FIRE WEATHER FORECASTING
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The weather forecasting problem areas can be divided into broad-scale (Synoptic) problems and local or meso-scale problems.

One major **meso-scale** problem area is **fire weather forecasting**. Conditions can change rapidly on "blow up days". Winds can freshen and temperatures soar in the space of an hour or two. Dry air mixing down from higher level can decrease the humidity suddenly so that the fire danger can increase alarmingly. Local effects play a major part in wind direction and weather observations are usually sparse or non-existent at the fire scene. The movement and timing of fronts and wind changes are often difficult to predict. In recognition of these difficulties specialist staff from the Bureau of Meteorology are allocated to fire forecasting in the summer season to provide individual forecasts for major fires, attempting to take into account all the variables that will affect a particular location.

Atmosphere (winds, stability) can have a big impact on fire behavior

Australian fire falls into broad classes

1. **That behaviour can be predicated with reasonable accuracy, taking account of terrain and weather factors.**

2. **And that behaviour is erratic.**

Majority of fires are **type one**, due to low intensity seldom exceeding 1000 BTU/sec/foot. **(Note: BTU unit of heat equal to 1055 joules.**

By contrast, fire **type two** is of high intensity and usually large and very destructive, the term BLOW UP being applied to them. This type of fire sometimes appears suddenly on smaller fires. The intensity of BLOW UP fires can reach to 20,000 to 30,000 BTU/sec/foot of the fire front.

The geometry of the two types of fires

1. **The type one (predicated behaviour) is a two-dimensional due to convective activity over the fire being restricted of the order of some ten's of feet.**

2. **The BLOW UP fire is three-dimensional nature with vertical structure extending to many 1000 of feet. Occasionally a large BLOW UP may reach an energy output comparable with that of thunderstorms.**

WEATHER AND TOPOGRAPHICAL FACTORS INFLUENCING FIRE INCIDENCES AND FIRE BEHAVIOUR

The list of factors which affects fire behaviour is frightening and would make it appear that problem of forecasting fire behaviour in the field extremely difficult.

Parameters affecting fire behaviour are:

1. **Fuel and moisture content**
2. **Wind velocity**
3. **Fuel quantity , size and arrangement**
4. **The spotting process**
5. **Slop**
6. **Atmospheric instability**

Relative Humidity

High fire hazard is always a result of low relative humidity. Strong winds and slope, intensity heat from burning materials increase the rate of fire spread, but regardless of these factors any fire will die down to the smoldering stage and remain so if the relativity humidity becomes high.

Relative Humidity %	Fire Behaviour
Over 60%	Fire will not spread
50 -60 %	Fire spread slowly
40 - 50%	Fire begin to pick-up
30 -40 %	Fire may spread rapidly
Below 30%	Fire may go beyond control
Below 25%	Crown fires develop

Wind Speed and Direction

Wind speed and relative humidity are the meteorological parameters of greatest every importance in connection with fire behaviour.

1. Wind accelerate the rate of drying wet material

2. Wind supplies oxygen and remove combustion products, thereby increase fire intensity. Higher winds means more oxygen and more intense flames i.e. double the wind speed will quadruple the rate of spread of the fire.

3. Winds also carry burning embers downwind which can start new fires- this is known spotting

4. Winds fans the flames and bends the flames over, thus focussing the radiation onto unburned fuel and increasing the rate of spread

5. In the case large fires with activity "convection columns" winds transports burning embers and cause spot fires ahead of the main fire front, thus making control extremely difficult.

Stability

It is common knowledge that fires tend to undergo a pronounced change in behaviour towards evening " the damping down" due to:

1. Higher relative humidity
2. Cooling of the lower atmospheric layers
3. Increasing in air stability

The increase instability can have an opposite effect of fire behaviour. **There are two types of severe fires:**

The first: Driven by **high winds** is characterised by high rate of spread especially while crowning. This type has not been considered dangerous for experience fire fighters.

The second Type: This type differs from the first in that its **peculiar whirling nature** and unpredictable behaviour made even a flank attack dangerous. This second fire was ascribed to the effect of **instability.**

Observers in aeroplanes found that the air was always bumpy on days when whirling fires occurred and when the flying become smooth in the late afternoon, whirls did not occur.

Topography

Topography is important for many reasons. From the forecaster's point of view, the existences of up-slope and down-slope winds, ravine winds, and mountain and valley winds should receive careful consideration.

From the fire fighter's point of view the slope and aspect of the terrain are of major importance.

The influence of topography on the rate of spread of fire is so marked that it has always been considered an important fire behaviour factor.

A fire spreading up a steep slope resembles a fire spreading before a strong wind.

A 10 degree slope will double the rate of spread, and a 20 degree slope will increase spread four times.

Australian Bush Fire Spread.

1. Australian bush fire spread as thin front of flames, with flame usually about as thick as they are high
2. Forest fires normally travel 1 to 3 km/hr, have flames 10-22M high/thick . And will pass a spot in 30-60 seconds.
3. Severe fires travel 12 km/hr - 100 -150M high/thick
4. Grass fires generally travel about 30-10 km/hr, but speeds up to around 25 km/hr have been recorded.