoke out at lower heights.*

*If mixing heights are low and transport winds too low then the smoke might not disperse from the surface.*

*Preferred transport winds for prescribed burns are 9-20 mph.*

## Critical Fire Weather Patterns to Avoid



Critical fire weather patterns are weather conditions which support extreme fire danger and/or extreme fire behavior. These conditions can cause unwanted ignitions or control problems with existing fires. Critical fire weather patterns can pose a threat to life and property. The National Weather Service (NWS) calls these weather conditions Red Flag Events.

The NWS issues Red Flag Warnings and Fire Weather Watches for such events. Fire Weather Watches will be issued up to 72 hours in advance of a Red Flag Event when reasonably confident. A Red Flag Warning is issued within 24 hours of a Red Flag Event. Most Fire Weather Watches and Red Flag Events in South Texas are issued due to low RH with strong winds.

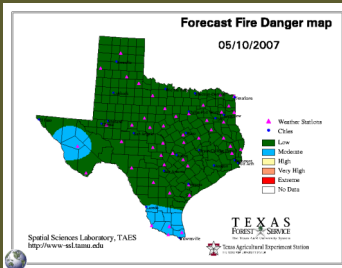
### Red Flag Criteria for South Texas

#### Inland Counties

RH at or below **30%**  
And  
20-Foot winds  
sustained or frequently  
gusting at or above **25 mph**

#### Coastal Counties

RH at or below **40%**  
And  
20-Foot winds  
sustained or frequently  
gusting at or above **25 mph**



### Other South TX Fire Weather Patterns to Look Out For

- Sudden changes in wind direction, speed and RH after cold front and sea-breeze boundary passages
- Fast moving low clouds just after daybreak (once morning inversion breaks these stronger winds can mix down to surface)
- Unexpected calm in the wind may indicate an approaching wind shift
- Thunderstorms above or close to the burn
- Dust devils or whirlwinds developing
- Upper level ridges (high pressure) can result in a hot/dry patterns
- The far western fringes of tropical systems in the western Gulf of Mexico can produce stable, subsident and dry conditions across South Texas.



Above: A lightning strike combined with a critical fire weather pattern to produce this wildfire on the Padre Island National Seashore in Nov. 2005

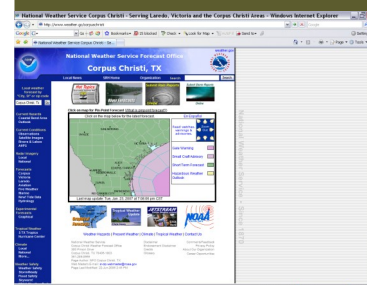
## National Weather Service Products and Services

Your local NWS Weather Forecast Office (WFO) issues a suite of products to assist crews in their prescribed burns. These include the Fire Weather Planning Forecast, Fire Weather Watches, Red Flag Warnings as well as

graphical and digital products available on our website. SPOT forecasts are a specialized, site specific forecast available to federal land management or those agencies or officials that represent the forecast is needed to public safety.

The following section describes in detail these products. All of these products can be found under the Fire Weather link on the WFO Corpus Christi website:

[www.weather.gov/corpuschristi](http://www.weather.gov/corpuschristi)



[www.weather.gov/corpuschristi](http://www.weather.gov/corpuschristi)  
Click on Fire Weather

## Fire Weather Planning Forecast

	TODAY	TONIGHT	WEDNESDAY
CLOUD COVER	CLOUDY	CLOUDY	CLOUDY
PRECIP TYPE	RAIN	RAIN	RAIN
CHANCE PRECIP (%)	70	90	90
TEMP	45	41	47
RH %	73	91	74
20FT WND MPH(AM)	N 10		N 11
20FT WND MPH(PM)	N 9	N 8	NE 11
MIXING HGT (FT-AGL)	1700		1700
TRANSPORT WIND (KTS)	N 17		N 16
LAL	1	1	1

REMARKS...NONE.

.FORECAST FOR DAYS 3 THROUGH 7...

.THURSDAY...CLOUDY WITH AREAS OF LIGHT RAIN. LOWS IN THE LOWER 40S. HIGHS IN THE UPPER 50S. NORTHEAST WINDS AROUND 10 MPH.

.FRIDAY...MOSTLY CLOUDY WITH A 30 PERCENT CHANCE OF SHOWERS. LOWS IN THE LOWER 40S. HIGHS IN THE UPPER 50S. NORTHEAST WINDS AROUND 10 MPH.

.SATURDAY...MOSTLY CLOUDY WITH SCATTERED SHOWERS. LOWS IN THE UPPER 40S. HIGHS IN THE MID 60S. LIGHT WINDS.

.SUNDAY...PARTLY CLOUDY. LOWS IN THE UPPER 40S. HIGHS IN THE MID 60S. NORTH WINDS 10 TO 15 MPH.

.MONDAY...MOSTLY CLOUDY WITH A 20 PERCENT CHANCE OF LIGHT RAIN. LOWS IN THE MID 40S. HIGHS IN THE UPPER 50S. NORTHEAST WINDS AROUND 10 MPH.

The Fire Weather Planning Forecast (FWF) is issued daily by WFO Corpus Christi. The heart of the FWF is a tabular forecast for Today, Tonight and Tomorrow containing predictions of several weather elements. The FWF also contains a general forecast for days 3-7. In addition, at the top of the FWF is a weather synopsis and any Fire Weather Watches or Red Flag Warnings that may be in effect (not pictured on the left).

*Fire Weather Planning Forecasts are a great tool for input in decision-making related to pre-suppression and other planning. For specific hourly weather information check out our hourly weather graphs on the internet! (more info on page 6)*

## Fire Weather Watches and Red Flag Warnings

<p>RED FLAG WARNING NATIONAL WEATHER SERVICE CORPUS CHRISTI TX 152 PM CST TUE NOV 14 2006</p> <p>TXZ229&gt;234-239&gt;247-150600- /O.UPG.KCRP.FW.A.0015.061115T1500Z-061116T0000Z/ /O.NEW.KCRP.FW.W.0025.061115T1500Z-061116T0000Z/ LA.SALLE-MCMILLEN-LIVE OAK-BEE-GOLIAD-VICTORIA-WEBB-DUVAL- JIM WELLS-KLEBERG-NUECES-SAN PATRICIO-ARANSAS-REFUGIO-CALHOUN- 152 PM CST TUE NOV 14 2006</p> <p>...RED FLAG WARNING IN EFFECT FROM 9 AM TO 6 PM CST WEDNESDAY DUE TO LOW RELATIVE HUMIDITIES AND STRONG NORTHWESTERLY WINDS...</p> <p>THE NATIONAL WEATHER SERVICE IN CORPUS CHRISTI HAS ISSUED A RED FLAG WARNING...WHICH IS IN EFFECT FROM 9 AM TO 6 PM CST WEDNESDAY. THE FIRE WEATHER WATCH IS NO LONGER IN EFFECT.</p> <p>A STRONG COLD FRONT WILL MOVE OFFSHORE EARLY WEDNESDAY MORNING. VERY STRONG NORTH TO NORTHWEST 20 FT WINDS WILL DEVELOP BEHIND THE FRONT WITH SPEEDS RANGING FROM 20 TO 30 MPH WITH HIGHER GUSTS. IN ADDITION...VERY DRY AIR WILL RAPIDLY MOVE INTO SOUTH TEXAS AND ALLOW FOR THE RELATIVE HUMIDITY VALUES TO PLUMMET TO 15 TO 30 PERCENT IN THE AFTERNOON. THE COMBINATION OF HIGH WINDS AND LOW RELATIVE HUMIDITY VALUES WILL LEAD TO A HIGH WILD FIRE DANGER ON WEDNESDAY.</p> <p>PLEASE ADVISE THE APPROPRIATE OFFICIALS AND FIRE CREWS IN THE FIELD OF THIS RED FLAG WARNING.</p>
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As described in the Critical Fire Weather Patterns section, Fire Weather Watches (RFW) and Red Flag Warnings (RFW) are designed to provide land management personnel with appropriate notification of the likelihood weather conditions that support extreme fire danger and/or fire behavior. The RFW is issued on an as needed basis.



*Fire Weather Watch and Red Flag Warning Criteria for South Texas:*

20 ft Winds:  $\geq 25$  mph

And

RH:  $\leq 30\%$  (inland counties)

$\leq 40\%$  (coastal counties)

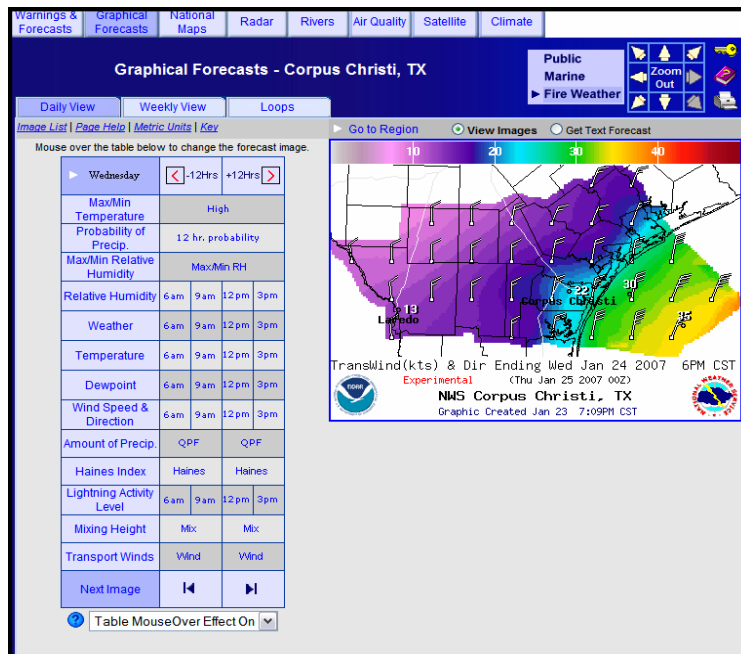
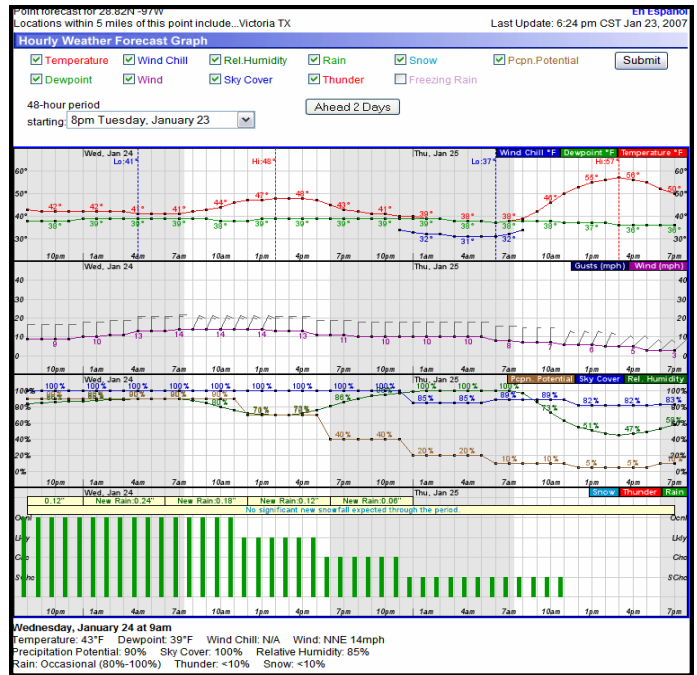
www.weather.gov/  
corpuschristi



# More NWS Products and Services

## Digital and Graphical Products

Specific hourly weather forecasts for a point are available on our website. On our main page just click the location on the map where you need the forecast. On the next page click the link for Hourly Weather Graph. These hourly forecasts for select weather elements are available out to seven days. Scrolling you cursor over the graph will give a readout at the bottom of the page for the time the cursor is over.



Regional views to fire weather elements for select times out to seven days are also available on our website. On our main page click on the link for Experimental Forecasts - Graphical. The click on the tab for Fire Weather.