

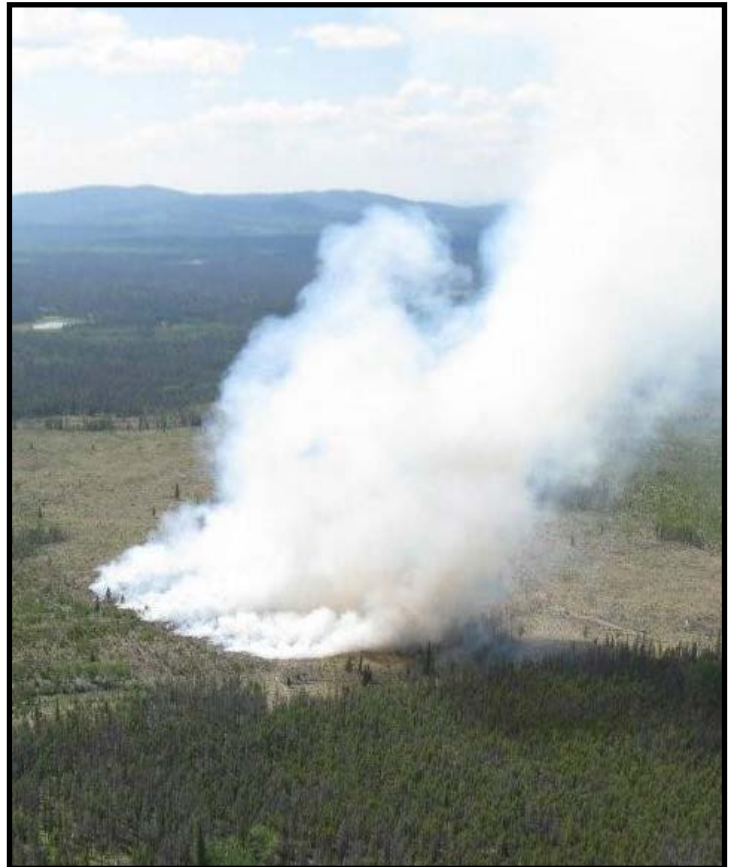


S - 241 (for the
Province of BC)

Fire Assessment

TRAINEE MANUAL

Wildfire Suppression Training



S-241 (BC)

Fire Assessment

TRAINEE MANUAL

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Ministry of Forests, Lands and Natural
Resource Operations**



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Errors and omission:

Great effort has been made to ensure that the material contained within the *S-241 Fire Assessment* course is complete and factual, however errors may still exist. Please email any comments to Forests.ProtectionBranchOffice@gov.bc.ca.

Acknowledgements

Thank you to the BC Wildfire Service employees and forest industry personnel who reviewed and revised the subsequent copies of the S-241 course.

Initial Course content developed by:

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TABLE OF CONTENTS

1. COURSE OVERVIEW.....	1-1
2. INTRODUCTION TO FIRE ASSESSMENT.....	2-1
3. ROLES AND RESPONSIBILITIES.....	3-1
4. FIRE BEHAVIOUR.....	4-1
5. PREPARING FOR A FIRE ASSESSMENT	5-1
6. CONDUCTING THE FIRE ASSESSMENT.....	6-1

1. COURSE OVERVIEW

Course Learning Objective

Upon completion of this course, the trainee will develop the working knowledge and the ability required to complete and deliver an accurate fire assessment.

Course Outline

The British Columbia Wildfire Service S-241 Fire Assessment course is a four-hour training session taught in a lecture format.

Target Audience

This course was designed for delivery to the following individuals involved in wildland fire suppression operations:

- BC Wildfire Service Employees.
- Contract Crews.
- Local Government Staff.
- Forest Industry Personnel.

Recognition of Training

This course is recognized by the British Columbia Ministry of Forests as the minimum recommended training standard for fire fighters responsible for or expected to deliver accurate fire assessments to Fire Centre Duty Officers.

Evaluation

Individuals will be evaluated on this course using the following criteria:

- | | |
|---|------|
| • Written Exam (30 minutes at the end of the day) | 70 % |
| • Fire Assessment Exercise | 30 % |

A final combined mark of 70 % will be required for successful completion.

2. INTRODUCTION TO FIRE ASSESSMENT

Section Learning Objectives

Upon completion of this section, the trainee will develop an understanding fire assessment application by learning:

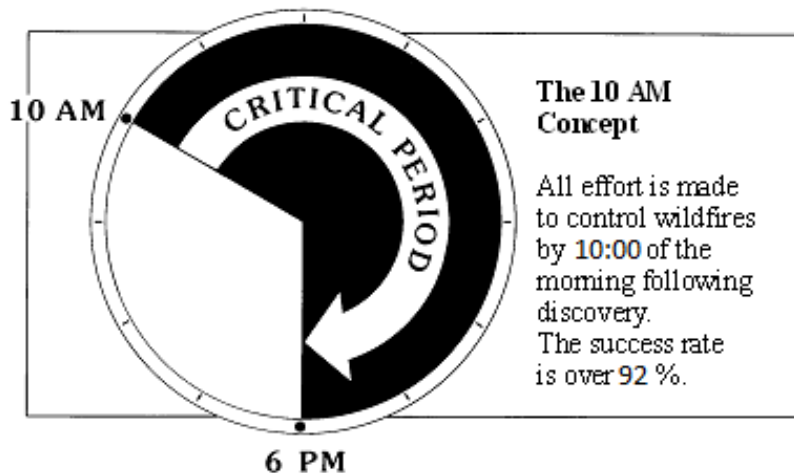
- ✓ What a fire assessment is;
- ✓ When a fire assessment is done;
- ✓ Why a fire assessment is done;
- ✓ Who performs a fire assessment;
- ✓ A Fire Assessment versus an Initial Fire Report (IFR);
- ✓ Who receives a fire assessment?

Wildfires in British Columbia

Over the past 10 years, British Columbia has experienced approximately 2000 wildfires burning close to 115000 hectares of valuable forest. Lightning strikes cause 61 % of the Province's wildfires while industrial activity, such as logging, accounts for an additional 20 %. The remaining 19 % are caused by the public as a result of various recreational activities.

The 10 A.M. Concept

The BC Wildfire Service provides aggressive initial attack and suppression efforts on all wildland fires. Early detection is critical to the success of these crews - every effort is made to control the wildfire by 10:00 a.m. of the morning following discovery. This is called the '10 AM Concept.'



By controlling fires before 10:00 a.m. (when temperature starts to increase, and relative humidity starts to decrease causing fires to spread) firefighters can suppress fires more easily with a greater chance of success. Existing success rates are very high with over 92 % of all wildland fires being controlled within 24 hours of discovery at less than four hectares in size. This expectation is the minimum standard.

Fire Assessment

When a fire is detected then prompt and accurate reporting to the British Columbia Wildfire Service is very important. The Provincial Wildfire Coordination Centre (PWCC) will work with the six Regional Wildfire Coordination Centres to suppress any fires of concern as soon as possible.

The ability to accurately assess a fire is critical to initial attack success because an accurate assessment will 'paint a clear picture' of the fire situation to Fire Centre staff. This enables an effective response and ability to meet the minimum standards that are in place.



What is a fire assessment?

A fire assessment is an ongoing process involving detailed information about a wildfire that is communicated to the Regional Wildfire Coordination Officer (RWCO) who operates out of the Fire Centre. A fire assessment provides accurate and current information including:

- All values at risk.
- Present and expected fire behaviour (fuels, weather, topography).
- Fire potential.
- Resources required for suppression.
- Best plan of attack.
- Fire hazards and crew safety issues.

When are fire assessments done?

A fire assessment is done on every fire detected regardless of whether the fire is actioned. On some fires, a fire assessment can be completed and communicated under the 'Remarks' section of the Initial Fire Report (IFR). The fire assessment is an ongoing process and follow up fire assessments should be communicated regularly and whenever there is a significant change in the fire information. You should conduct a fire assessment:

- As soon as you get to the wildfire.
- When a fire related factor changes (e.g. weather, fire behaviour, equipment breakdowns, production rates, change in priorities, etc.).
- When you (as the Incident Commander) need to be updated about the fire activity.
- When your supervisor needs to know how the incident is developing.

Why are fire assessments done?

A fire assessment assists the Duty Officer to make informed attack decision involving fire suppression using a priority basis. The Zone Wildfire Coordination Officer (ZWCO) will also receive this information and try to fill resource requests at that level.

Fire assessments:

- Ensure that the RWCO has the most current fire information.
- Provide the RWCO with an accurate estimate for the amount and type of suppression resources required.
- Are useful in establishing priorities when multiple fire starts occur and/or when initial attack efforts are failing on several fires ('fire bust' situations).
- Ensure that suppression resources are allocated effectively.



Note: When fire situations are changing quickly then delays in dispatching resources to the fire may render the resources ineffective upon arrival.

A Fire Assessment versus An Initial Fire Report (IFR)

A fire assessment provides additional information not contained in the IFR.

An IFR is part of fire assessment as it provides the Duty Officer with useful fire information; however, an IFR is not a fire assessment without additional information.

Important differences between fire assessments and IFRs include:

- Fire assessments on a fast spreading fire may be numerous - updated and communicated to the Duty Officer frequently as the fire situation changes. An IFR is done only once on a fire.
- A fire assessment may be provided with the IFR. This is not unusual when experienced fire personnel provide the IFR. However, not all persons providing IFRs have sufficient fire experience or training to provide a fire assessment. The IFR contains information that is important to a fire assessment, so it will be covered in detail later in the course.

Who performs fire assessments?

A variety of fire personnel may be required to perform a fire assessment depending on the fire situation in that region. These individuals include:

- **Incident Commander**
- **Air Patrol Crews**
- **Experienced Firefighters**

The quality of fire assessments varies with experience and firefighters should practice these skills if time permits.

Who receives fire assessment information?

Fire assessment information is provided to the Fire Centre Duty Officer as a standard procedure. The same information should also be communicated to firefighting crews on the fire, so they can work safely.

The fire assessment you provide is critical for effective fire management by the RWCO particularly when conflicting priorities or fire targets arise.



NOTES:

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3. ROLES AND RESPONSIBILITIES

Section Learning Objectives

Upon completion of this section, the trainee will develop an understanding of the fire assessment roles and responsibilities by examining:

- ✓ The various individuals who may be required to complete a fire assessment;
- ✓ The responsibilities of an individual when conducting a fire assessment;
- ✓ The specific objectives an individual must meet while performing a fire assessment before and after arrival at the fire as well as throughout a fire;
- ✓ The responsibilities of the RWCO and ZWCO receiving the fire assessment information;
- ✓ The attack priorities during situations with multiple new fires;
- ✓ Decision options if control objectives are not met.

Who performs fire assessments?

A variety of individuals will be required to perform a fire assessment including:

1. **An Incident Commander (IC):** The Incident Commander (Initial Attack Crew Leader on IA fires) often provides a fire assessment.
2. **Air Patrol Crews:** Pilots, air observers and Air Attack Officers (AAOs) may provide fire assessments.
3. **Experienced Firefighters:** When fires present control difficulties or are burning in areas with significant values at risk, the RWCO may request that the most experienced fire personnel available (not already a part of the fireline organization under the IC) conduct a fire assessment. This is not unusual and does not imply that the Incident Commander is performing inadequately. However, it is important that the chain of command be observed by all personnel including the Duty Officers to ensure that fire operations remain safe and efficient.



The Duty Officer may also request that an experienced firefighter (Air Attack Officer or fire personnel flying over the fire) perform a fire assessment on a wildfire that has not been actioned by ground crews. These fires will not have an Incident Commander.

Experienced versus Inexperienced Fire Assessments

The quality of a fire assessment varies with fire experience. It is not likely that you will be asked to assess a fire that is beyond your capabilities or scope of practice. However, the nature of wildland fires is such that less experienced firefighters will be challenged in attempting to provide a quality fire assessment at times.

Always be prepared to take on responsibilities you normally would not be given such completely a fire assessment. Be thorough, accurate and communicate effectively when completing this task.

Remember, you are part of a larger, highly experienced team and other team members (RWCO, ZWCO, AAO, etc.) are ready to assist. These experience fire personnel will be able to lead you through sections of your fire assessment that may need clarification.

**Responsibilities When Performing a Fire Assessment**

It is the responsibility of the firefighter performing a fire assessment to:

- Be Prepared:*** Be prepared to take on the responsibility of conducting a fire assessment. Organize and prepare for all fire assessment tasks (IFR pad, notepad, pens, compass, etc.).
- Be Thorough:*** Perform a complete and ongoing reconnaissance of the wildfire or incidents assigned.
- Be Accurate:*** Accurately record all fire information.
- Communicate:*** Communicate fire information effectively to the RWCO and ZWCO.

Before Arrival at the Fire

- Obtain the best available information on the location of the fire, the resources being deployed and current and forecasted weather conditions and fire behavior.
- Travel by a route that will provide the best vantage point for sizing up the fire when responding to larger incidents.
- Record the description of any vehicles or people in the area or leaving the area (include direction of travel).

***Upon Arrival at the Fire***

- Identify or review **Lookouts, Anchor Points, Communications, Escape Routes** and **Safety Zones**, and any other fireline hazards or safety concerns.
- Determine probable spread during the first burning period.
- Notify the RWCO if the resources assigned to the fire will be adequate. Give an estimate of the fire potential and additional resources required.
- Inventory and analyze possible environmental damages both because of the fire and possible fire control objectives.
- Develop an Incident Action Plan (IAP) - plan strategies and tactics based on current information and anticipated situations.
- Keep the RWCO and ZWCO informed.
- Determine the point of ignition if possible.
- Preserve evidence at the suspected area of ignition if possible.
- Investigate the cause and determine responsibility (human vs. lightning).

Ongoing Fire Updates

- Continuously re-assess the fire as well as weather conditions, update strategies and tactics and adjust resource requests accordingly to ensure safe and effective suppression efforts.

Responsibilities of the RWCO and ZWCO

It is the responsibility of these Duty Officers who receive the fire assessment information includes:

- Compiling all information about the fire (from the IFR and fire assessments).
- Leading less experienced fire personnel through the assessment process and describing different key points of interest;
- Developing a 'clear picture' of the incident as it has been described;
- Deploying the necessary resources to meet the fire suppression objectives and providing additional resources as required;
- Request additional support from the PWCC and contractors as required.

Multiple Fire Situations

The RWCO will determine initial attack priorities after considering the pertinent information from multiple fire assessments. The RWCO will examine:

- 1) The specific concerns outlined for the identified fire zones - values at risk.
- 2) The number of fire suppression resources available to for deployment - in the Zone and in the Fire Centre.

When the Control Objectives Are Not Met

If the control objective is not met (e.g. the fire is not controlled by 10 AM the day after discovery), 1 of 2 decisions will be made by the RWCO:

1) Continue Fire Suppression

- The IC will determine resource requirements.
- The RWCO will provide necessary support.

2) Stop Fire Suppression (for a period of time and as per a Fire Analysis)

- Determine location of containment lines.
- Monitor the fire behaviour.
- If fire approaches containment lines, a decision must be made to mobilize resources.
- The RWCO will provide the necessary support.



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4. FIRE BEHAVIOUR

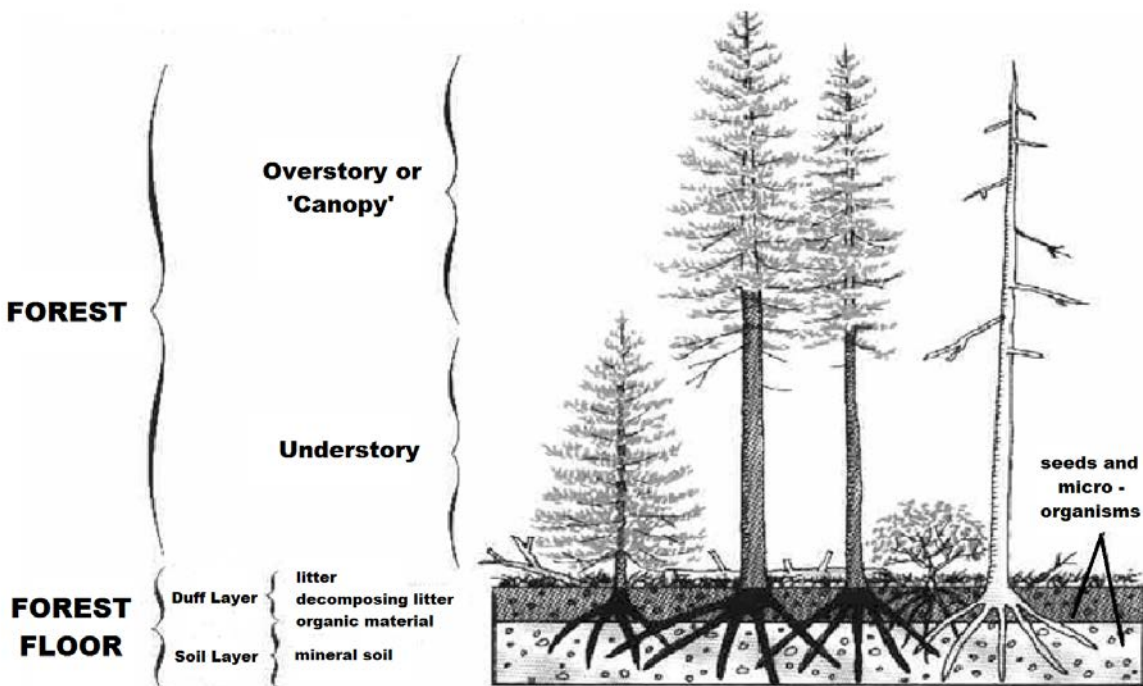
Section Learning Objectives

Upon completion of this section, the trainee will have a basic understanding of the following aspects of wildland fire behavior:

- ✓ The basic arrangement of forests and fuels in the wildland fire environment;
- ✓ The three elements of the fire triangle;
- ✓ The three key factors that influence fire behavior and the 30/30 Crossover concept;
- ✓ The main components of the Canadian Forest Fire Danger Rating System;
- ✓ The four fire types as well as candling and spotting;
- ✓ The Fire Intensity Ranking System;
- ✓ The parts of a wildfire.

Forest Layers

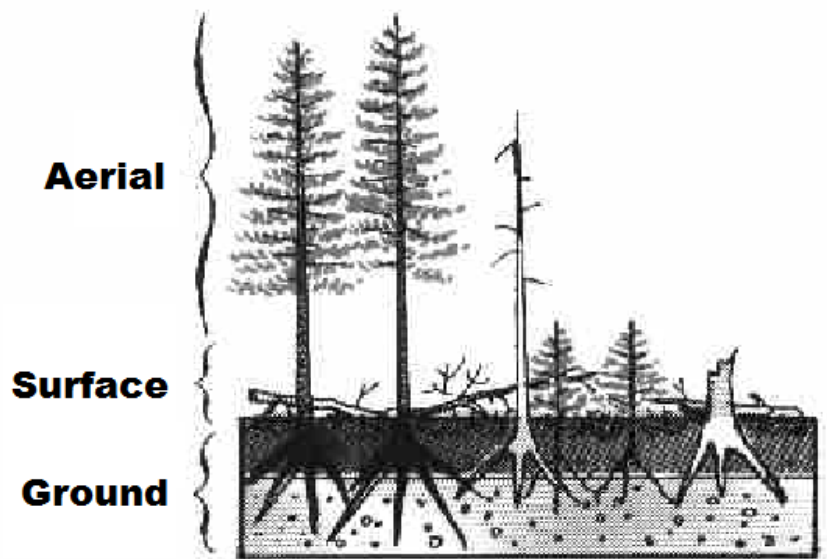
A typical forest consists of a plant community dominated by trees growing on a forest floor. A duff layer rests on top of the soil layer, and this duff evolves from each year's dead and decomposed plants and animals. Mineral soil evolves from decomposition of rocks.



Forest Fuels

Any materials that will ignite and combust (burn) are considered to be a fuel. There are 3 types of fuel in wildfires:

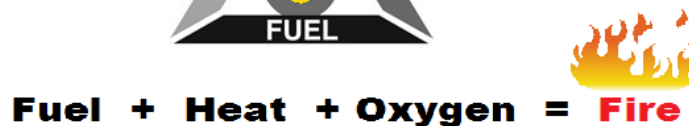
- **Aerial** fuel: combustible material higher than 1 metre (3.29 feet) above ground level.
- **Surface** fuel: includes all combustibles less than 1 metre above ground level and 1 year's litter accumulation.
- **Ground** fuel: includes all combustible substances below the surface litter and down into the duff layers.



The Fire Triangle

To successfully fight forest fires, we must first understand what factors make a fire grow in size.

Three elements: *fuel*, *oxygen* and *heat* must be present to start and maintain a fire.



In a wildland fire:

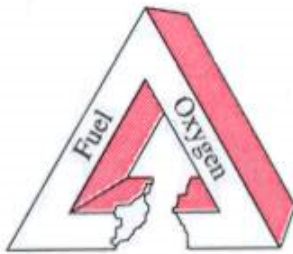
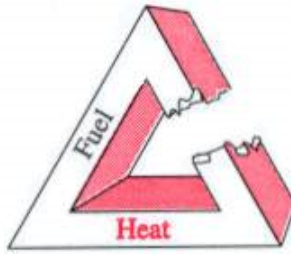
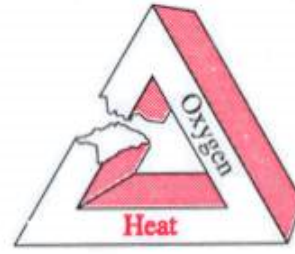
- the forest provides the fuel;
- there is oxygen in the air; and
- heat is produced naturally by lightning strike or is introduced by humans.

These three elements (fuel, oxygen and heat) are related to a triangle with each side representing a key element. If any one of these elements is altered, then the fire will behave differently, and if one side of a triangle is removed, then the fire will be suppressed.

Remove heat by cooling the area with water.

Remove oxygen by covering the area with soil or class 'A' fire foam.

Remove the fuel by building a fuel free control line between the fire and the fuel. Ignite any unburned fuel.



The Heat Transfer Process

The process by which heat travels from an object or body to another is known as heat transfer. There are three ways from this process to take place.

Radiation: transfer of heat through the air from warm surfaces to cooler surrounding areas (the heat you feel when you are sitting next to a campfire).

Convection: transfer of heat by the movement of a hot air mass, which is usually upwards as hot air rises (the heat from a burning log boils water in a kettle suspended above).

Conduction: transfer of heat through solid matter (the heat you feel when you touch a lightbulb).

Factors Influencing Fire Behaviour

There are three key factors that influence fire behaviour. The following is a list of factors:

Key Factors		
1. Fuel	2. Weather	3. Topography
Moisture	Wind	Slope
Size	Precipitation	Aspect
Spacing (continuity)	Relative Humidity	Terrain
Fuel Loading	Temperature	Elevation

Fuel

Fuel Moisture

Fuel moisture content is the single most important fuel related factor affecting fire behaviour. **A fire will ignite easier and spread faster in fuels with lower fuel moisture.**

Fuel moisture in wildland fuel types is determined by:

- Weather related factors affecting the amount of moisture in the fuel. For example, the amount and type of precipitation (rain or snow).
- The percentage of live or dead (drier or cured) fuel. For example, green grass will not burn as well as brown (cured) grass.

Fuel Size

- **Heavy, slow-burning fuels** include logs, stumps, large branch wood, trees and deep duff layers. These fuels take longer to ignite (due to moisture content). Fires spread slowly but burn longer and with greater intensity. The moisture content change is slower due to a low surface area to volume ratio.
- **Light, fast-burning fuels** include grass, dead leaves, tree needles, brush and small trees. These ignite quickly, result in fast spreading fires and act as kindling to light heavier forest fuels. The moisture content change is faster due to a high surface area to volume ratio.

Fuel Spacing (Continuity)

Fuel spacing refers to the arrangement of fuel on the landscape and is divided into fuel distribution between the horizontal and vertical planes. Fuels that are closer together increases the ability for fire to spread; while fuel that is spaced further apart decreases the ability of fire to spread.

Horizontal Fuel Spacing - refers to the linear distance between sections or groups of fuel, and this is usually described as “continuous” or “patchy.”

Vertical Fuel Spacing - refers to the distance between surface fuels and aerial fuels. The fuels present between the two are called **ladder fuels** (branches).

Fuel Loading

Fuel loading refers to the weight or mass of fuels in a given area. This is generally measured in tonnes per hectare. Fuel loads may vary across the fire area. Higher density fuel loads will burn at higher intensities if the fuel moisture conditions make all the fuels dry enough for combustion.

Weather

Wind

Wind is the single most important weather factor affecting fire behaviour and influences fire activity by:

- Decreasing fuel moisture levels.
- Heating, drying and igniting new fuels.
- Carrying sparks and embers into new fuel sources (spotting).
- Driving the direction of a fire.

Precipitation

Precipitation influences fire behaviour by affecting fuel moisture. The effect of precipitation on fuel moisture is greatly dependent on fuel size as:

- Less precipitation is required to raise the fuel moisture content in fine fuels than in heavy fuels.
- The duration of precipitation, not the quantity, is the most important factor when determining the effect of precipitation on fuel moisture.

Relative Humidity

Relative Humidity influences fire behaviour by affecting fuel moisture. Relative humidity is the percentage of water vapour present in the air. When the air is dry the relative humidity is low, and fuels are likely to dry out. When the air is damp the relative humidity is high, and fuels are likely to absorb moisture (fuel moisture increases). Typically, the relative humidity will increase overnight and decrease during the day.

Temperature

Temperature fluctuations affect relative humidity, thereby affecting fuel moisture content. To a lesser degree, temperatures also influence the amount of preheating required to bring a fuel to its ignition point.



The 30/30 Crossover

Watch for Extreme Fire Weather

The 30/30 Crossover describes the condition where the RH drops below 30 % and temperature rises to 30° C or more. If this occurs on a fire, then there may be an increase in fire activity depending on fuel moistures. This is a useful rule of thumb to use - all precautions must be taken accordingly to ensure crew safety.

Topography

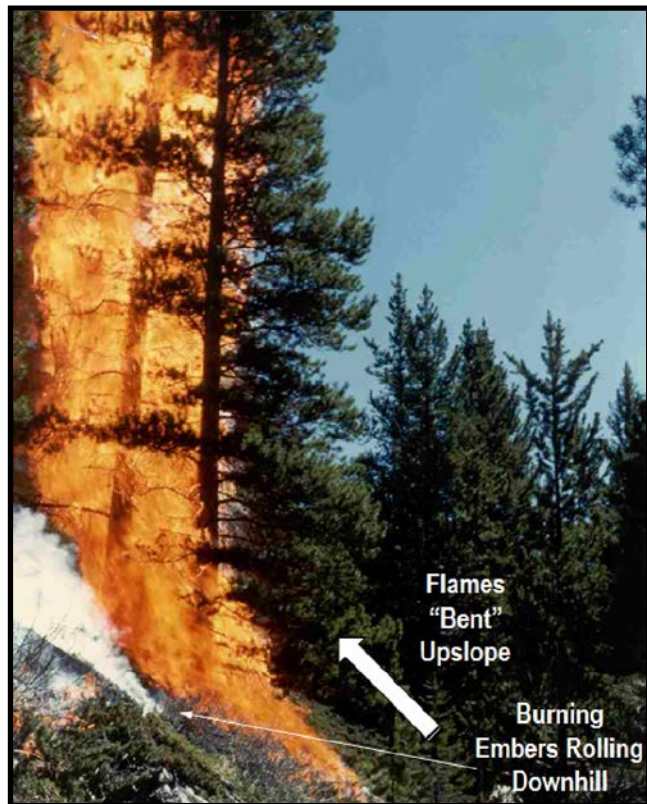
There are 4 topographical factors that influence fire behaviour:

- Slope
- Aspect
- Terrain
- Elevation

Slope

Slope is the single most important topographical factor affecting fire behavior and spread rates. Slope affects fire behaviour in the following ways:

- Flames are closer to fuels on the uphill side thus heating and igniting these new fuels.
- Convective heat (rising heat) from the fire travels up the slope heating and drying new fuels.
- The convective air may carry firebrands or embers, which can ignite spot fires above the main fire.
- Burning embers and large burning material may roll downhill igniting new, unburned materials below the fire.
- Firefighting efforts are hampered and slowed on all slopes.
- Cooling at night and weather changes can cause winds to blow down slope.

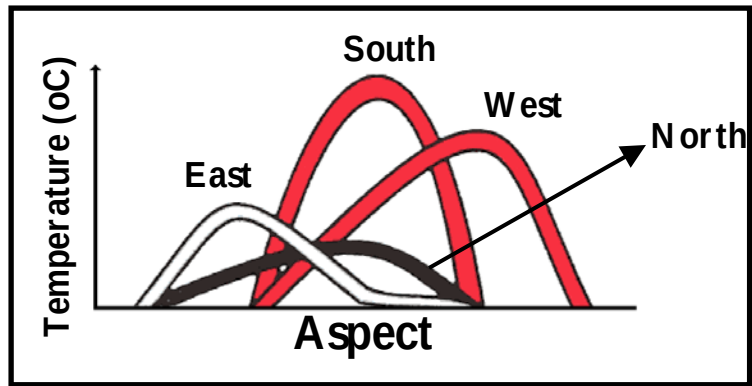
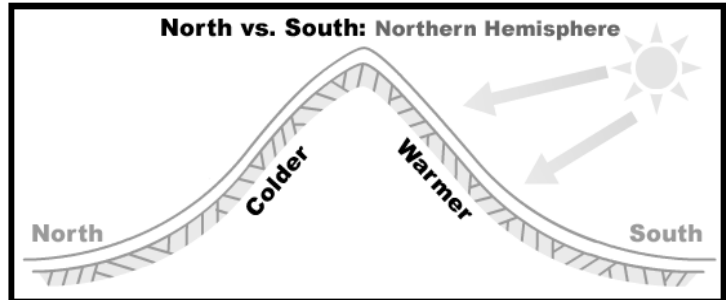


Aspect

Aspect refers to the direction the slope faces. For example, a southwest aspect is a slope that faces southwest.

The following aspect factors affect fire behavior directly:

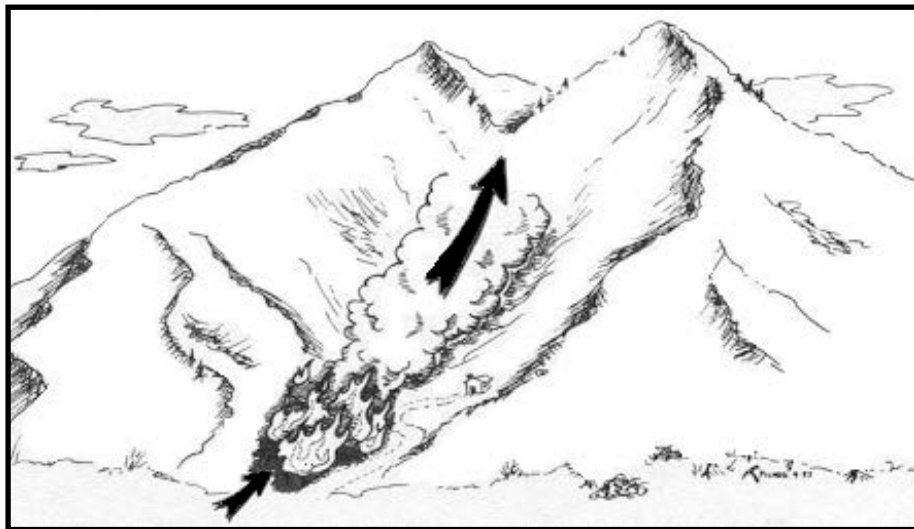
- Southern slopes receive the most direct heat from the sun and therefore achieve highest temperatures during the day.
- Fuels on south facing slopes have the lowest fuel moisture.
- Fuels on the south facing slope will be finer and ignite readily.



Terrain

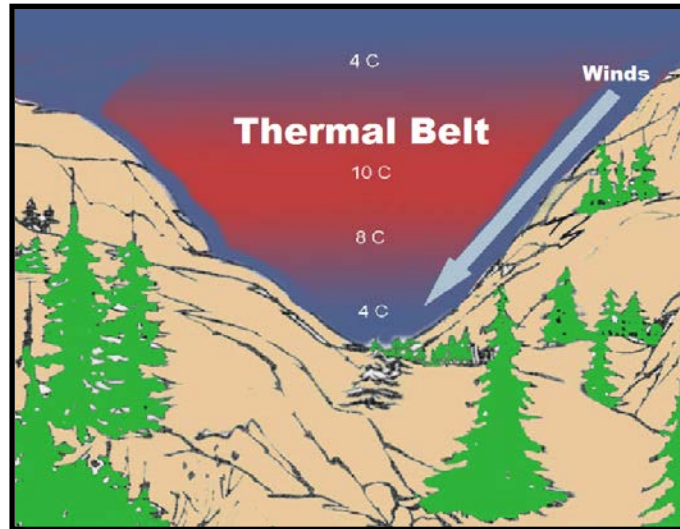
Terrain is the variation in land features, which primarily affects fire behaviour by altering wind direction and speed in certain locales. The terrain affects wind patterns in the following ways:

- Turbulence or 'eddies' can be generated on the leeward side when wind blows across ridges.
- Terrain restrictions, such as narrow portions of valleys, or knolls, can increase wind speed as the wind passes.
- Steep-sided gullies or canyons running uphill can create a 'chimney effect' that dramatically increases uphill spread rates and fire intensity. In many cases these terrain features will also be heavy fuel loaded.



Elevation

Typically, air temperatures follow an elevation gradient with temperatures being warmer at lower elevations and cooler at higher elevations. Quite often, atmospheric conditions will cause a band of warm air to be trapped at mid-elevation between cool air at lower elevations and cool air above. In mountainous terrain this is a temperature inversion known as a **thermal belt**.



The temperature will be higher within the thermal belt and relative humidity will be lower than the elevations above and below - possibly creating extreme fire conditions when the event is unexpected.

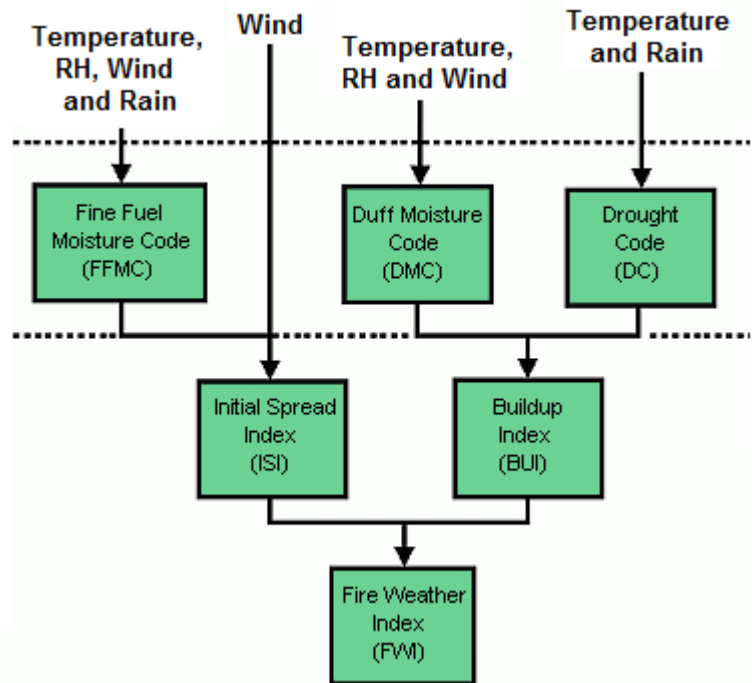
The Canadian Forest Fire Danger Rating System (CFFDRS)

The Canadian Forest Fire Danger Rating System (CFFDRS) is a standard national system of rating fire danger in Canada. The fire potential and fire spread rates are used to determine daily fire preparedness levels and suppression requirements for the various Fire Centre operations.

Firefighters should have a general understanding of the CFFDRS and the importance of the various codes and indexes. This will help with a proper fire assessment.

The CFFDRS has two sub-systems:

1. **The Fire Weather Index (FWI) system.**
2. **The Fire Behaviour Prediction (FBP) system.**



NOTES:

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The Fire Weather Index (FWI) System

The Fire Weather Index (FWI) system uses four weather readings, which are taken each day by weather stations at 1300 hours (PST). These weather inputs are:

- Temperature (wet and dry bulb).
- Relative Humidity.
- Wind Speed and Direction.
- Rainfall (cumulative - last 24 hours).

The weather readings are entered into standard tables that provide firefighters with three Fuel Moisture Codes and three Fire Behaviour Indexes.

Fuel Moisture Codes

Fuel Moisture Codes are numerical ratings that express daily changes in moisture content of three classes or layers of forest fuel (each class has a different drying rate). Fuel Moisture Code values increase with lower fuel moistures.

Code	Represents	Time Lag*	Amount of 24 hour rainfall required to lower value...
FFMC Fine Fuel Moisture Code	Surface litter	2/3 day	0.6 mm
DMC Duff Moisture Code	5 - 10 cm duff	12 days	1.5 mm
DC Drought Code	10 - 20 cm duff	52 days	2.9 mm

* Time lag refers to the time required for a fuel to lose 2/3 of its moisture under standard drying conditions.

Fine Fuel Moisture Code (FFMC) - The FFMC represents the moisture content in litter (needles, twigs) and other cured fuels on the surface. This fuel group is extremely sensitive to all daily weather changes. The FFMC expresses ease of ignition and fuel flammability.

CODE / INDEX	INTERPRETATION
FFMC Less Than 77	Generally, a fire will not start without a concerted effort.
77 - 86	Approximately 50% of ignition sources will start fires.
More Than 86	Easy ignition of wildland fuels.
Greater Than 94	Almost 100 % of ignition sources will ignite wildland fuels.
ISI Less Than 10	When FFMC is less than 86, fire spread is generally not great.
Above 10	Expect rapid spread rates which escalate rapidly as the FFMC increases.

Duff Moisture Code (DMC) - The DMC represents the moisture content of the duff layers 2 - 4 inches (5 to 10 centimetres) deep. This fuel group is affected by rainfall, temperature and humidity. The DMC expresses fuel consumption in medium-depth duff layers and of medium-sized woody material.

CODE / INDEX	INTERPRETATION
DMC Less than 35	Do not expect a great deal of involvement of fire in this layer. At a DMC above 35, one can expect more intense fires.

Drought Code (DC) - The DC represents the moisture content of deep duff layers 5 - 10 inches (10 to 20 centimetres) deep. This fuel group is affected by rainfall and temperature. The DC expresses seasonal drought effects on forest fuels and the amount of smoldering that will occur in deep duff layers and in large logs during a fire.

CODE / INDEX	INTERPRETATION
DC 0 - 300	Very little involvement of this fuel in most areas.
300 - 450	Increased involvement with fires becoming more intense and mop-up problems increasing.
500 +	Extensive involvement of the fuel layer. Fires are intense with difficult mop-up problems due to the depth of the fires.

Fire Behaviour Indexes

Initial Spread Index (ISI)

The ISI represents the expected rate of fire spread immediately after ignition.

Build Up Index (BUI)

The BUI represents the total amount of fuel available for combustion, which is useful for determining mop-up requirements and is used in calculating a fire's rate of spread.

Fire Weather Index (FWI)

The FWI represents the potential fire intensity at the head of a fire. Fire danger levels (classified as very low, low, moderate, high or extreme) summarize predicted wildland fire conditions for a specific area.

Fire danger class ratings are calculated for 3 danger regions in the Province of British Columbia and are used to determine the need for open fire bans and public travel restrictions or road closures in forested areas. Industrial activities use the fire danger classes to determine restrictions on industrial operations such as the need for early shutdown, 'fire-watch' following early shutdown or complete shutdown of industrial activity.

The Fire Behaviour Prediction (FBP) System

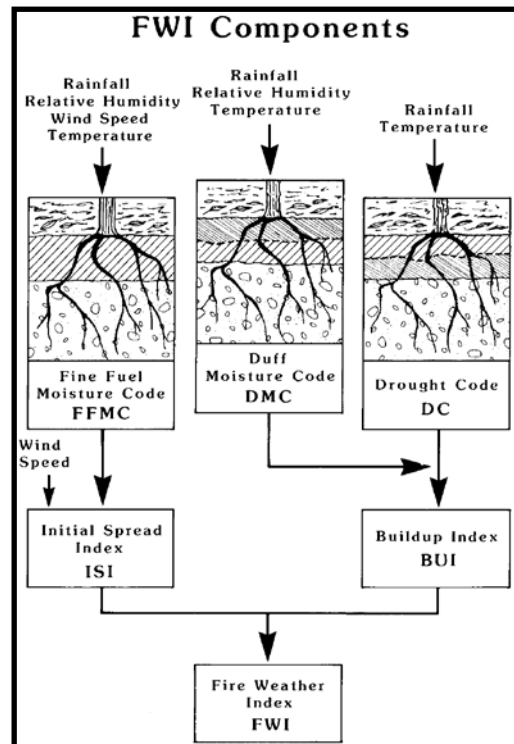
The FBP system predicts fire rate of spread in a given fuel type with a known ISI.

The FBP system evaluates:

- FWI indices on site or from the nearest weather station.
- Fuel type (17 different fuel types).
- Topography (slope and aspect).
- Time of day / time of year.

Primary outputs of the FBP system are:

- Rate of Spread (metres per minute).
- Fire Type (surface, intermittent crown, crown).
- Fire Intensity (kilowatts per metre).



Fire Types



Fire Intensity Ranking System

This fire ranking system is a very convenient way of quickly assessing the fire. It is important to understand the Fire Intensity Ranking System enables firefighters to communicate a summarized assessment of fire behaviour. Numbers from 1 (low) to 6 (extreme) are based on the FWI values.

The Fire Ranks

Rank 1

- No open flame, white smoke, smouldering ground fire

Rank 2

- Visible open flame, surface fire only, white smoke
- Unorganized flame front, little or no spread

Rank 3

- Organized surface flame front, white to grey smoke
- Moderate rate of spread
- Vigorous surface fire

Rank 4

- Organized surface flame front, disorganized crown involvement
- Moderate to fast rate of spread on the ground
- Short to moderate range spotting
- Grey to black smoke

Rank 5

- Organized crown fire front
- Moderate to long range spotting
- Independent spot fire growth
- Copper to black smoke

Rank 6

- Organized crown fire front
- Moderate to long range spotting
- Independent spot fire growth
- Copper to black smoke, presence of fire balls and fire whirls

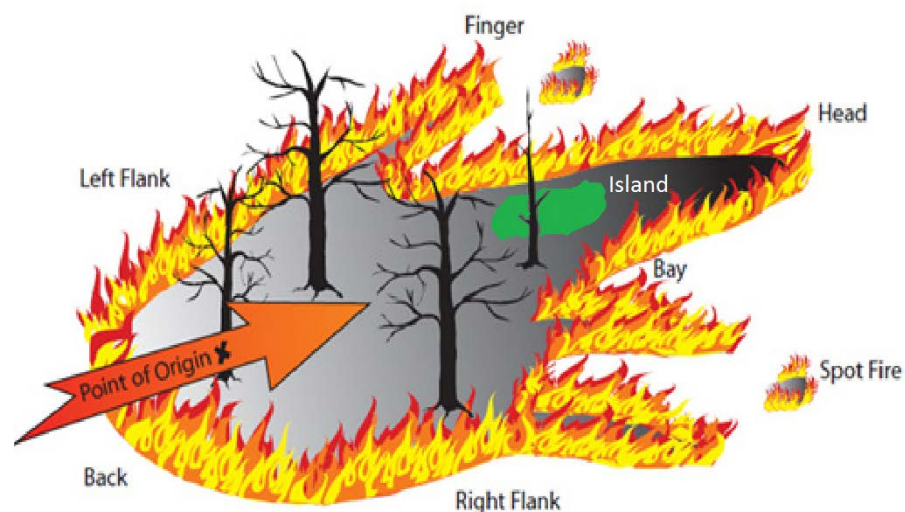
Fire Definitions

Candling - A single tree or a small clump of trees is said to candle when its foliage ignites and flares up. This usually occurs from the bottom to the top.

Spotting - A fire producing firebrands that are carried by the surface wind, a fire whirl and/or convection column, which fall beyond the main fire perimeter and result in spot fires

Parts of the fire

It is very important that you can describe the anatomy of a wildfire. You will need this to describe your position on the fire or the position of an observation you are making from afar. The following anatomical descriptors are important to remember and understand:



Head - The head or front of the fire is the portion of the fire that has the greatest rate of spread. The head is also the direction in which the fire is growing or spreading. The head is usually on the downwind or upslope part of the fire.

Back/Heel - The back or rear of the fire is opposite the head and usually has the slowest rate of spread. It is also known as the base and the point of origin may be found near this area.

Flank - The flanks are any areas between the head and the back. The flanks are often referred to in relation to a geographic feature such as the 'north flank.'

Finger - A finger is an elongated burned area projecting from the main body of the fire. Fingers often occur on wind driven fires.

Bay - A bay is a marked indentation in the fire perimeter. A bay is usually located between two fingers.

Island - An island is an area of unburned fuel located within the fire perimeter.

Spot Fire - A spot fire is a fire ignited by firebrands (embers) outside the main fire perimeter. Spots can occur very close to the fireline, or under windy conditions a spot can be a great distance from the fireline.

Hot Spot - A hot spot is any part of the fire that is particularly active. The term hot spot is also used to identify active areas during mop-up and patrol.

NOTES:

5. PREPARING FOR A FIRE ASSESSMENT

Section Learning Objective

Upon completion of this section, the trainee will develop an understanding for the minimum preparations requirements to adequately complete a fire assessment by learning:

- √ The daily preparation requirements;
- √ The current fire behaviour in the area of coverage;
- √ The full range of suppression resources available and their capabilities;
- √ The equipment and materials required for fire assessment.

Note: An accurate fire assessment starts with preparation ahead of time.

Weather Considerations for Fire Assessment

Daily Fire Weather and Fire Behaviour Forecasts

Review the fire weather conditions and current fire activity in your zone. Take forecasting notes on the following as part of your daily routine:

- Temperature and Relative Humidity.
- CFFDRS FWI values (13:00 hours) from the weather stations in your area. Know the location of these weather stations as you can choose the values that most closely represent any fires you assess.
- Any changes in wind speed and direction.
- Possible cold front and thunderstorm development and activity.
- Approaching frontal systems
- All Fire Behaviour Advisories issued.



The fire weather forecasts and other weather information are received daily from the Weather Forecaster at a Fire Centre. This information can be obtained through daily briefings, or dispatch if required.

- The 13:00 PDT fire weather readings and indexes are updated daily between 13:30 and 14:30 PDT.
- Fire weather forecasts are issued twice daily at 07:30 and 13:30 hours.



Current Fire Behavior in your Area

There may be a number of active wildfires in the area. You should know about the fire behavior and any control difficulties these fires are experiencing. This knowledge will be useful when performing fire assessments on new fires burning in similar fuel types and influenced by common weather patterns. The current local fire conditions must be discussed with ground personnel. Monitor the radio to be aware of any changes including increases in fire behaviour elsewhere in your zone.



Resources Available and Capabilities

The BC Wildfire Service has a wide variety of suppression resources available to throughout the 6 Fire Centres. The Zone Duty Officer is an excellent source of resource information and all heavy equipment contacts as well as industry contract crews will be made available upon request. You should know the capabilities and limitations of the resources listed below:

- Air Tankers
- Helicopters
- Heavy Equipment (dozers, excavators, skidders, etc.)
- Specialty Crews (Para-Attack Crews and Rappel Crews)
- Water Delivery Systems (tenders and fire departments)
- Sustained Action Crews (Unit Crew and Contractors)



The availability of suppression resources should not be an immediate concern of the person doing the fire assessment. If something is required, it should be requested as soon as possible. The RWCO and ZWCO will determine the availability of the resources you request and provide an estimated time of arrival (ETA), which may require you to alter your request if necessary.

Never assume a resource is unavailable. Always ask for it if you need it.

Equipment and Materials Required for Fire Assessment

You must have a fire assessment kit adequately stocked and ready to go if you are on standby. All of your required items should be in a kit that can be used for assessments done from the air or ground. Check your kit and ensure everything is functioning properly at the beginning of your shift. The following items will be required to ensure a fire assessment is done properly:

- Map kit with 1 to 600000 and 1 to 250000 map sheets of the area.
- Pens, pencils and a ruler.
- A pad of FS-260: Initial Fire Reports.
- A clipboard with note paper and a Fire Assessment Checklist.
- Flagging tape and/or ticker tape to paper trail the fire.
- A hand-held GPS unit and a radio.

Additional items that should be taken if available include:

- Air photos or Vegetation Resource Inventory (VRI) maps of the fuel types surrounding the fire.
- CFFDRS FBP System Field Guide (need knowledge of how to use it).
- A completed IFR for the fire if already done.
- A digital camera with extra batteries and memory card.
- A digital video camera to record fire behaviour.

On Route to the Fire

If you have time before you go to assess a fire, find an air photo and a vegetation resource inventory map of the general fire location. The information this material provides may be useful in completing the assessment.

While you are on route to the fire become as familiar as possible with the fire area. Get topographic maps out and study all available information. Complete as much paperwork as possible in advance. You will have a much better idea of what to expect at the fire by doing the preparation work in advance.

You should be predicting expected fire behaviour based on knowledge of the indices: FFMC, ISI, BUI, CFFDRS Fuel Type and FWI. Be prepared to take detailed notes about what you see when you get into visual range of the wildfire. This information is crucial when relaying the fire assessment to the RWCO who will deploy resources if appropriate.



NOTES:

[illegible]

6. CONDUCTING THE FIRE ASSESSMENT

Section Learning Objective

Upon completion of this section, the trainee will demonstrate an understanding of the key components involved in successfully conducting and transmitting an accurate fire assessment. The trainee will learn the following information to complete a written assignment:

- ✓ The general considerations when conducting fire assessments.
- ✓ The initial communications to the Fire Centre Dispatch;
- ✓ Transmitting the IFR to the RWCO and ZWCO;
- ✓ How to do a reconnaissance or 'Recce';
- ✓ Completing the Initial Fire Report;
- ✓ The fire assessment.

General Considerations

When conducting a fire assessment:

- **Remain calm** - complete the task carefully and methodically.
- **Check your location** - if you have been dispatched to a particular fire then be sure you are on the right fire. There may have been multiple fire starts in the same general area.
- **Use common sense** - size-up, develop objectives and order your resources based on the objectives.
- **Use Adaptive management** - re-evaluate the situation on a regular basis and re-adjust the resources you request as needed.
- **Do not avoid decisions** - if you are unsure, ask for input from other team members including the RWCO or a direct supervisor.
- **Communicate** - the fire assessment information to the crews on the fire. This will help them complete fire suppression assignments safely and effectively.

Initial Communications to the Fire Centre

Immediately notify the Fire Centre Dispatch and have the rough geographical location passed on to the RWCO. Do not wait until you have completed an IFR and a fire assessment. A fire report or fire assessment is a high priority. Do not hesitate to break routine radio traffic by identifying yourself, the station you are calling and stating you are reporting a wildfire.



Sample Radio Transmission

"Prince George Fire Centre. Prince George Fire Centre. This is NIFAC 72 Alpha with a fire report. Are you ready to copy?"

Wait for response and then continue...

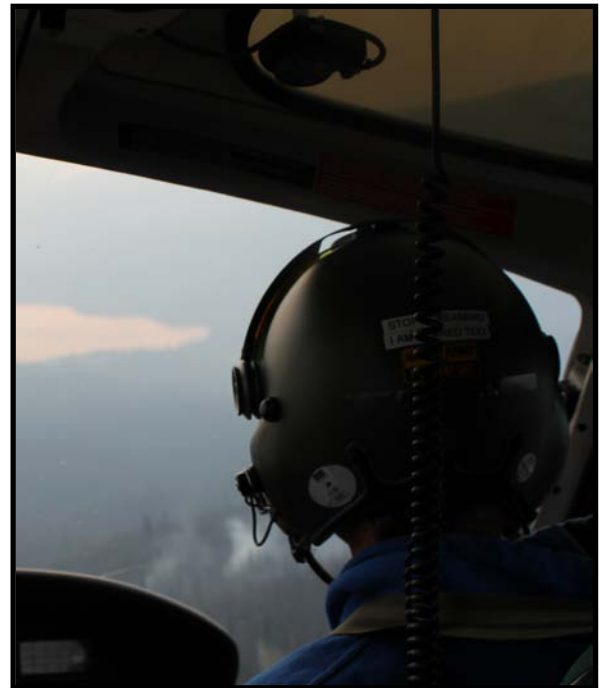
"I have located a small (or large), fast (or slow) moving wildfire 1 kilometre north of Gwillim Lake, approximately 300 metres west of a Forest Service Road. It is putting off white smoke. Please standby for an IFR and fire assessment."

A prompt notification alerts the RWCO and provides a general location so suppression resources can be dispatched immediately. In the sample, the initial communications stated that the fire was close to road access, which assists the RWCO or ZWCO in determining the best way to get additional resources to access the fire. Proceed to the fire after spotting the smoke and relaying the initial information to start a reconnaissance of the fire. Complete the Initial Fire Report and fire assessment that will be transmitted to the Fire Centre and Zone.

It is a good idea to get a latitude and longitude of the fire immediately. A pilot will be able to provide this information as well as a number of weather readings to be used in the fire assessment. This will also ensure that you are on the correct fire in a multi fire situation.

Fire Reconnaissance or 'Recce'***From an Aircraft***

- Brief the pilot on what you are looking for and how you want to proceed.
- The aircraft should be flown so that the person assessing the fire (not the pilot) has the best possible view of the incident. It is the pilot's job to fly the aircraft and the observer's job to assess the fire.
- It is important to record every observation as soon as they are noted. Do not rely on memory.
- If you have another crew member on board, have this individual take photos or video footage while following your directions.



**1. Fly High on the First Pass**

- Fly at 1000 to 2000 feet to see as much of the fire area as possible.
- The initial call to the Fire Centre should be made at this time.

2. Fly Low on the Second Pass

- Fly a few hundred feet above and either way around the fire perimeter. This can be done in the burnt area or on the outside of the perimeter if that is not possible.
- Avoid flying so low that rotor downwash from the helicopter fans the fire and increases fire spread.
- Observe details regarding fire activity, topography, fuels, water sources and access for crews with heavy equipment.
- Record the description of any vehicles or people in the area or leaving the area including direction of travel.
- Take the time to have an excellent look at the fire. Remember to make notes and do not rely on memory.



On the Ground (at the fire)

Aerial reconnaissance is followed up by ground reconnaissance, which occurs when firefighters arrive at the fire. This is usually completed by the initial IC.

Arrange to have the helicopter remain in the air over the fire (within radio range) after dropping the crew off. This gives the Incident Commander a chance to complete a quick ground reconnaissance and determine if the initial assessment needs to be modified.

If it is safe, walk around the fire or view it from a distance. Always ensure that you continually assess for potential Escape Routes and Safety Zones as you size-up the fire. If fire behaviour increases, these locations may be used to shelter from any fire hazards.

From a Vehicle

Stop and observe on approach to the fire at a point where you can see the entire fire and surrounding area at the same time if possible. If possible, approach the fire from a direction where you can continue to observe the fire as you drive closer.



The Initial Fire Report (IFR)

The IFR is the first report on the wildfire. An experienced firefighter will expand the IFR into a full fire assessment. Use a sample IFR to refer to as you learn about this process. An IFR is divided into fire related sections using the phonetic alphabet and number rankings to readily communicate the information. A wildfire will be measured in hectares (ha) and distances will be described in metres (m) or kilometres (km) depending on a fire's size.

Geographic Location

Provide a brief description of the fire's location, which will be used to identify the fire if it grows to an expanded attack incident. It is important to crosscheck this information with the latitude and longitude.

Elevation

This can be obtained using topographic maps, the altimeter in a helicopter or a hand-held GPS (global positioning system) unit.

Latitude and Longitude

"Lat. and Long." - this universal system is used in BC to grid fire locations on all map scales. Lines of latitudes (parallels) run east and west while lines of longitude (meridians) run north and south.

Most aircraft will have GPS units capable of displaying latitude and longitude coordinates.

Bearing, Degree, Minute and Vertical Angle

This information is supplied by fire lookouts.



 BRITISH COLUMBIA The Best Place on Earth		 Ministry of Forests and Range		<h1 style="margin: 0;">INITIAL FIRE REPORT</h1>		INCIDENT NUMBER _____	
REPORTED BY _____				DATE YY ____ MM ____ DD ____	TIME _____		
GEOGRAPHIC LOCATION _____							
CO-ORDINATES LAT _____ LONG _____				ELEVATION _____ M/R _____			
ALPHA – SIZE		BRAVO – FIRE RANK		CHARLIE – FUELS			
☐ 1. Single Tree ☐ 2. Spot _____ mX _____ m ☐ 3. 0.1 - 0.2 ☐ 4. 0.3 - 0.5 ☐ 5. 0.6 - 1.0 ☐ 6. 1.1 - 2.0 ☐ 7. 2.1 - 4.0 ☐ 8. 4.1 - 8.0 ☐ 9. Other _____ ha		☐ 1. Rank 1, Smoldering Ground Fire ☐ 2. Rank 2, Open Flame, No Spread ☐ 3. Rank 3, Vigorous Surface Fire, Moderate Spread, May See Candling ☐ 4. Rank 4, Moderate to Fast Spread Short Aerial Bursts, Spotting ☐ 5. Rank 5, Continuous Crown Fire, Spotting, dist. _____ m ☐ 6. Rank 6, Continuous Crown, Blow-up		☐ 1. Grass ☐ 2. Brush ☐ 3. Deciduous ☐ 4. Slash ☐ 5. Reproduction ☐ 6. Open Timber ☐ 7. Heavy Timber ☐ 8. Other _____ ☐ 9. FBP Type _____			
DELTA – VALUES AT RISK (Immediately Threatened)						ECHO – WIND	
☐ 1. Life/Property _____ ☐ 2. Timber (Forest)Resources (Includes Reproduction) _____ ☐ 3. Other Special Values (Watersheds, Parks) _____ ☐ 4. Distance _____ m. N S E W of the fire						☐ 1. Calm ☐ 2. Speed _____ kph ☐ 3. Direction N S E W	
FOXTROT – ADJACENT FUELS			GOLF – SLOPE		HOTEL – ASPECT		
☐ 1. Grass ☐ 2. Brush ☐ 3. Deciduous ☐ 4. Slash ☐ 5. Reproduction			☐ 6. Open Timber ☐ 7. Heavy Timber ☐ 8. Other _____ ☐ 9. FBP Type _____		☐ 1. Flat/Rolling ☐ 2. Moderate < 30% ☐ 3. Steep >30% < 60% ☐ 4. Extreme >60%		
INDIA – SLOPE POSITION			JULIET – ACCESS		KILO – AVAILABLE WATER		
☐ 1. Bottom ☐ 2. Lower Third ☐ 3. Middle Third ☐ 4. Upper Third ☐ 5. Top			☐ 1. Road _____ m ☐ 2. Helispot _____ m ☐ 3. Hover Exit _____ m ☐ 4. Other _____ m ☐ 5. N S E W of the fire		☐ 1. None ☐ 2. Adjacent ☐ 3. _____ m. N S E W of the fire		
LIMA – PAPER TRAILED		MIKE – PHOTOS		NOVEMBER – SUSPECTED FIRE CAUSE			
☐ 1. Yes ☐ 2. No		☐ 1. Yes ☐ 2. No		☐ 1. Human ☐ 2. Lighting			
ACTION TAKEN/RECOMMENDED							
PROBABILITY OF SUCCESS: LOW _____ MED _____ HIGH _____							
RECEIVED BY: _____				ESTIMATED COST OF CONTROL: \$ _____			

ALPHA - SIZE

- ☐ 1. Single Tree
- ☐ 2. Spot _____ m x _____ m Less than 10 m by 10 m or the
- ☐ 3. 0.1 - 0.2 size of an IA truck.
- ☐ 4. 0.3 - 0.5 0.5 ha = 100 m x 50 m
- ☐ 5. 0.6 - 1.0 1.0 ha = 100 m x 100 m
- ☐ 6. 1.1 - 2.0 2.0 ha = 100 m x 200 m
- ☐ 7. 2.1 - 4.0
- ☐ 8. 4.1 - 8.0 5.0 ha = 200 m x 250 m
- ☐ 9. Other _____ ha

A single hectare is 10000 square metres (100 m x 100 m).

Try to specify the fire size as precisely as possible. For example, "Alpha 3" refers to a fire between 0.1 and 0.2 of a hectare in size and is not specific enough to allow effective resource allocation.

A better method of communicating estimated fire size is "Alpha 3 - 0.2 ha."

Size and Distance Estimation

It can be difficult to accurately estimate fire size and distance from an aircraft. Pilots will be able to help, but you are responsible for accurate estimates. There are two common methods used for estimating distances from an aircraft including:

1. Lineal Comparison

- Use a map to check the length of a lake, runway or the distance between two roads. Compare this distance with the length of a fire flank or the distance from the fire edge to a water source or heli-spot.
- Tree heights can also be useful on smaller fires. Estimate the average tree height and use the number of tree lengths between two objects to calculate an approximate distance.

2. Distance and Size by Flight Time - to accurately determine distance on the ground you need to complete the following:

- Have the pilot set up the aircraft to fly at a pre-determined speed.
- Time the aircraft as it flies between two points on the fire perimeter.
- Calculate the length of the flight path by simple multiplication and division.

Note: If there is a strong wind that affects air speed, the wind factor must be considered, or the calculated distances will be incorrect. Fly the line between the two points in both upwind and downwind directions making note of flight times. Average the flight times and use this number when calculating the distance.

Example: Flight time on upwind length = 40 seconds
 Flight time on downwind length = 20 seconds
 Average time: $40 + 20 = 60$ then $\div 2 =$ **30 seconds**

Note: If the aircraft air speed indicator registers in 'knots' then multiply the knots by 1.852 to obtain kilometers per hour.

Distance/Time Conversion Chart					
Ground Speed	knots/hr	km/h	km/min	m/sec	feet/sec
	5	9.26	0.15	2.57	8.43
	25	46.3	0.77	12.86	42.19
	50	92.6	1.54	25.72	84.39
	75	138.9	2.32	38.58	126.59
	100	185.2	3.09	51.44	168.78
	200	370.4	6.17	102.89	337.56

The example below shows how a timed flight to distance calculation is performed on a length of fire perimeter.

Example #1: Distance by Flight Time

Speed = 220 km/h

Flight time from Point A to Point B = 30 seconds

Conversion from time to distance:

$220 \text{ km/h} \div 60 \text{ minutes} = 3.67 \text{ km/min}$ then $\div 60 \text{ seconds} = 61 \text{ m/sec}$
 $61 \text{ metres} \times 30 \text{ seconds} = 1830 \text{ metres}$

The distance from Point A to Point B is 1800 metres or 1.8 kilometres.

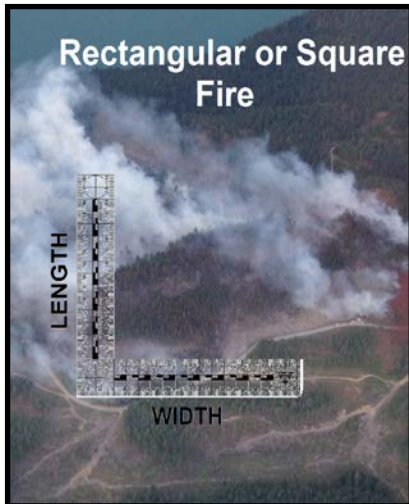
Size

The approximate size of larger fires may be determined once the methods of measuring distance are understood. To calculate fire size, you must:

- Visualize the fire as a square, rectangle or triangle.

- Fly along and measure the distance of one side (length) and one end (width) of the fire. Measure the height and base for triangle shaped fires.

The 2 examples below show how size calculations are performed on both 4-sided (square or rectangular) and 3-sided (triangular) fires.



Example #2: Size by Flight Time

Speed = 180 km/h

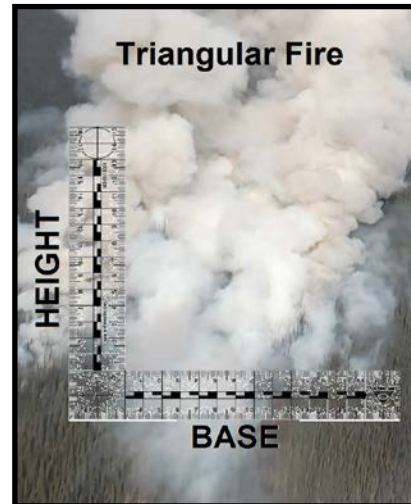
Flight time for length = 40 seconds
Flight time for width = 20 seconds

$180 \text{ km/h} = 50 \text{ m/sec} \times 40 \text{ seconds}$
 $= 2000 \text{ metres}$

$180 \text{ km/h} = 50 \text{ m/sec} \times 20 \text{ seconds}$
 $= 1000 \text{ metres}$

Area of a 4-sided object =
Length x Width

$2000 \text{ m} \times 1000 \text{ m} = 2000000 \text{ m}^2$
 $2000000 \text{ m}^2 \div 10000 \text{ m}^2 = 200 \text{ ha}$



Example #3: Size by Flight Time

Speed = 110 km/h

Flight time for height = 30 seconds
Flight time for base = 20 seconds

$110 \text{ km/h} = 30.5 \text{ m/sec} \times 30 \text{ seconds}$
 $= 915 \text{ metres}$

$110 \text{ km/h} = 30.5 \text{ m/sec} \times 20 \text{ seconds} =$
 $= 610 \text{ metres}$

Area of a 3-sided object =
Height x (1/2 x Base)

$915 \text{ m} \times (1/2 \times 610) = 279075 \text{ m}^2$
 $279075 \text{ m}^2 \div 10000 \text{ m}^2 = 27.9 \text{ ha}$

Providing an accurate estimation of fire size is not impossible for experienced firefighters. Please remember:

- A fire 100 m x 100 m is 1.0 ha in size.
- A fire 100 m x 50 m is 0.5 ha in size.
- A fire 100 m x 30 m is 0.3 ha in size.

- A fire 50 m x 50 m is 0.25 ha in size.
- A fire 50 m x 25 m is 0.125 ha in size.

BRAVO - FIRE RANK

- ☐ 1. Rank 1, Smouldering Ground Fire
- ☐ 2. Rank 2, Open Flame, No Spread
- ☐ 3. Rank 3, Vigorous Surface Fire, Moderate Spread, May See Candling
- ☐ 4. Rank 4, Moderate to Fast Spread, Short Aerial Bursts, Spotting
- ☐ 5. Rank 5, Continuous Crown Fire, Spotting Distance _ m
- ☐ 6. Rank 6, Continuous Crown Fire, Blow-up

The Fire Intensity Ranking System enables firefighters to communicate a summarized assessment of fire behavior and can be used to describe characteristics of the fire. Numbers from 1 (low) to 6 (extreme) are based on the Fire Weather Index values. The characteristics of the fire behaviour are important because this will help to dictate the number and type of resources required to suppress the wildfire.

CHARLIE - FUELS

- ☐ 1. Grass
- ☐ 2. Brush
- ☐ 3. Deciduous
- ☐ 4. Slash
- ☐ 5. Reproduction
- ☐ 6. Open Timber
- ☐ 7. Closed Timber
- ☐ 8. Other _____
- ☐ 9. FBP _____

This is a critical component of the IFR because knowing the fuel type the fire is burning in can help to determine how rapidly it will spread.

DELTA- VALUES AT RISK (Immediate Threat)

- ☐ 1. Life/Property _____
- ☐ 2. Timber (Forest) Resources (Includes Reproduction) _____
- ☐ 3. Other Special Values (Watersheds, Parks) _____

- ☐ 4. Distance _____ m, N S E W of the fire

The values at risk in this section will determine the priority of the fire for the RWCO with the **Life and Property** values being given the highest consideration.

ECHO - WIND

- ☐ 1. Calm
- ☐ 2. Speed _____ km/h
- ☐ 3. Direction N S E W

Calm	Smoke is rising straight up.
1 to 15 km/h	Smoke fans and bends slightly from a vertical to a horizontal.
16 to 30 km/h	Smoke flows with the wind direction.
30 to 74 km/h	Smoke flows parallel to ground and fire activity increases.
75 + km/h	Wind storms pushing the fire in new directions and fire will be out of control.

Wind speed and direction information is important as it directly influences fire behavior predictions.

Beaufort Scale

Beaufort Scale	Wind Speed (km/h)	Sailing Terms		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1 to 4.8	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	6.4 to 11.3	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	12.9 to 19.3	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	20.9 to 28.9	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	30.6 to 38.6	Fresh Breeze		Small trees begin to sway.
6	40.2 to 49.9	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	51.5 to 61.1	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	62.7 to 74	Fresh Gale		Twigs and small branches broken off trees.
9	75.6 to 86.9	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	88.5 to 101.4	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	103 to 115.8	Storm		Very rarely experienced on land; usually with widespread damage.
12	117.4 or Over	Hurricane Force		Violence and destruction.

NOTES:

[illegible]

FOXTROT - ADJACENT FUELS

- ☐ 1. Grass
- ☐ 2. Brush
- ☐ 3. Deciduous
- ☐ 4. Slash
- ☐ 5. Reproduction
- ☐ 6. Open Timber
- ☐ 7. Closed Timber
- ☐ 8. Other _____
- ☐ 9. FBP _____

Again, this is a significant component of the IFR because knowing the fuel types adjacent to the fire will help to determine the rates of spread and suppression priorities.

GOLF - SLOPES

- ☐ 1. Flat/Rolling
- ☐ 2. Moderate < 30 %
- ☐ 3. Steep > 30 % and < 60 %
- ☐ 4. Extreme > 60 %

10 % slope - 1 metre of vertically rise for every 10 metres of horizontal distance.

50 % slope - 1 metre of vertical rise for every 2 metres of horizontal distance.

100 % slope - 1 metre of vertical rise for every 1 metre of horizontal distance.

Slope in Degrees to Slope in Percent - Conversion Table									
Percent	0	1	10	25	40	50	100	120	200
Degrees	0	0.57	5.71	14.04	21.8	26.57	45	50.19	63.43

There are a number of ways of taking slope measurements in the field including:

- Using a clinometer - slope measuring tool.
- Distance and contour interval readings from a topographic map.
- GPS elevation comparisons.

Slope is deceiving from the air and mountainous terrain will usually look flatter than it does from the ground. Steep slopes limit helicopter capabilities and heavy equipment options. Always double check slope estimates while on wildfires to ensure safe working conditions (slope = rise/run).

Slope is measured as a percent, in degrees or as a ratio. The BC Wildfire Service uses percentages because it is easier to calculate in the field. Slope can be measured in degrees, but the two methods are different and should not be confused. For example, a 50 percent slope means 50 metres of rise in 100 metres of horizontal distance (2:1 ratio or 26.6°).

If you are performing your fire assessment from the ground, an estimate of slope can be checked by a clinometer. When you are performing your fire assessment from the air, you will find it easier to estimate slope during a lower pass over the wildfire.



HOTEL - ASPECT

- ☐ 1. North
- ☐ 2. South
- ☐ 3. East
- ☐ 4. West

The south and southwest aspects will have fine, flashy fuels that dry out rapidly due to the long durations of direct sunlight, which results in an increase in fire activity.

**INDIA - SLOPE POSITION**

- ☐ 1. Bottom
- ☐ 2. Lower Third
- ☐ 3. Middle Third
- ☐ 4. Upper Third
- ☐ 5. Top

The fire's position on a slope will indicate fuel type and timber values as well as fire potential. In addition, slope position serves as a location reference.

JULIET - ACCESS

- ☐ 1. Road _____ m
- ☐ 2. Heli-spot _____ m
- ☐ 3. Hover Exit _____ m
- ☐ 4. Other _____ m
- ☐ 5. N S E W of the fire

The distance and direction from the fire should be noted during the IFR. Natural or constructed openings make good heli-spots and old fires in the area may already have heli-spots cleared. Large clearings close to the fire that have good road access can be used as 'staging areas' for crews and equipment to gather at for briefings. If there are no obvious access sites, note the fire as a possible rappel target.

KILO - AVAILABLE WATER

- ☐ 1. None
- ☐ 2. Adjacent
- ☐ 3. _____ m N S E W of the fire

The availability of water and proximity to the fire will determine water delivery options. This may also influence the possible fire camp locations.

Indicate the source and potential supply issues (e.g. a small pond, a large creek, etc.). Indicate the distance from the fire to the water source as well as the difference in elevation from the source to the top of the fire.

Check water sources for use with portable pumps and as a fill site for tenders. Any water source within a kilometre (1000 m) of the fire should be noted.

Small streams are difficult to see from the air; however, patches or a string of deciduous growth, spruce or cedar that differs from the rest of the timber in that stand could indicate a water source.



LIMA - PAPER TRAILED

- ☐ 1. Yes
- ☐ 2. No

All fires should be paper trailed unless they are large and there is no doubt that ground crews will find them. Paper trailing will assist additional resources in locating fires that do not produce as much smoke, and this will also inform other aircraft that a fire has been discovered and reported.

MIKE - PHOTOS

- ☐ 1. Yes
- ☐ 2. No

Photos are valuable for fire behaviour analysis and fire cause investigation.

NOVEMBER - SUSPECTED FIRE CAUSE

- ☐ 1. Human
- ☐ 2. Lightning

Determining the cause of the fire is extremely important for Fire Centre staff when billing for the incident. If it is a human caused fire, the point of origin should be barricaded once it has been located.

ACTION TAKEN/RECOMMENDED

PROBABILITY OF SUCCESS: LOW _____ MED _____ HIGH _____

This section is extremely important and should not be overlooked. The RWCO and ZWCO need to be informed about what resources are required to suppress a new wildfire or if suppression efforts are necessary at all.

Incident Number

Get the number of the incident from the Fire Centre when you report it. This serves as positive identification of the report should there be any questions later. Complete incident numbers will be provided by the dispatch staff.



The Fire Assessment

Fire Assessment Considerations

The Initial Fire Report (IFR) is a way of communicating information about a new wildfire to Duty Officers.

Fire assessments are another method of communicating this information and can be included in the IFR or communicated separately. Fire assessments are completed and provided to the Fire Centre as required (e.g. after any significant change in the fire situation).

The following items should be considered when preparing a fire assessment. An experienced firefighter will prepare a personal 'fire assessment checklist' with the key items written down to assist getting ready for the fire assessment efficiently and accurately.

Fire Assessment Checklist

1. Update the basic information on the fire

Provide any section of the IFR information that has changed since the original was completed.

2. Provide a summary of fire suppression activities

This information is critical for Duty Officers. An accurate and thorough summary of ongoing suppression activities should be provided and updated regularly, or whenever there is a change in the fire situation. Consider the following:

- **Resources on the fire** - firefighters, equipment, dozers, skidders, tenders, pumps, helicopters, etc.
- **Control line locations and types** - hand or machine line and retardant line, roads or natural breaks.
- **Resources required** - what resources will be needed to suppress the fire.
- **Control problems (resistance to control)**
 - burn conditions, line resistance, equipment breakdowns and crew limitations
 - capabilities, fatigue, equipment, etc.
- **Anticipated time of control** - provide estimates on time of control, time of mop-up and time to pick up the crew.
- **Recommended action in the event of initial attack failure** - if initial attack failure appears likely then ask for help.



3. Safety Concerns

Danger areas: dangerous trees, rolling rocks, cliffs, terrain traps, rivers, etc.

Look Outs should be in place, control lines need to start from **Anchor Points**, a **Communications** plan should be developed, **Escape Routes** that lead to adequate **Safety Zones** must always be noted in case firefighters and equipment are threatened by sudden changes in fire behaviour.

On small fires with poor communication links - safety check in times should be established with the Fire Centre by using an aircraft to relay information. These are established times when aircraft will fly over the fire and serve as a communication link to the dispatchers.

4. Resource Request Considerations

Determining what resources are required to suppress a fire is 1 of the fundamental tasks of fire assessment. The following points should be considered:

- **Attempt to meet the control objective** - keep the fire small and minimize the cost (including damages) by controlling the fire before the next day's burning period has started. The fire assessment you provide is important to the decision-making process, but the final decision regarding fire control action rests with the Duty Officer.
- **Anticipate fire behavior** - consider not only what the fire is doing now, but what it may do over the next several hours. Understand that the resources requested may not be available - be flexible and innovative.

For example: Initial assessment of the fire suggests that eight to ten firefighters will be required. The ZWCO informs you that it will take four hours to get these resources to the fireline. By anticipating fire behavior, you may instead choose to recommend that a larger crew and aircraft support should be committed to the fire. If you assess a fire as requiring 20 firefighters and the RWCO informs you that it will take three hours to get the cats to the fire, you may choose to recommend that 40 firefighters be used. **Delays in receiving resources depend on fire location and access as well as resource availability.**



- **Make your resource requests complete** - consider what equipment will be required to support crews and what crews will be required to support equipment.

For example: If a helicopter is required on a fire, ensure that all required accessories (e.g. heli-torch and long line) are requested at the same time. Similarly, if 50 firefighters are required, ensure that sufficient hand tools, supervisory and first aid support are available for the fire.

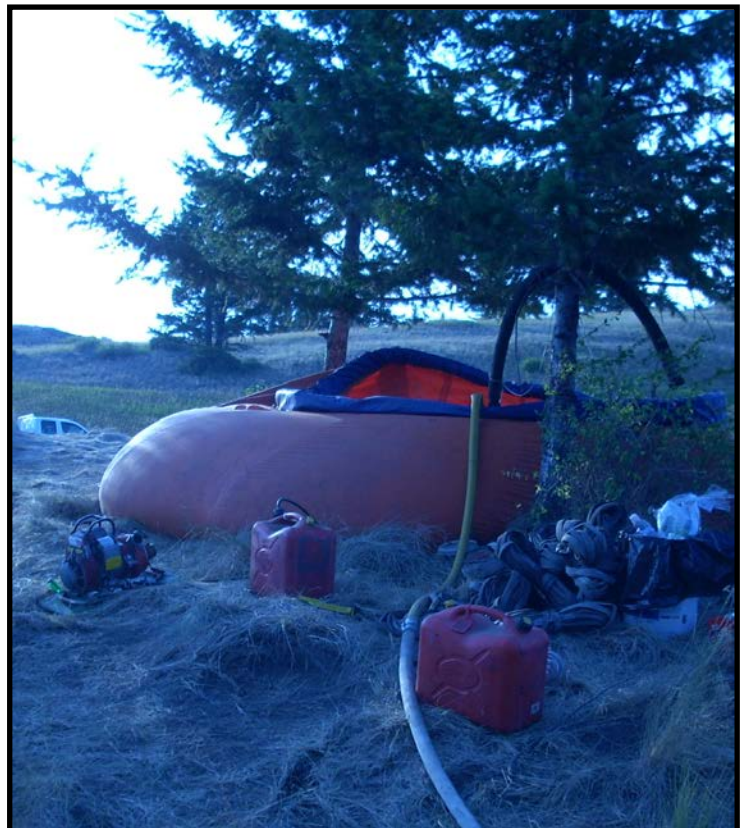
- **Fight the fire aggressively**
An important rule of firefighting is to action a wildfire aggressively, but a safety-first attitude need to be employed. Experienced fire personnel will make sure that sufficient firefighters and equipment are provided to fight the fire aggressively when determining resource requirements.

A request for six firefighters may result in a fire requiring three days to mop-up. More experienced fire personnel would request 20 firefighters that could mop-up the fire in one day. Failure to provide adequate resources may compromise safe work procedures. Overworked crews will become fatigued and are more likely to suffer an increased number of accidents and injuries.

Estimating Resource Requirements

Water Delivery Systems - consider the following:

- Elevation gains (water sources to the top of the fire).
- Number of pumps (1 pump - operator probably not required or multiple pumps - 1 or more operators required)
- General rule: 3 firefighters per nozzle - 1 nozzle person, 1 hose handler/grubber, 1 grubber.
- Difficult terrain and ground cover will require larger crews.



Water Tenders/Skidder with Tanks - consider the following:

- 5 firefighters - 1 pump operator, 1 nozzle with shut off ability, 1 hose handler, 2 firefighters with hand tools.

Dozers and Excavators- consider the following:

- Availability (time to arrive at fire and access).
- Machine ability (terrain, rocks, swamps, steep slopes, etc.).
- Environmental sensitivity (domestic watershed, riparian zones, streams, aesthetics, etc.)
- Number of machines (2 dozers and 1 excavator per flank).
- Line locators (1 per flank, 2 in steep terrain and at night).
- Burn out and suppression crews (crew size is a function of control line resistance, fuel loading and time of day).



Control Line Resistance

Numerous saw operators and swampers will be required in fuel types with slash and blow down. Steep, rocky or swampy ground will also slow down control line production.

Are air tankers required?

Air tanker support can be extremely useful on initial attack fires. There are no tools that can slow down a fire in as rapid a fashion as air tankers dropping retardant or water on a fire.

However, air tankers may have a considerable lag time following an air tanker request and these machines are ineffective by the time a fire is out of control.

“It is better to be safe than sorry” is a good policy for air tanker requests. Air tankers, unlike wildfires, can always be sent back.

The decision to request air tankers is made after considering the following points:

- **What information was obtained during your daily preparation and safety briefing?**
- What are the indices - Fuel Moisture Codes and Fire Behavior Indexes?
- What is the fire weather forecast?
- What is the current fire behavior being experienced in the area?
- It is important to have this information available as it will influence your assessment.
- If you do not have the indices and weather information, request this information from the Fire Centre.

Consider the fire rate of spread.

- Compare how the situation has changed from the initial reports (provided by lookouts, IA crews or aircraft in the area) to present.
- If a fire is spreading quickly, ground crews will need air tanker support to enable them to establish and hold control lines.
- Even if fire spread is not rapid, the decision to use air tankers may be made if the fire is threatening to spread into problem fuel types or areas with poor access.



Access factors for ground resources.

- Consider access factors for ground crews and heavy equipment. Air tanker action can support crews already on the fire or it may contain a fire until these crews arrive. Retardant drops rarely extinguish a fire completely and will only slow the rate of spread on moderate to high intensity fires.

The temporary advantage gained by a retardant drop will be wasted unless ground crews follow up with aggressive control actions. Always provide for ground crew objectives in your resource requests if air tankers are utilized.

**Multiple fire starts.**

- Several small fires may be located in the same general area. Air tankers are often an ideal solution in these situations because a drop can be split between two fires.
- Consider all of the factors mentioned above and apply some common sense. If you think you need air tankers, then you probably do.

Helicopter Bucketing vs. Air Tanker Drops

The decision to use helicopter bucketing is based on several factors. Bucketing will not impact fire behavior to the same extent as air tanker drops. A helicopter bucket delivers a smaller quantity of water with varying amounts of time lapse between drops due to the location of sufficient water sources.

For example: An intermediate helicopter will deliver 210 gallons (795 litres) of water to the fire compared with an air tanker group - 4 AT 802 Fire Boss Aircraft @ 800 gallons (3028 litres) each or 2 L-188 C Electra with 3300 gallons (12500 litres) - delivering long term retardant or water.



Using a six minute turnaround time for the helicopter and considering that an air tanker group may be able to deliver retardant drops on an average of once per hour we can make the following comparison:

- **Intermediate Helicopter** - 210 gallons x 10 turnarounds/hour
= **2100 gallons** of water or foam per hour
- **Land Based Air Tanker** - 3300 gallons x 1 drop/hour
= **3300 gallons** of retardant, water or foam per hour

Bucketing can be an effective initial attack option when fires are small and the distance to a water source (bucket turnaround times) is reasonable. An advantage of bucketing is that buckets are usually carried with the helicopter that delivers ground crews to the fire thus the buckets can be used immediately.

Helicopter Bucketing Guidelines: Various criteria (status of fire, previous air tanker action, estimated time/costs, etc.) are established for the use of helicopter bucketing. Firefighters performing fire assessments should be familiar with these guidelines for helicopter bucket use.



The Fire Sketch

A sketch of the fire is important and should form a part of any fire assessment on larger and more complex fires. It will assist you in keeping fire information organized and is very useful when briefing fire suppression crews.

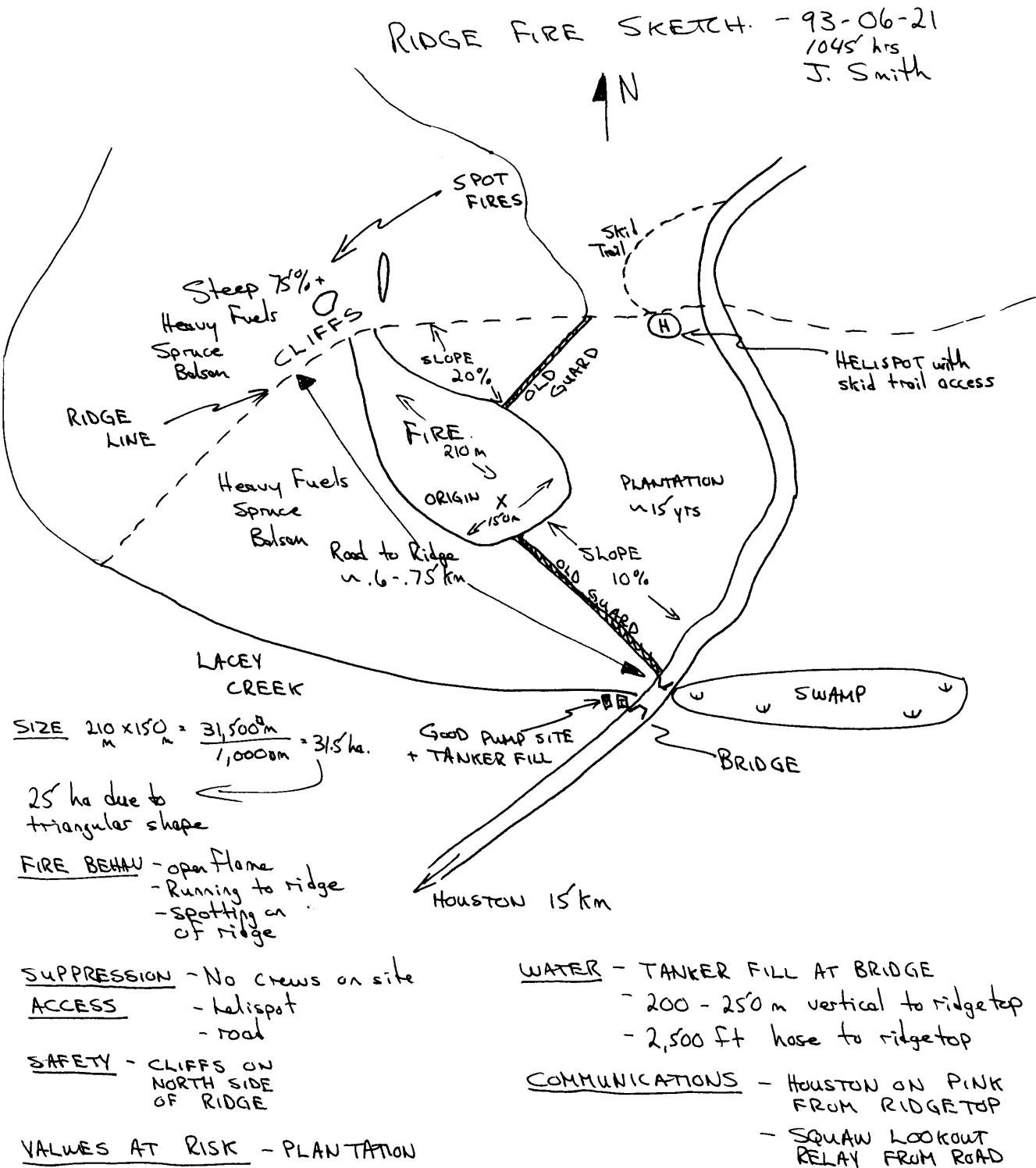
Procedure for Making a Fire Sketch

- Use a piece of plain paper attached to a clipboard.
- List the items to be recorded on the left side of the paper.
- Orient North and South directions and look for some obvious topographical landmarks at or near the fire (e.g. creeks, roads, lakes, rock slides, ridges, etc.).
- Draw a North arrow on the sketch paper.
- Draw in two or more of the topographical features on the sketch showing them in approximate relation to North, South, East or West. Mark the estimated distance between each.
- Draw the fire perimeter in relation to these topographical features.
- Draw in other significant items around the fire perimeter which pertain to fire control including water sources, natural breaks, fuel types, point of origin, etc.
- Do not try to complete all of the features mentioned above in 1 circuit of the fire. It is too fast and too confusing. Circle the fire two or three times and do the sketching in the sequence described.
- Outlining the fire perimeter on a topographical map is also effective.

Debriefing Process

An important part of fire assessment training is the debriefing process. This can be done during a general fire debrief or After Action Review on smaller incidents.

An experienced firefighter will contact the users of your fire assessment (e.g. Duty Officers, AAO, Initial Attack Crew Leaders, Crew Supervisors, etc.) after the fire has been actioned and solicit comments from these individuals as to the quality and accuracy of the assessment.



NOTES:

[illegible]