New Zealand Experimental & Wildfire Observer Guide

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The Author

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INTRODUCTION

Well-documented fires can be used to evaluate suppression methods, validate burning restrictions, test fire behaviour models, and limit possible legal action against a fire protection agency. However, the data must be gathered accurately and uniformly among fire observers to have any value. The purpose of this guide is to provide a field reference for researchers and rural fire observers to accurately document important aspects of rural fire behaviour.

Several aspects of fire observation are presented in this guide. Field navigation aids, mapping techniques and field instruments for weather observation are explained to help fire observer's accurately record fires. Communicating and documenting fire observations can be facilitated by simple guidelines for communications and documentation using standard forms, which are outlined in this guide. Documentation over a wide range of weather, topographic and fuel conditions are essential to advance our understanding of fire behaviour. Fire observations from a one-tenth hectare rural fire can be just as valuable as on a 100-hectare experimental burn. Rural fire observers and those conducting experimental fires are encouraged to use the standards outlined in this guide.

In making observations of fire behaviour, personal safety and the ability to recognise and communicate severe fire behaviour, or significant changes in fire behaviour is of prime importance. Always have good situational awareness of your surroundings and always make sure **L**ookouts, **C**ommunications, **E**scape Routes and **S**afety Zones are in place.

NAVIGATION AIDS

The following sections discuss the correct use of basic tools used by observers in the field, and basic mapping techniques for locating and mapping field locations.

Compass

The compass is an instrument frequently used by field personnel. Accurate compass bearings are essential for navigating over open terrain and for finding and mapping a location.

Parts of a Compass

A multitude of compass models exist with different features; however, all compasses have the following *(Figure 1)*:

Magnetic needle—The magnetic needle, drawn by the pull of the magnetic north pole, always points to magnetic north. The north end of the needle is marked by an arrow, or painted red.

Revolving 360° dial—The dial is marked with the cardinal points, N, E, S, W and is graduated by degrees (0-360). Within the dial is a transparent plate with parallel orienting lines and an orienting arrow.

Transparent base plate—Has a direction of travel arrow and ruled edges.

Obtaining Accurate Compass Bearings

Always hold the compass level, so the magnetic needle can swing freely. Hold the compass away from magnetic objects such as metal stakes, watches, mechanical pencils, cameras, and belt buckles that can draw the magnetic needle off bearing.

Prismatic compasses like the one shown below are recommended for higher field accuracy.

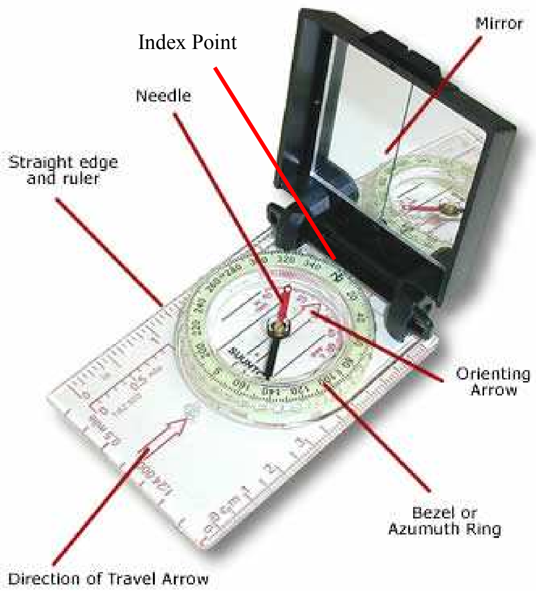


Figure 1

Taking a Bearing (Direction of Travel)

Hold the compass with the base plate level and the direction of travel arrow pointing forward *(Figure 2)*. Turn your body with the compass in front of you, to point the direction of travel arrow towards the object you want to take a bearing on. Turn the revolving dial until the red north end of the magnetic needle is aligned within the orienting arrow in the compass dial. Read the bearing on the compass dial at the index point.

Figure 2

Setting a Bearing

If you know the bearing from your current position to an object, turn the compass dial until the degree or cardinal point is aligned with the index point and direction of travel arrow. Then hold the compass with the base plate level and the direction of travel arrow pointing forward *(Figure 2)*. Turn your body with the compass in front of you until the red north end of the magnetic needle is aligned within the orienting arrow in the compass dial. You are now facing in the direction of the bearing.

Walking a Bearing

Look straight ahead in the direction of travel. Choose a landmark that lies in line with the bearing. Walk to the landmark. Continue in this manner until you reach your destination.

Using a Compass in Conjunction with a Map

You may use a compass in conjunction with a map in either of two ways:

1) Determine a bearing from a map and then travel that direction in the field (map to terrain), or
2) Take a bearing in the field and plot that bearing on a map (terrain to map).

Declination

Whenever combining compass (field) bearings with map (true) bearings, you must account for declination. Declination is the degree of difference between true north and magnetic north. True north is where all lines of longitude meet on a map. Magnetic north is the location of the world's magnetic region (in the upper Hudson Bay region of Canada). Declination is east or west, depending upon where magnetic north lies in relation to your position. If magnetic north lies to the east of your position, declination is east. If magnetic north lies to the west of your position, declination is west.

In New Zealand, the declination is between 18° east to 25° east *(Figure 3)*. Declination diagrams are located in the bottom margin of topographic maps. Keep in mind that declination changes slightly over time as magnetic north moves slowly west; therefore, the current declination in your area may be slightly different than the declination at the time the map was printed. Always use the current declination.

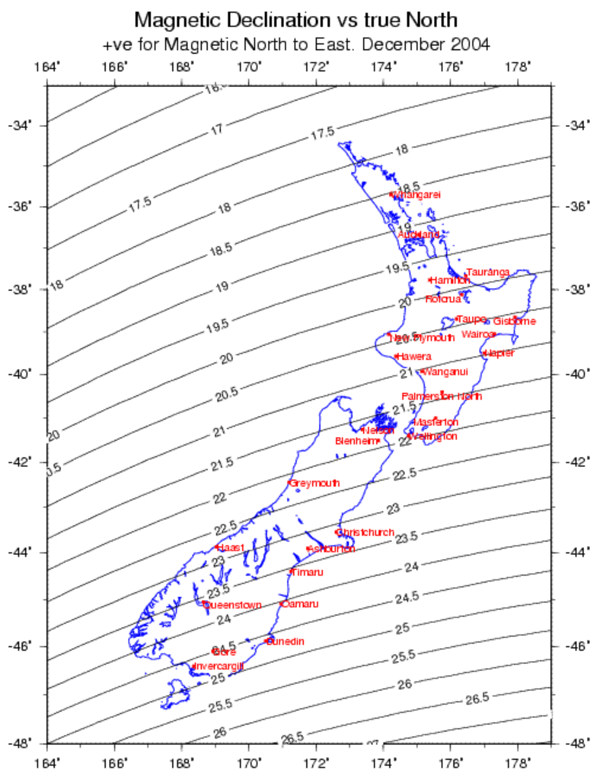


Figure 3 Declination maps are updated every five years.

Aircraft compasses point to magnetic north and do not use declination. Keep this in mind if giving or receiving a compass bearing from or to an aircraft.

Setting Declination on the Compass

Some compass models have a declination adjustment screw. The set screw key is usually attached to a nylon cord that hangs from the compass. Using the key, turn the set screw to the appropriate declination. Once you have set the proper declination you do not need to change it until you move to a different area. If you move to a new area, remember to reset the declination on your compass. If you do not have a compass with a declination adjustment screw, you must add or subtract declination to determine the correct bearing. Whether you add or subtract declination depends on whether you are working from map to terrain or terrain to map.

Setting Declination Map to Terrain

If you have determined a bearing between two positions from a map, and you are going to walk the bearing, you must convert that bearing to a magnetic bearing. In New Zealand to convert map to terrain bearings:

• For declination east, turn dial east (subtract number of degrees of declination)

Example: A map bearing for a location in Christchurch is 240°.
The compass bearing is 240° – 23° = 217°

Setting Declination Terrain to Map

If you have taken a field bearing and want to plot the position on a map, you must convert the bearing from a magnetic bearing to a map (true) bearing. Simply reverse the map to terrain rule:

• For declination east, turn dial west (add)

Example: Standing in Christchurch, a compass bearing to an unknown mountain is 240°. The map bearing is 240° + 23° = 263°. Plot a line on the map 263° from your location. The mountain feature is along the plotted line.

Note to international visitors:

Manufacturers make up to five versions of compasses to compensate for several magnetic latitude zones. This is to compensate for magnetic inclination or dip by a counterweight on one end of the needle, to prevent it from dragging on the top or bottom of the capsule.

• Not all compasses work well in New Zealand. Use a local compass or a **global compass**.

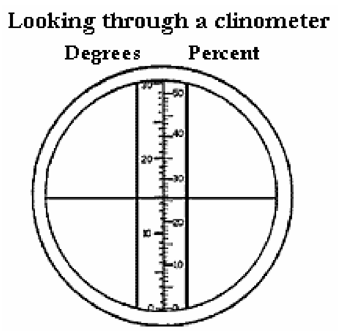
Clinometer

A clinometer measures slope in degrees. Slope is one of the most important topographic influences on fire behaviour.

Measuring Slope Using a Clinometer

The degree scale gives the angle of slope in degrees from the horizontal plane at eye level.

To use a clinometer:
- Hold the clinometer so that the round side-window faces to the left.
- Hold the clinometer up to your right eye but keep both eyes open (you can hold the instrument up to your left eye, if that is more comfortable).
- Aim the clinometer in the direction of the slope you want to measure.
- Fix the hair line of the clinometer on an object in your line of sight and **at the same height as your eye level**, a range pole may be useful *(Figure 4).*
- Look into the viewing case, and read where the hair line intersects the degree scale.



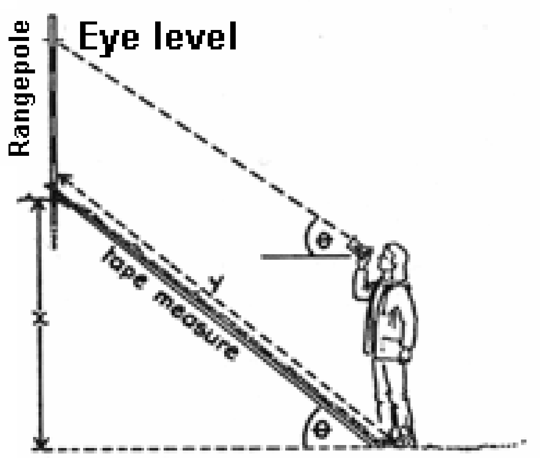


Figure 4 Graphic of use of a clinometer.

MEASURING FIELD DISTANCES

Determining Distances in the Field

Distances along the ground can be measured by various means. You can measure distances along a road in a vehicle with an odometer. In the field you can use a tape measure or a hip chain, though over long distances this method is often impractical. Pacing is a common means of measuring distance in the field. By knowing the length of your pace you can measure the distance over ground simply by walking. A pace is defined as the distance between the heel of one foot and the heel of the same foot in the next stride. Therefore, one pace equals **two** steps—one step of each leg.

Determining Your Pace on Level Ground

- On level ground, lay out a course of known distance (e.g., 50 m).
- Walk the length of the course counting each pace (two steps). Take the first step with your left foot, then count each time your right foot touches the ground.
- Repeat the process several times to obtain an average number of paces per length.
- Divide the number of paces into the measured distance to arrive at the length of your pace.

Example: 50 m/32 pace = 1.6 m/pace

To determine the distance you have paced in the field, multiply the number of paces by your distance per pace.

The distance between point A and point B is 30 paces. Your pace distance is 1.6 m.

30 paces × 1.6 m/p = 48 m

Determining Your Pace on Sloping Ground

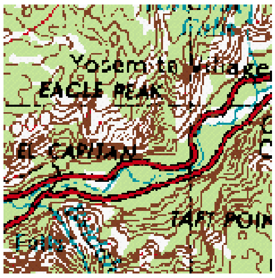
Walking on a slope, either uphill or downhill, your paces will be shorter; consequently you will take more paces to cover the same distance on a slope as on level ground. To determine your pace on sloping ground:

- Lay out a course of the same distance used on level ground with moderately steep slope.
- Walk upward on this course, counting the number of paces as before.
- Divide the total distance by the total number of paces.
- This is the length of one pace on a slope.

Walk the course several times both uphill and downhill until you have an average length of a pace on sloping ground. Your upslope pace may be different than your downslope pace.

BASIC MAP TECHNIQUES

Working with Scale



It is inevitable to use maps with many different scales during map work. If a map is enlarged or reduced, the scale of the map will change, and a new scale must be determined. Scale on a map is determined by the formula:

$$\text{Scale} = \frac{\text{Map Distance (MD)}}{\text{Ground Distance (GD)}}$$

Map distance equals the distance measured between two points on a map. Ground distance equals the distance on the ground between the same two points.

To determine the new scale of a map that was enlarged or reduced, follow these steps:

• On the original map of known scale, measure the map distance between two points of two horizontal distances and two vertical distances (because copy machines are not precision instruments and may skew the map).
• Determine the ground distances of the two horizontal and the two vertical map distances using the original map scale.
• On the enlarged (or reduced) map measure the map distances between the same four distances (although the map distance has changed, the ground distances between the four distances are still the same).
• Calculate the scale of the enlarged (or reduced) map with the scale formula, using each of the four distances.
• Average all four scales, and use this for determining ground distances on the enlarged (or reduced) map.

Determining the Direction or Bearing Between Two Map Points

To determine the direction between two points on a map, follow these steps:
• Draw a line connecting the two points (X Y) *(Figure 5).*
• Place your compass with the edge of the base plate along the line.
• Orient the compass with the line of travel arrow pointing towards point Y.
• Turn the revolving dial of the compass until the orienting lines within the compass dial are parallel with the north-south coordinate lines on the map, and the North arrow points to north on the map.
• Read the bearing at the index point on the compass.
Note: The direction of the magnetic needle is irrelevant in this procedure. If you are going to **set a field bearing** using this map bearing, remember to **subtract the declination** according to the rules in the previous section (page 5). If your compass has the declination set, you do not need to make any adjustments.

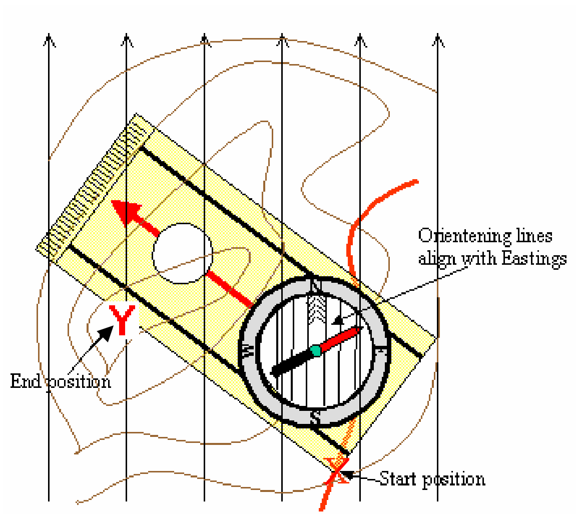
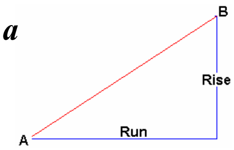


Figure 5

Determining the Distance Between Two Map Points

• Align the edge of a piece of paper with the line drawn between the two points.
• Make a mark on the paper at points A and B.
• Hold the paper against the scale on the bottom of the map.
• Measure the distance against the map scale.

Calculating Slope From a Topographic Map



Determining the average slope of a hill using a topographic map is fairly simple. Slope can be given in two different ways, an angle of the slope in percent gradient or degree slope. Degree slope is the preferred reporting method in New Zealand.

1) Decide on an area for which you want to calculate the slope (note, it should be an area where the slope direction does not change; do not cross the top of a hill or the bottom of a valley).

2) Once you have decided on an area of interest, draw a straight line perpendicular to the contours on the slope. For the most accuracy, start and end your line on, rather than between, contours on the map.

3) Measure the length of the line you drew and, using the scale of the map, convert that distance to metres. This is the RUN.

4) Determine the total elevation change along the line you drew (subtract the elevation of the lowest contour used from the elevation of the highest contour used). You do not need to do any conversions on this measurement. This is the RISE.

To calculate a **percent slope**, simply divide rise over run and multiply the number by 100. A 100% slope = 45°.

To calculate the **degree slope**, divide the elevation change in metres (RISE) by the distance of the line you drew converted into metres (RUN). This is the tangent value for the angle of the slope. Apply an arctangent ($\tan^{-1}$) function to this value to obtain the angle of the slope (depending on the scientific calculator, hit the 'inv' or 'shift' or 2^{nd} function button and then the 'tan' button to get the slope angle). The angle you calculated is the angle between a horizontal plane and the surface of the hill.

$$\text{Slope}^\circ = \tan^{-1}\left(\frac{\text{RISE}}{\text{RUN}}\right)$$

For estimating field slope conversions:

25% slope = 14°
50% slope = 27°
75% slope = 37°
100% slope = 45°

Determining Your Location in the Field

You can determine your location with either of two instruments: a compass or a Global Positioning System (GPS) unit. You can use a compass to plot a location on a topographic map in the field using a method known as resection.

This is done by taking bearing on two landmarks you can see from your location and can identify on a map. On the map, draw a bearing line along the edge of the compass for both of the landmarks. The intersection of the two lines is your location.

Aspect

Aspect is determined by which way the slope is facing. This may be reported in cardinal direction or azimuth (0-360°).

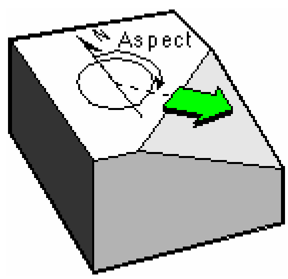


Figure 6 South East aspect

Coordinate Systems

Latitude/ Longitude (Lat/Long)

Latitude lines run east/west.
Longitude lines run north/south *(Figure 7).*
As a standard use degrees, minutes, seconds and decimal seconds to tenths.

Example:
Latitude:43°32'48.3"S   Longitude:169°16'03.5"E

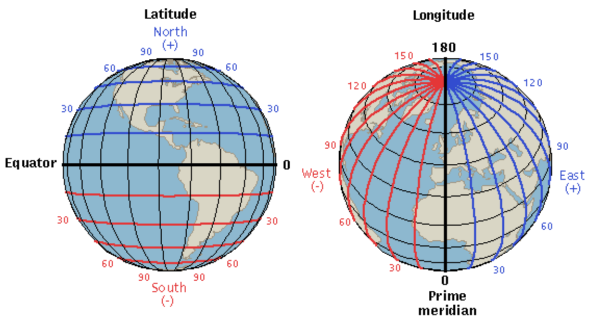
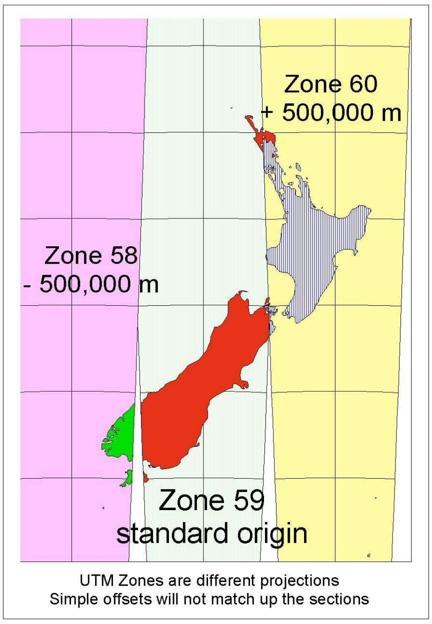


Figure 7

Easting and Northing

Lat/Long is a difficult system to work with on maps. A much easier system in New Zealand is commonly called "Easting and Northing" which denotes x and y coordinates in metres for describing point locations. This is based on the Universal Transverse Mercator (UTM) system *(Figure 8).* For maps produced from 1972 to 2001 the mapping system is call New Zealand Map Grid (NZMG). In 2001 the mapping system was upgraded to New Zealand Transverse Mercator (NZTM).



UTM Zones are different projections
Simple offsets will not match up the sections

Figure 8

Determining Plot Location Using Map Grid Coordinates on a Topographic Map

Locate the map grid line markings (NZMG) along the edge of a topographic map. The grid lines are spaced every kilometre or 1000 metres. Vertical grid coordinates are expressed as a distance in metres to the east, referred to as the "easting". Horizontal grid coordinates are expressed as a distance in metres to the north, referred to as the "northing".

Example: ☆= 2213500E 5622500N

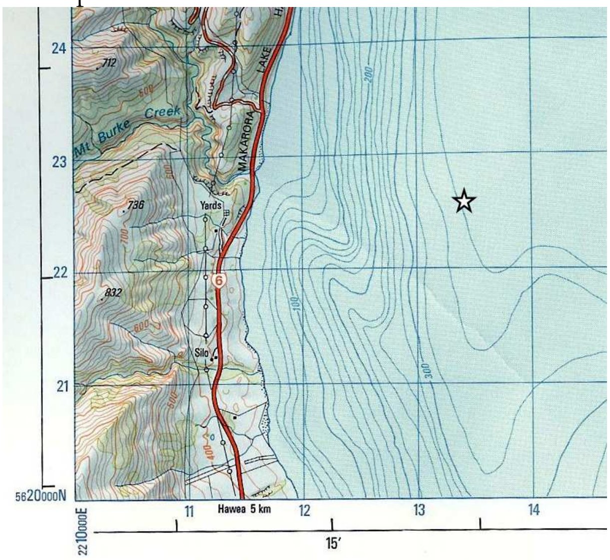


Figure 9

Another common coordinate method in New Zealand is to use a 6 figure grid reference. Each 1:50,000 scale topographic map has a Map Sheet number. This with the middle three digits of the easting and northing will give a location within 100 metres.

Example from Figure 9: Map Sheet: K30
Grid reference: 135225

GLOBAL POSITIONING SYSTEM (GPS)

How Does a GPS Work?

GPS units are dependent on passively receiving satellite signals from the sky, so they won't work underground or inside most buildings. They generally work fine in rough terrain, cloudy conditions and most of the time in the forest. However do not expect a fix in a steep gully under heavy bush canopy. They will work in a vehicle placed next to a window.

*When the receiver tracks at least four GPS satellites, it can calculate its position in three dimensions.
*Always work in 3D mode.
*In general, handheld GPS units have an accuracy of 10 to 20 metres.

Does a GPS Have a Compass?

A standard GPS unit acts as a moving compass, but standing still it can not tell you which way is North. Although several models have a built-in electronic version of a magnetic compass, always carry a magnetic compass when primarily using a GPS for navigation.

GPS Declination

If using a compass with adjustable declination, set your GPS to true north. If using a compass without adjustable declination, set your GPS to magnetic north.

Geodetic Datums

The reference systems that define geodetic datums describe the earth's size and shape. Various datums are used by different countries and agencies, and the use of the wrong datum can result in tremendous position errors of hundreds of metres.

The national geodetic datum for topographic maps for New Zealand is **NZGD2000**. This supersedes the previous datum **NZGD49** that was established in 1949. However, as of 2005 there is not a 2000 datum update available for GPS units, therefore **it is recommended to use NZGD49.**

✈Be aware that aircraft GPS typically use **WGS 84** datum which would be applicable for the lat/long location format. So if working with aircraft, switch the GPS datum to **WGS 84**.

For online datum and coordinate conversions:
http://www.linz.govt.nz

Use of the Garmin GPS 72

These instructions are good for most Garmin GPS units. For initial set up:

- 3D with four satellites is needed for navigation
- Set up in Main Menu:
  - Location Format: New Zealand
  - Map datum: Geod Datum '49 (NZGD49)
  - To make a <u>waypoint</u> (coordinates of a specific location) simply hold down the enter button from any navigation screen.

Setup Track Log For Perimeter Mapping

- Main Menu → Tracks
- Clear active log to start your track.
- Menu (Tracks screen) → Setup Track Log
  - Recording: <u>Stop when full</u>*
  - Record Method
    - <u>Distance*</u>: you can stop without recording points.
    - Time: 2 sec.= 1 hour of collection, 5 sec.= 2.5 hours of collection
    - Auto
  - Interval: 0.01km*

*Recommend settings.

- Save track log when complete.

**If possible*, it is best not to save the Track Log due to averaging waypoints. Just turn off the unit or turn off the track record mode.

🌍 Download GPS Tracks 🌍

- Open New Zealand Mapped software
- Connect serial cable to GPS and computer
- Map/GPS Settings (upper right corner)
  - Select GPS port number
  - GPS Datum (NZGD1949)
  - GPS Brand (Garmin)
- Location Set Editor (just left of map settings)
  - Add New…
    - Type Area
    - Type Route for track
    - Type Point of Interest for Waypoint
      - Label file name
  - Upload Plot/Trail for trail
  - Or Upload Waypoints

WEATHER OBSERVATIONS

Standard Observations
As a minimum during fire operations, the following observations should be recorded:

- Temperature (dry bulb)
- Relative Humidity
- Wind Speed
- Wind Direction
- Precipitation

How to Choose a Representative Site
Weather measurements should be taken at a site that is as similar as possible to the area in which the fire is burning to get the most reliable weather information. Avoid rock slopes, stay out of the burned area, stay out of the smoke, stay out of direct sunlight and keep the following parameters in mind when choosing a site:

-Elevation	-Aspect
-Slope	-Shading
-Proximity to Water Bodies	
-Fuel Type	

Keep the "worst case scenario" in mind. Don't take all the weather measurements on a south aspect if the fire is burning on a variety of aspects. Choose the worst case scenario—a northwestern aspect which receives a lot of solar radiation—if you must choose to monitor from only one site. Try to monitor a variety of sites.

Weather Meters
For accurate measurements, keep the weather meter in the shade and into the wind. Allow the unit to sit in ambient conditions for several minutes or whirl the meter for 30 to 60 seconds until the readings have stabilized for a final reading.

Observing Relative Humidity and Temperature with a Sling Psychrometer
A sling psychrometer is an instrument made of two thermometers and a sling handle. One thermometer has a wet wick over the bulb and one does not. The dry bulb measures air temperature. When the instrument is ventilated, water evaporates from the wet wick and cools the thermometer bulb. Drier air will result in more evaporation and more cooling. When the difference between the wet and dry bulb temperature is small, little evaporation is possible and the relative humidity is high. When the difference between the wet and dry bulbs is high, the humidity is low. If they are the same, the relative humidity is 100%. When using a sling psychrometer, follow these steps:

1. Choose a representative site in the shade, facing the wind, and away from smoke. Shade the psychrometer with your body if necessary. It is more important to be in the shade than to face the wind.

2. Both thermometers should show the same temperature before wetting (within ½ degree) to ensure their accuracy.

3. Make sure the wick is clean. Replace if discoloured or hard. Replace every month if used daily and replace more often if heavily used on fire assignments where the air generally has more particulates.

4. Wet wick with distilled water and stand in the shade, facing the wind if possible.

5. Ventilate the thermometer until the lowest wet bulb temperature is reached. Do this by slinging the psychrometer for 1 minute, checking the wet bulb and slinging it again for 30 seconds. If readings are the same, stop. If they are different, sling for another 30 seconds. If you do not record the *lowest* wet bulb temperature you will calculate an RH that is too high. Be sure the wick has not dried out before you read the wet bulb temperature.

6. Read both thermometers to the nearest whole degree.

7. Relative Humidity and Dew Point tables are available to calculate the relative humidity and dew point from the proper elevation table for your location. Slide ruler RH calculators are not very accurate.

Note: If the mercury column in the thermometer has separated, try placing the thermometer in warm/hot water. If this does not work, get a new thermometer.

Observing Wind Speed

Using a handheld anemometer (many weather meters have this included):

1. Stand away ten times the height of a wind barrier to observe wind speed.
2. Facing the wind, hold the anemometer at arm's length with the display facing you.
3. Winds are usually quite variable. On wildfires try taking the wind reading every minute for 10 minutes and averaging the result. This will be more accurate than holding the instrument up for a few seconds and reading the highest wind speed.
4. Reporting gustiness is important in fire behaviour.
5. Be sure to record winds as "observed at eye level" for a reference.

Note: Weather forecasts give 10 metre winds.

As rule of thumb for FWI calculations:
10 metre winds = 1.5 x eye level winds

Observing Wind Direction

Record wind as the direction the wind is coming FROM with respect to true north. It is often more helpful to describe winds as up slope/up valley or down slope/down valley when in mountainous terrain.

When using a compass, be sure the proper declination has been set on the compass so the wind is given with respect to true north. Stand facing the wind and hold the compass base pointing straight into the wind. When accuracy is highly important, use degrees instead of cardinal direction. Take wind direction often to get an average or to determine if winds are highly variable.

How Often to Take Measurements

Taking weather observations every ½ to 1 hour is common depending on the situation. This will usually be decided by the Incident Controller or another person in a position of authority. If weather data is not asked for at a certain time, decide what an appropriate monitoring schedule is and stick to it. Monitoring may be done more frequently during the burning period. If the opportunity is there, walk around a lot to get weather measurements from different sites—ridge tops, valley bottoms, and different aspects.

Do not hesitate to measure and record weather and fire behaviour variables even if they are not requested. This is important during changes in fire behaviour and weather fronts. Communicating just a slight change in wind direction can improve fire fighter safety and awareness. Documenting the time when changes occur help with fire investigation.

FIRE OBSERVATIONS

Flame Length
Flame length *(Figure 10)* is the distance between the flame tip and the midpoint of the flame depth at the base of the flame—generally the ground surface or the surface of the remaining fuel. Flame length is described as an average of this measurement as taken at several points. *This is a good indicator of fire intensity which is a key measurement in fire behaviour calculations. Be aware, observers tend to over estimate flame length, so take care in observations.

Flame Height
Flame height *(Figure 10)* is the average maximum vertical extension of flames at the leading edge of the fire front. The occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are tilted due to wind or slope.

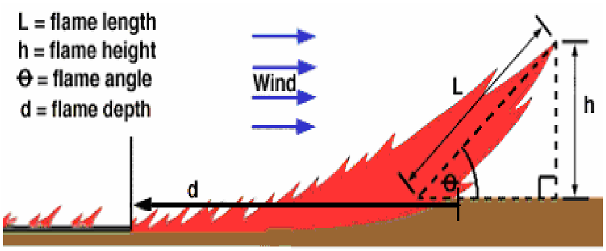


Figure 10

Flame depth
Flame depth *(Figure 10)* is the width of the flaming front. Monitor flame depth if there is an interest in flame residence time. Measure the depth of the flaming front by visual estimation.

Fire spread direction
The fire spread direction is the direction of movement of that portion of the fire that the fire is advancing to.
The fire front can be described as a head (H), backing (B), or flanking (F) fire *(Figure 11)*.

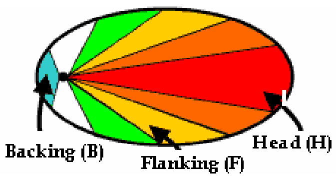


Figure 11

Rate of Spread
Rate of Spread (ROS) describes the fire progression across a horizontal distance; it is measured as the time it takes the leading edge of the flaming front to travel a given distance. ROS is recorded as metres per hour. ROS calculations should be made from a flaming front that has reached a steady state and is no longer influenced by adjacent ignitions.

Use a stopwatch to measure the time elapsed during spread. During wildfires, the selection of an appropriate marker, used to determine horizontal distance, is dependent on the expected ROS. Pin flags, metal stakes, trees, rocks, roads, etc., can all be used as markers. If smoke is obscuring your view, try using firecrackers, or taking photos using black-and-white infrared film.

Perimeter or Area Growth
Map the perimeter of the fire and calculate the area. It is a good idea to include a progression map depicting perimeter locations at different times and a legend with the final documentation.

A map should STAND⇨
Scale
Title
Author
North arrow
Date

Fire Types
Surface Fire – A fire burning along the surface without significant movement into the understory or overstory, with flame length usually below 1 metre.

Intermittent or Torching – The ignition and flare-up of a tree or small group of trees.

Crown Fire –The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.

Spot Fire – A smaller fire that has started from sparks and brands thrown in the air by the main fire.

Fuel Types

- Pine plantation – by age
- Logging slash
- Indigenous forest – Beech/Podocarp
- Pasture grassland – Ungrazed/Grazed
- Crop stubble
- Tussock grassland
- Scrublands – Gorse, Manuka/Kanuka, Heathlands/Wetlands, Scrub Hardwoods

Smoke Characteristics

Visibility – Smoke visibility and density is important to evaluate exposure time for firefighters on the line and nearby public. It is also used to evaluate roadway safety.

Smoke Column – Smoke columns may be described as bent, leaning, sheared or rising straight up. Column height and colour is important for fire behaviour. This information will help to quantify how the fire was burning and under what atmospheric conditions. Using the smoke column guide (Form 5), describe the observed smoke column characteristics and atmospheric conditions.

(Nelson Mail newspaper, 21 June 2005)

PASSING ON INFORMATION

What is Important?

Above all else, safety of firefighters and fire observers is the most important. Safety should never be compromised to observe fire weather or fire behaviour. From a safe location:

- Record the current weather accurately and on time.
- Record changes in fire behaviour.
- Report any erratic fire behaviour.
- Report unusual shifts in wind, RH, or temperature.

Protocol for Calling in a Radio Report

- Know what to say before transmitting. Even better, write it down.
- Always say the unit name you are calling first, followed by your name. Example:
  "Dispatch, Dispatch this is Observer 2" or
  "Hamish, Hamish this is Jono"

Example of incident weather radio report:
"The current weather as of 1300. The temperature is 28 degrees, up 2 degrees, and the RH is 44% which is down 5%. Winds are from the West at 11 km/h with gusts up to 20 km/h. End of report."

Site Specific Weather Forecasts Request

If an incident is longer than one day or for a planned event such as a large experimental burn, a site specific weather forecast from the MetService is recommended. *See Form 3.*

If a weather station is not close by, be sure to give two to three on-site weather observations which include cloud description. Indicate the length of time the incident will occur. Request for an output of:

- General situation statement for the day and following day(s).
- Detailed weather forecast for the following four days consisting of maximum and minimum temperatures, RH, wind direction and speed at different times of the day, dew point temperature in the early afternoon, and likelihood of rain.
- A general outlook for the area from days 5 through to 10.
- Weather charts for NZ for the day issued, and the following 2 days.

PHOTO PROCEDURES

- Use a photo record sheet (Form 6) or take photo notes on the fire behaviour forms to record photo annotations.
- Next to the experimental plot, set up a page or whiteboard to describe the plot. Take a photo of the page:

Date	Location
Time	Unit
Fuel Type	Plot

- It's useful to set up photo reference distance markers. For example:
  - On experimental burns, a big number "20" at the 20 metre mark.
  - A two-metre height pole
  - A pen for close ups
- Take a variety of fire behaviour photos from low to high intensity. People tend to only photograph the "big flames".
- Take photos of plot set-up, equipment, and people.

Saving research photos:

- Be sure to label all photos and delete poor quality photos.
- Example of photo filing:

- File name: "Darfield05_Plot1_20m.jpg"
- If possible use photo archiving software to annotate the photo. For example:

Darfield 5 March 2005 Crop Stubble
Unit: Kings Road
Plot 1 20m Time: 1311

Unlabelled photos are useless photos!

POSTBURN REPORT

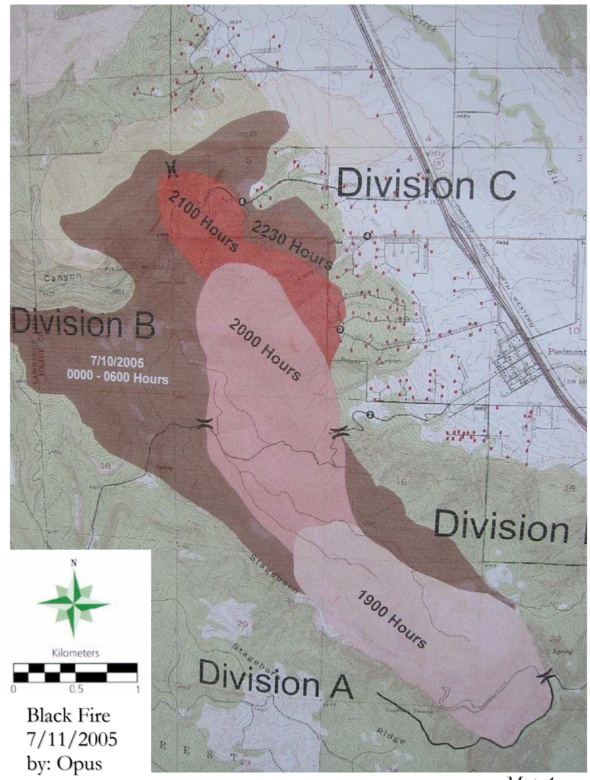
Fire managers often need a summary of information immediately following a fire. While detailed information on fire effects are not immediately available, detailed information regarding fire observations and fire conditions can and should be summarized soon after the fire. This information may be used to refine prescriptions, strategy, and tactics over both the short and long term. **Decide in advance who is responsible for preparing this report.** A fire observer can collect most of the information required. Consultation with the Incident Controller is recommended.

In the following list, consider these items to include in the postburn report:

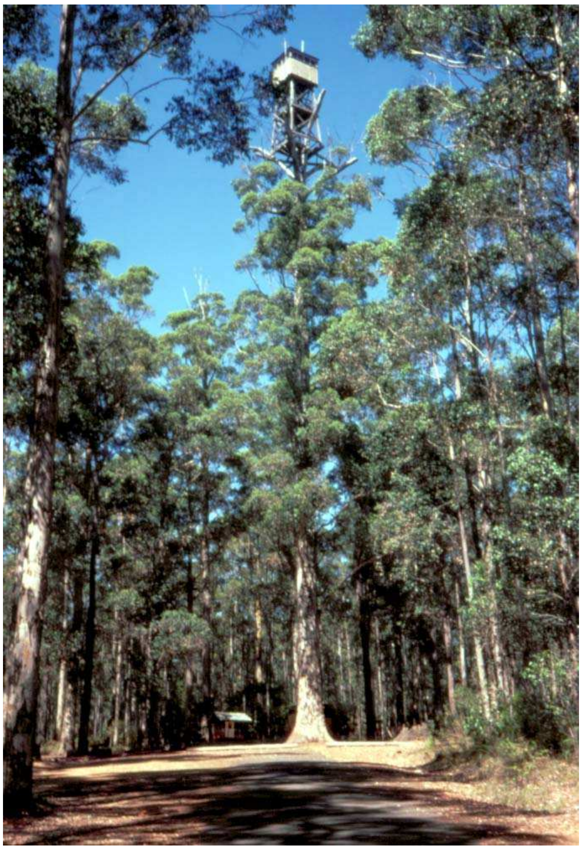
- Fire name
- Fuels and topography
- Detailed weather observations
- Accuracy of fire weather forecast
- Fire behaviour information
- Chronology of fire behaviour
- Chronology of smoke movement and dispersal
- Resource numbers and type (personnel and equipment)
- Strategies and tactics
- Chronology of significant events
- Hectares burned
- Post fire debrief from all personnel to include:
    1. What was planned?
    2. What really happened?
    3. Why did it happen?
    4. What can we do better?

Attachments:

- Map of area burned and fire progression map
- Fire weather observations data sheets
- Fire behaviour observations data sheets
- Weather station data
- Weather forecasts and weather charts
- Photo record sheet and photos
- Copy of field notes



Map 1



Get a clear view of the fire area by seeking high ground (Tokezone photo gallery. [Online] Available: http://www.quadranet.org/tokezone/itchy/pix_oz/imagepages/image16.htm [4 January, 2006])

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Figure 5: Field, Tony of Chasetrek [Online] Available: http://homepage.ntlworld.com/markdfield/chasetrek/tutorial/mapcompass.html [4 January, 2006]

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Figure 11: Finney, M.A. 1998. *FARSITE*: Fire Area Simulator-- Model Development and Evaluation. USDA For. Serv. Res. Pap. RMRS-RP-4.

Map 1: Mount Blogmore: A Rapid City Journal politics blog, July 2005. [Online] Available: http://www.rapidcityjournal.com/politicalblog/?m=20050710