EuroFire

Unit EF4: **Training : Apply Hand Tools to Control Vegetation Fires**

Introduction:

These training materials support the EuroFire Level 2 competency standard **EF4 Apply hand tools to control vegetation fires.**

This document is for people who are required to use hand tools to manage vegetation fires. It is for situations where: the fire management operation is simple, the level of risk, complexity and fire behaviour is low and the operator is under direct supervision.

All national and local laws relating to fire management techniques must be followed. In addition local landowners may need to be consulted or give their approval before operations takes place.

The training for this unit may be delivered through a combination of formal training, mentoring and coaching. Self-learning should be restricted to knowledge and understanding of the material and not practical application, which must only be carried out under direct supervision.

The nominal/notional/guided learning hours for this unit is 10 - 20 hours.

EuroFire is a pilot project. The training material will be evaluated as part of an on-going process. A feedback form is included on the website www.euro-fire.eu

The target audience for this material are the people who work in fire services, farming, forestry, game management, conservation, range land and recreation management who have a role assisting with the management of vegetation fires, either on a full or part-time basis.

Relationship with EuroFire competency standards

Reference to the EuroFire competency standards should be made to understand the full range of expected learning outcomes. The sections of the standards are: unit title, element title(s), about this unit, key words and phrases, what you must be able to do, this element covers, and what you must know and understand.

The support materials for all the EuroFire competency standards are designed to support a flexible approach to training delivery. They can be adapted or modified to suit a particular target audience. The learning material for this unit should be used with the support materials for other units to ensure all learning outcomes in the standards are covered.

There are various European Union Safety Directives which have been enacted as specific Health and Safety legislation in each country in the EU. This legislation is designed to improve workplace safety and health and reduce work related accidents and diseases. All necessary safety legislation, risk management policies and procedures, for your location, agency or organisation must be followed.

Preparatory (pre-requisite) learning:

EF 1 - Ensure that your actions in the vegetation fire workplace reduce the risks to yourself and others
EF 2 - Apply techniques and tactics to control vegetation fire.

Complimentary (co-requisite) learning:

EF 3 - Communicate within a team and with supervisors at vegetation fires (to be developed)
EF 5 - Control vegetation fires using pumped water (to be developed)

Learning objectives:

- Prepare hand tools for vegetation fire control activities
- Carry out vegetation fire control operations using hand tools

Keywords and phrases:

Anchor Point, Control Line, Hand Tools, Type Of Combustion, Type Of Vegetation, Type Of Fire

Application:

Hand tools are used in fire management operations. For level 2 training the following activities are covered:

- Direct Attack
- Control line construction
- Mop-up

Some standard hand tools can be extremely effective in fire fighting activities.
Hand tools are mainly used to construct fire line. It is very important to choose the correct tool for different fuel types. Several have multiple uses, while some are intended for specific tasks only.

There are digging, cutting, scraping,, spraying and smothering, tools. Each tool has a specific application.

Table 1: Types of tools

Digging	Scraping	Cutting	Spraying	Smothering
Shovel Spade Mattock Gorguis	Rake Hoe McLeod Gorguis	Axe Pulaski Gorguis Slasher Brush Hook	Knapsack	Fire Beater Spade Shovel

Methods of Extinguishment

Cutting off the oxygen supply - Reducing the temperature - Removing the fuel

There are basically three methods of extinguishing a fire, each designed to break the fire triangle. You can:

1. Cut off the oxygen supply to **SMOTHER** the fire
2. Reduce the temperature to **COOL** the fire
3. Remove the fuel from the path of the fire to **STARVE** the fire

or Use a **COMBINATION** of these methods to extinguish a fire.

Illustration EF2 2.4 Broken fire triangle (fuel)

The operations that involve digging, cutting, and scraping break the fire triangle by separating the heat from the fuels. Spraying works by cooling the fire and smothering by removing the oxygen.

Table 2: Flame length, tactics and techniques guidelines

Flame Length (m)	Significance
0 – 0.5	Fires generally self extinguish
0.5 – 1.5	Fire intensity low Hand tools can be used in direct attack to control the fire
1.5 – 2.5	Fire too intense for direct attack with hand tools Pumped water or bulldozers may be needed Flanking / parallel attack recommended
2.5 – 3.5	Fire too intense for direct attack from control line Helicopters & fixed wing aircraft drops may be needed Flanking / parallel attack depending on local flame length
3.5 – 8	Very intense fire Backburning and backfiring may knockdown the head fire Flanking / parallel and indirect attack recommended depending on local flame length
8m+	Extreme fire behaviour Defensive strategies recommended

*The highlighted box indicates the range of flame lengths that hand tools can be used to control a fire, either in direct or indirect attack.

There are four phases of fire suppression that will occur on any wildfire incident. These phases are commonly known as knockdown, containment, control, and mop up and patrol.

• **Knockdown** is the initial suppression work aimed at reducing the fire's intensity and slowing or stopping fire spread. Implies that the foreseeable danger of the wildfire has been significantly reduced.

• **Containment** is attained when a control line has been established around the perimeter of the fire and stopped further growth.

• **Controlling** a fire means that the control lines have been improved and secured to the degree that there is no foreseeable chance of the fire escaping.

• **Mop up and Patrol** commences after the fire has been controlled and involves extinguishing the burning area until there is no possibility of re-ignition. Patrolling the perimeter of the fire will help to ensure that the fire will not escape outside of the control lines. A fire can be called "out" after the completion of this phase.

Each phase of fire suppression is equally as important as the others. The key issue is to avoid re-ignition. There are significant dangers that need to be avoided. For example re-ignition occurring in areas thought to be extinguished, a fire driven by wind could threaten crews who have moved ahead. Another example is where there are hotspots near a control line that flare-up and the fire jumps the fireline.

Fitness:

Using hand tools in fire fighting operations is likely to be a strenuous activity requiring strength, flexibility, fitness and endurance from the operator.

You need to follow your organisations guidance on the level of fitness required for manual work.

Handtools

Each hand tool is designed to achieve a particular effect in the most efficient way. Often it is best to work in a team with a variety of hand tools so that different vegetation types and ground conditions can be tackled effectively.

A number of tools can be used for more than one purpose, especially the McLeod rake hoe and the Gorgui combination tool.

The fuel types that hand tools are suitable for include: small trees, shrubs, branches, grasses, stumps, roots and peat.

Description and handling of selected hand tools in fire control:

Axe / Brush Hook:

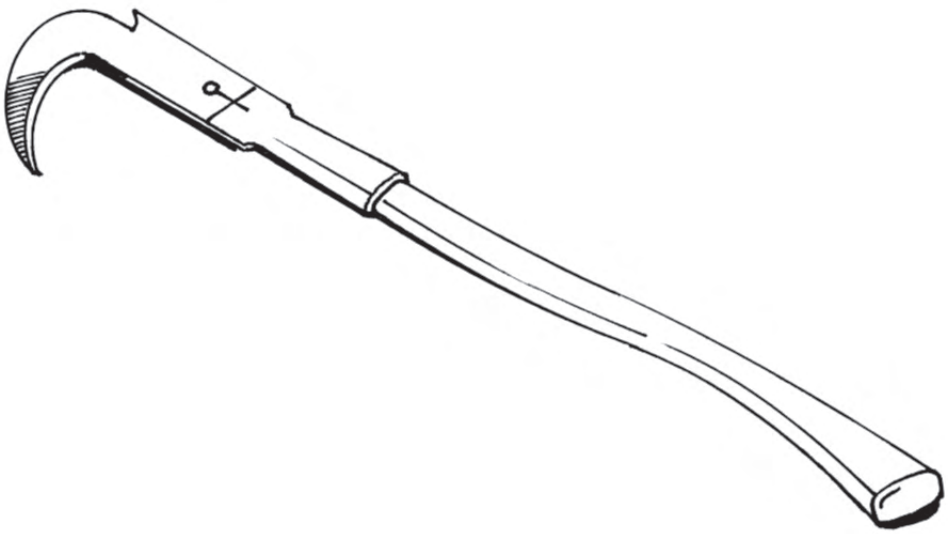

Illustration 1.1 Brush Hook

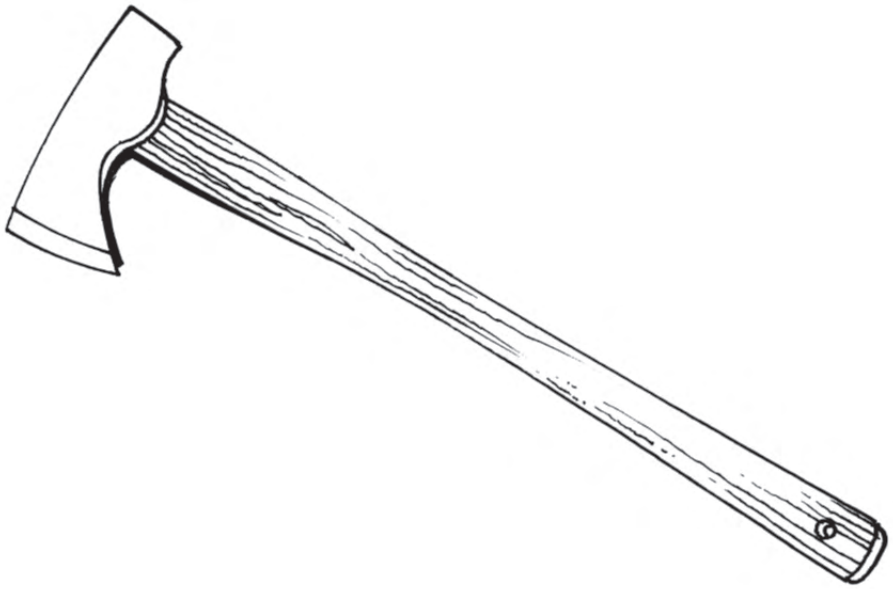

Illustration 1.1a Axe

The axe and the slasher are often used for clearing the initial path through vegetation and in mopping up operations. They can be used for:

- Cutting down small trees and removing branches
- Clearing areas of ground of short vegetation
- Removing embers and splitting logs, allowing them to cool down
- Removing stumps

Care must be taken not to abuse these tools and to sharpen them after use.

Fire Beater / Swatter:

Fire beaters are often used to:

- Knock down low intensity fires in direct attack on the fire edge
- Often used in flanking attack

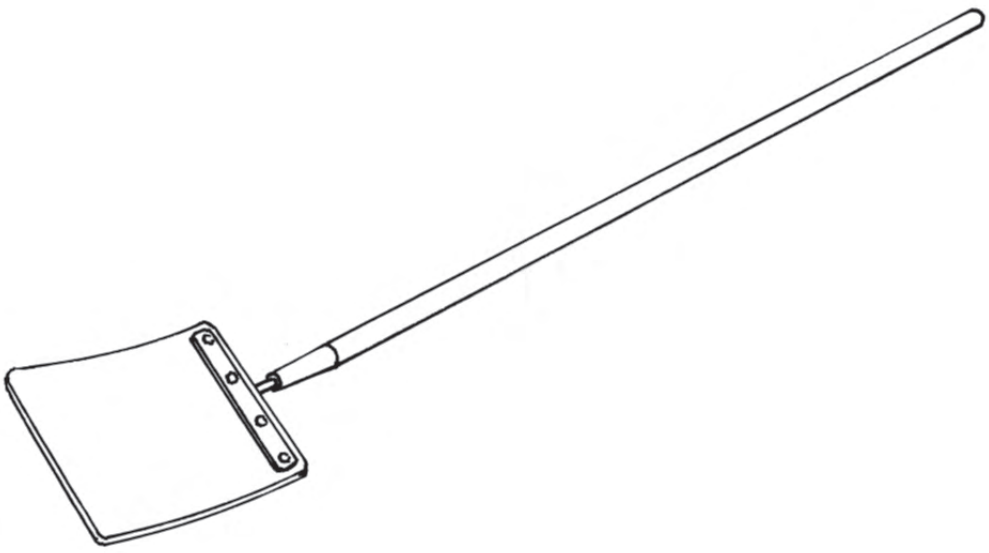

Illustration 1.4 Fire Beater - Flap head

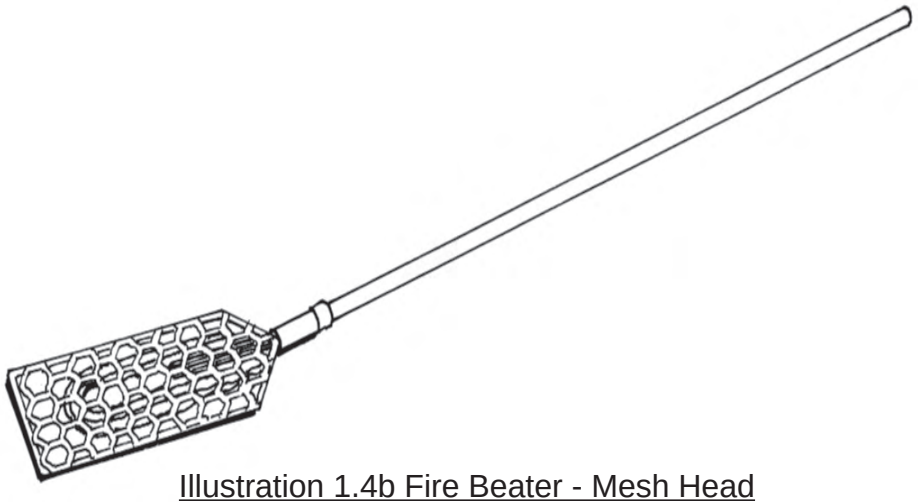

Illustration 1.4b Fire Beater - Mesh Head

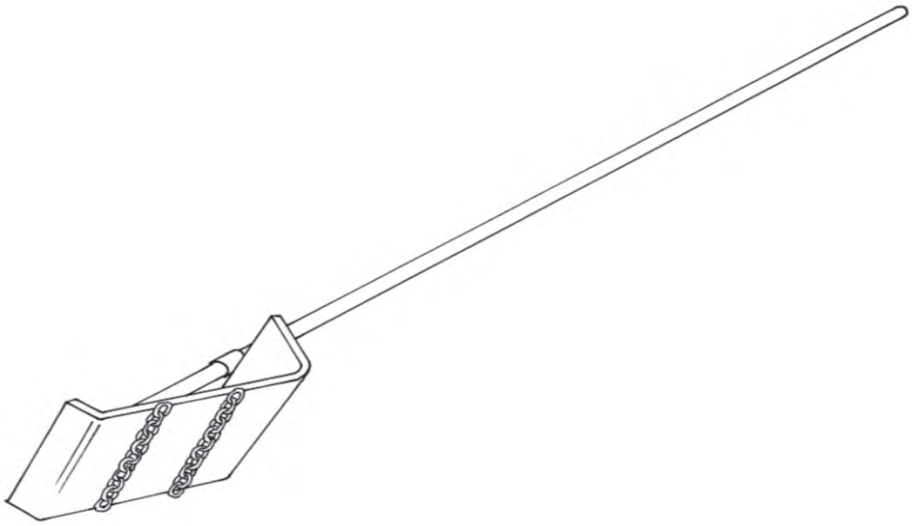

Illustration 1.4c Fire Beater - Metal Plate

The fire beater is a large flap of rubber, plastic or metal material attached to a long, straight handle. The user swats the flames with the flat side of the swatter, depriving the fire of oxygen.

The radiant heat from a fire reduces with distance. It is important to have a long handle to minimise heat exposure.

The fire beater is often used with light “pattings”, or by dragging it directly on and along the fire edge in a scrubbing action. Hard, vertical swatting can fan the fire causing hot embers to spring back to life, spreading the fire instead of putting it out.

If flap head fire beaters are used in a team, overlapping them and working them in a rhythm, they are extremely effective in light fuels, like grass. Alternatively working in pairs alternating strokes with hits from the mesh head or the scrubbing action can also work well.

The different types of firebeaters have evolved to suit common local vegetation and fire types. The Flap head fire beaters work well on grass. Mesh head and metal plates beaters work best on shrub fuels.

However choose your firebeater carefully because features that make one design suitable for one situation can make it unsuitable for another. For example mesh head and plate head beaters with scrubbing chains attached should not be used on grass as burning embers get caught and they can spread the fire. Flap head firebeaters made of rubber can burn up and can fan the fire rather than putting it out, in more intense shrub fires

When the flames are above the range recommended (1.5 metres) in Table 2 for hand tools, you should stop and re-assess the tools and tactics you are applying. Other situations that may need a re-assessment are if the conditions are very dry. In these situations, using beaters and water from knapsack sprayers together, can be very effective. Often the most effective technique is to spray the water on the vegetation immediately in front of the fire beaters. This often reduces fire intensity to a level that the firebeaters can cope with.

Digging, scraping and cutting tools.

Grub-Axe / Mattock / Pulaski

The Grub Axe and Mattock are forestry tools that can be used for fire fighting. The Pulaski is a specialised firefighting tool. These tools are well suited to areas with: tussocky grass, rocks, logs, stumps, roots and peat. They are used in all 4 phases of fire suppression.

These tools are used for:

- Direct and flanking attack on low intensity fires
- Parallel and indirect attack on medium and high intensity fires
- Clearing firelines and control lines of vegetation, branches and plant litter, roots and peat.
- Containment and mopping up work breaking up hotspots and burning embers

Illustration 1.2 Grub-Axe

Illustration 1.2a Mattock

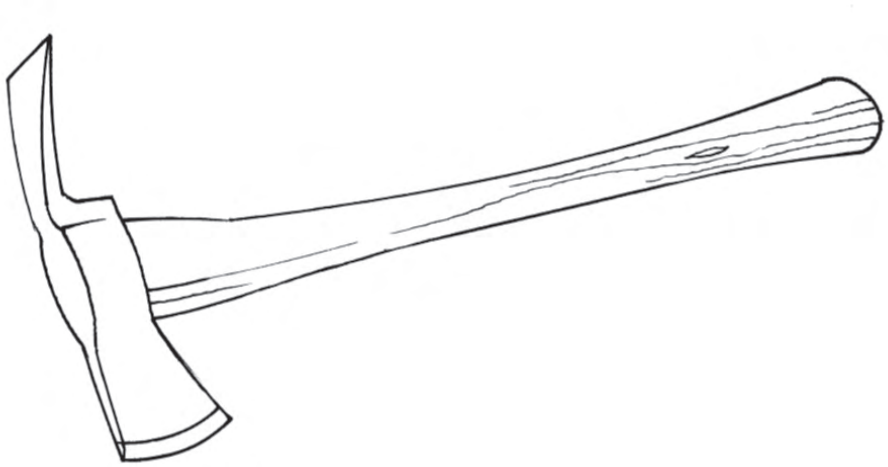

Illustration 1.3 Pulaski

Rake Hoe - The McLeod:

These are raking, scraping and chipping tools useful for light fuels, bark and litter. The rake hoe is equipped with prongs on one side for raking and a sharpened edge for cutting, chipping and scraping down to mineral soil.

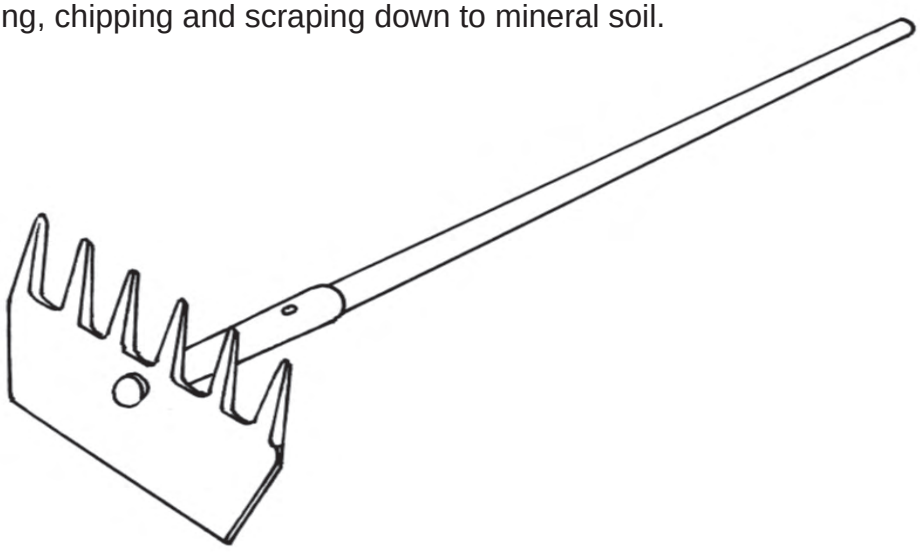

Illustration 1.5McLeod Rakehoe

Combination Tool - Gorgui

The Gorgui combination tool is a tool exclusively designed for fighting wildfires. It combines the functions of Pulaski, McLeod, axe and pick-axe. It can therefore dig, scrape and cut.

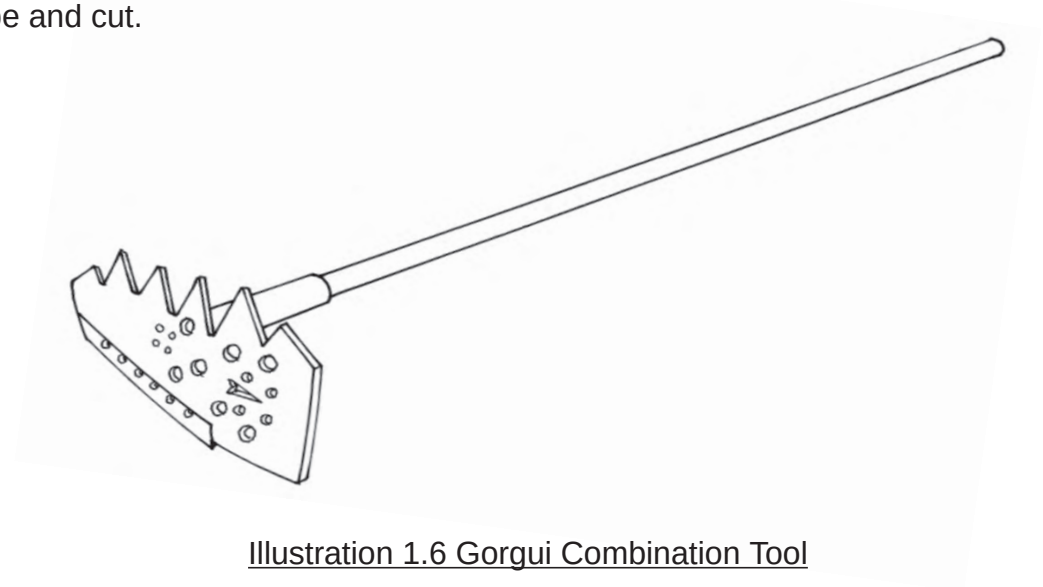

Illustration 1.6 Gorgui Combination Tool

Its principal characteristic is its versatility. It combines some of the most common tools used in firefighting in a single tool and so can cope with a variety of vegetation types and ground conditions.

Knapsack:

Illustration 1.7 Knapsack sprayer

A knapsack is a portable spray pump containing up to 20 litres of water and fitted with shoulder straps for carrying on the back. It has a hand operated force pump which can be used to deliver water either as a jet or a spray. Most modern knapsacks have flexible rather than hard containers. On the fireground you can use a knapsack to:

- Make a direct attack on a low intensity fire
- Support hand crew who are constructing line close to the fires edge
- Assist in mop-up operations

The hand piece has a nozzle which can be adjusted to give a straight jet for distance work or a spray for close work.

Care should be taken when loading the sprayer on to your back. If possible ask a “buddy” to help you. Caution is also needed when operating in rough terrain or steep slopes where there is a danger of losing your balance by tripping or falling.

Prepare hand tools for vegetation fire control activities

Tool inspection, Sharpening and Handle care

Each time you pick up a hand tool, inspect it to make sure that it is in good condition and safe for you to use. Examine all the parts of the tool to make sure they are not loose, cracked or broken. Make sure the blade is sharp. Make sure the tool is properly assembled and that you have any accessories you will need to properly use the tool. Test the handle by placing the head on the ground, the handle at a 45-degree angle, and applying firm, downward pressure.

Most hand tools should be sharpened by hand with a file.

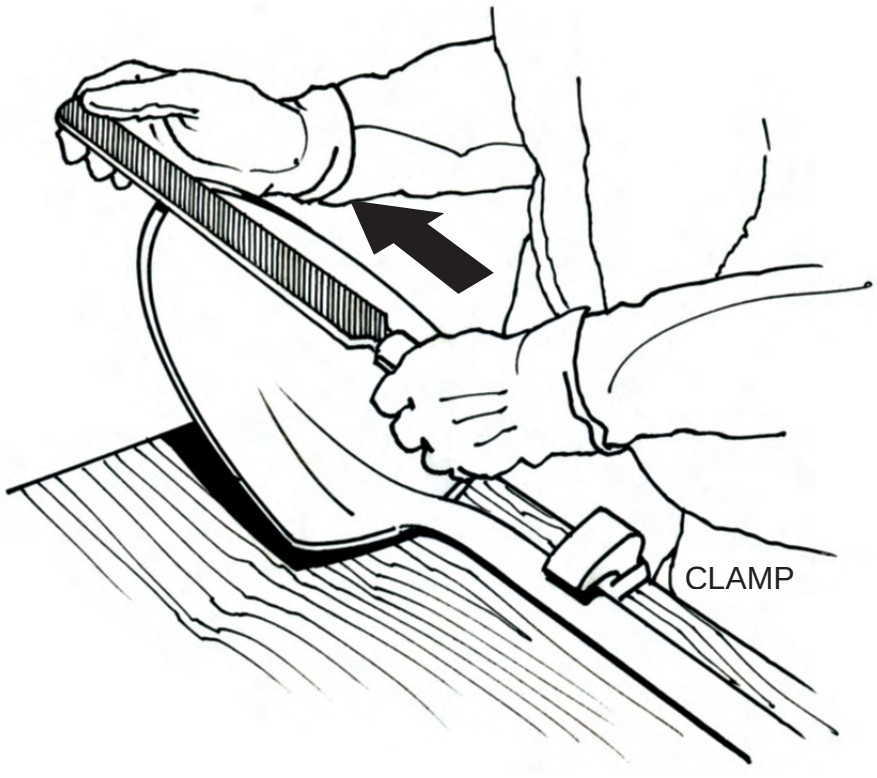

Illustration 2.1 Maintaining a shovel

- Always follow the correct procedure and use proper safety equipment when sharpening hand tools.
- Use a flat file with a safety guard to sharpen hand tools.
- Wear gloves
- Make all strokes with the file in a forward motion, holding the file at the same angle for each stroke.
- Use long, smooth strokes, applying even pressure, and releasing the pressure on the backstroke.
- When sharpening axes, Pulaski's, and brush hooks, the filing direction should always be away from the eye toward the cutting edge to reduce the chance of injury.
- Clean the file with a wire brush or file card between uses.
- Protect the edge with masking tape. This will protect the edge from damage while in storage. You can also use boxes, old fire hose, sheaths, old inner tubes and conveyor belt to protect the tools while in storage.
- When storing the tools on a vehicle, be sure the safety guards are properly secured and placed in the proper compartment. If they are to be transported by aircraft, be sure they are properly bundled.

Many tool handles are made of wood, which is light and strong, easy to use and inexpensive. Wood handles need to be properly maintained to extend their useful life and make them safe for the user.

- Handles should be smooth and free of burs, splinters and cracks. Sand rough handles smooth, and treat with a light coat of boiled linseed oil as a preservative. Never paint or varnish the tool handle.
- Handles that are bent, cracked, splintered or otherwise damaged should be replaced before the tool is used again. Some tools may have handles made of metal, fibreglass, or other synthetic material that may require different care.
- Tool heads should be tight on the handles. Use metal wedges to tighten tool handles on heads.

When carrying hand tools:

- Carry them close to your body with handles parallel to the ground.
- Do not carry them over your shoulder. If you swing a tool around it may strike another person or if you slip it may cause you serious injury.
- You should carry tools on the downhill side when walking on steep side slopes. This way if your feet slip out from under you will fall on the hill and not on the tool.

Safety

Hand tools are simple and effective, but can be dangerous if used carelessly.

To decrease the risk of injury:

1. Preparation

- Use the right tool for the job
- Ensure handles fit tightly and are free of splinters - do not use damaged tools
- Use a file with a handle to keep cutting edges sharp - blunt tools are ineffective and dangerous
- Cover cutting edges when not in use

2. Travel to the job

- Pass tools handle first
- Keep 3 metres apart when carrying tools to the task
- Carry tools at the balance point of the handle alongside the body with the blade forward and the cutting edge facing away from the body
- Secure tools when transporting

3. Using hand tools safely

- Use tools only for their intended purpose
- Work at least 3 metres apart
- Check your backswing and impact area is clear
- Remove overhanging limbs that might interfere when swinging the tool
- Be especially careful on hillsides
- When not in use, stand the tool upright, with the blade in soil

4. Efficient use of hand tools

- Have a firm grip on the handle and secure footing
- Use a natural balanced stance with room to swing the tool
- Start the movement by bending your knees and drawing the hand tool towards your body
- Maintain a firm grip on the end of the handle with one hand
- With the other hand, hold the handle close to the head (weight) on the pick-up / up-swing movement
- Control the power of your back-swing so that you do not lose your balance and footing
- On the down-swing move your hold down the handle away from the head and grip firmly with both hands
- Focus your effort on placing the head (weight) accurately on the desired point of impact
- Use good timing and technique to minimise fatigue
- Similar actions are used for grubbing, hoeing and raking but there is less movement because the hand tool is kept in front of the body.

5. After Use

- Cover cutting edges when not in use
- Do not leave tools where they can be stepped on
- Check that the tool is in good working order before returning to storage

Control Line / Fireline Construction

Control line is a comprehensive term used for all the constructed on naturally existing fire barriers and treated fire edges used to control the fire. Some examples of existing control lines include; streams, lakes, ponds, rock slides, areas of sparse fuels, roads, canals or previously burned (cold) fireline.

Fireline refers to any cleared strips or portion of a control line from which flammable material has been removed by scraping or digging down to mineral soil. A fireline is constructed for two purposes: to create a “safe strip” from which to start burning out to remove fuels between the fireline and advancing fire; and to isolate the burned area from the unburned area. The goal is to create a gap in the flammable materials which prevents the fire from continuing to spread. Fireline can be constructed using hand tools or mechanized equipment.

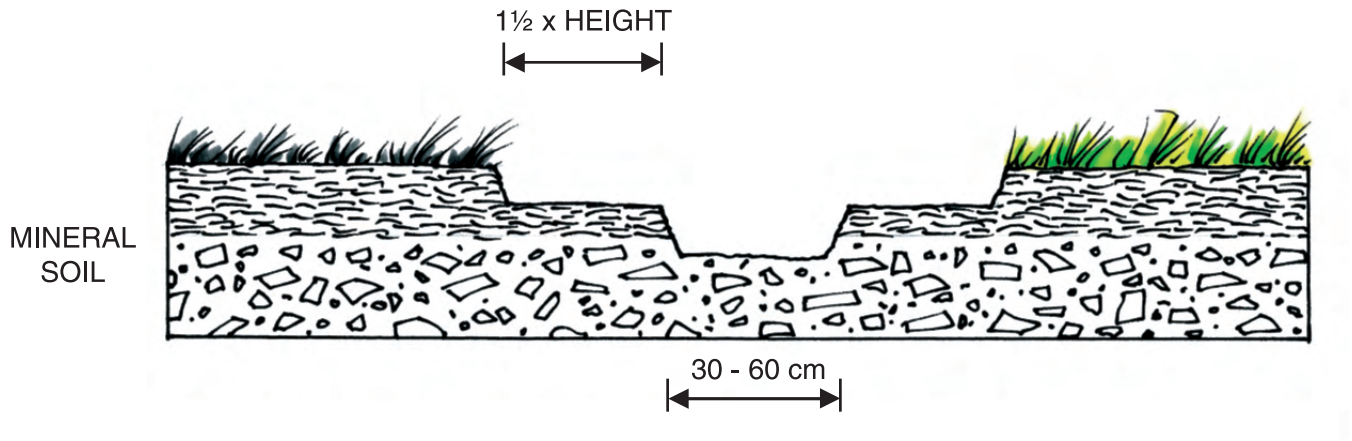

Illustration 3.1 Fireline construction - Separating fuels down to mineral soil

Any control line must be commenced at an anchor point. This is an existing area of low fuel (i.e. a road or track, rocky area, substantial stream or already burnt ground) that will prevent the fire burning around the end of the constructed control line. The anchor point should also provide a safety zone for firefighters in the event of a significant increase in fire intensity.

Basic fireline construction technique: 3 - 8 firefighters work as a team to:

Step	Action
1	Cut the vegetation at ground level.
2	Move cut vegetation away from the fire edge.
3	Scrape away surface fuels.
4	Cut into the duff layer.
5	Remove duff fuels.
6	Expose to mineral soil.

Constructing fireline in a team

When working as part of a team to construct fireline each person in the team either cuts, digs or scrapes vegetation or other fuel away to dig a line down to mineral soil (see illustration 3.2).

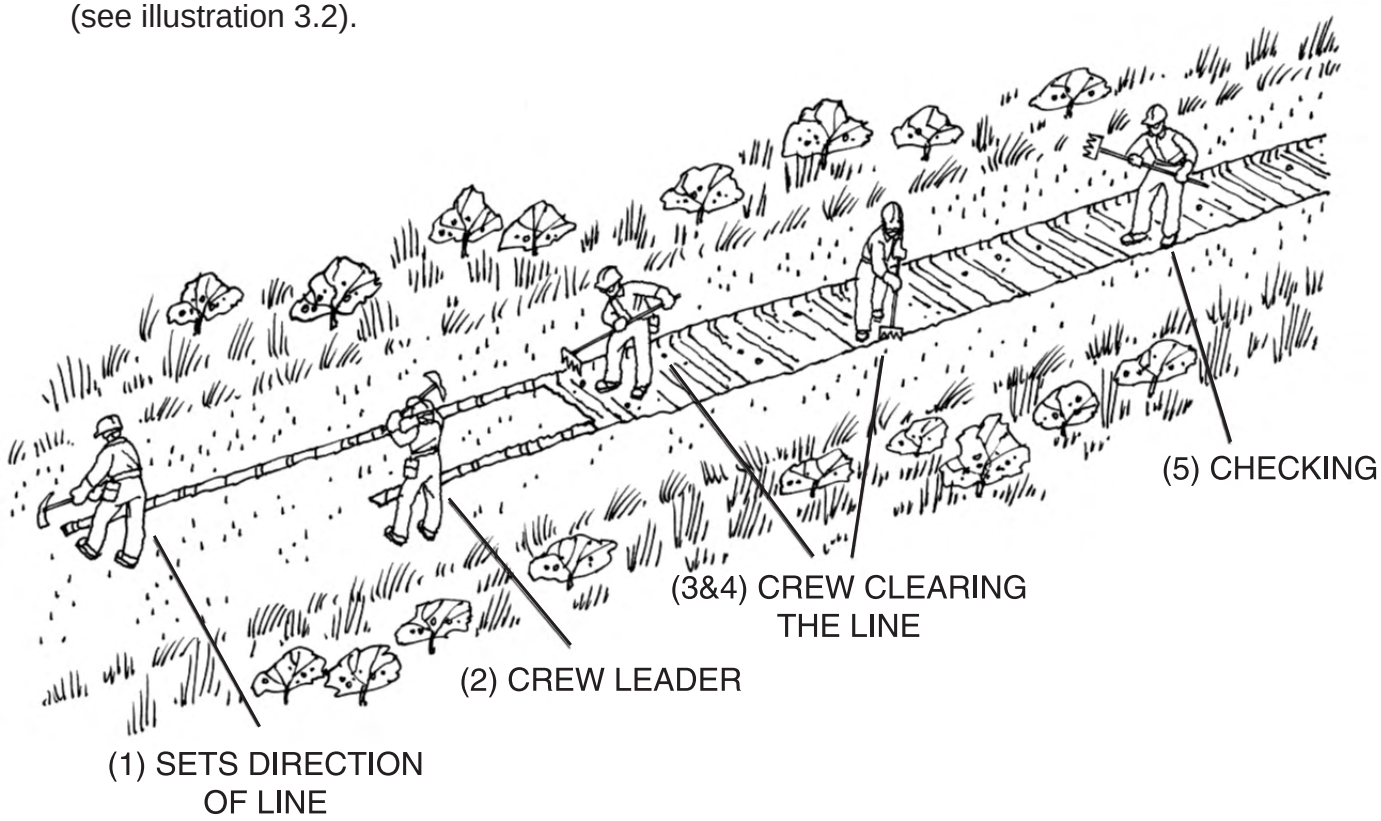

Illustration 3.2 Fireline construction using hand tools

Often different tools are used in different parts of the operation. Initially a rough path will be cleared with small trees, bushes and branches cut back. Then the actual fireline will be made down to mineral soil. Material should be scraped away from the edge of the fireline nearest the fire.

Sometimes a chainsaw is used to cut down trees and clear vegetation. Only people who have been specifically trained and achieved the necessary qualifications should use a chainsaw. When working near a chainsaw a minimum safe working distance of 2 tree lengths should be maintained when trees are being cut down and 5 metres when the chainsaw is being used to cut material close to the ground.

The last person in the team must check that the fireline has been constructed properly. The line should then be patrolled to make sure that the fire does not cross it. Good communications with your co-worker ("buddy system"), supervisor and other team members is necessary at all times.

You need to dig down and break the continuity of the sub-surface fuels. Normally the main surface fire will hit the control line first. However, you must make sure that you have dug down through any roots or other organic matter to mineral soil, preventing any smouldering ground fires crossing the control line.

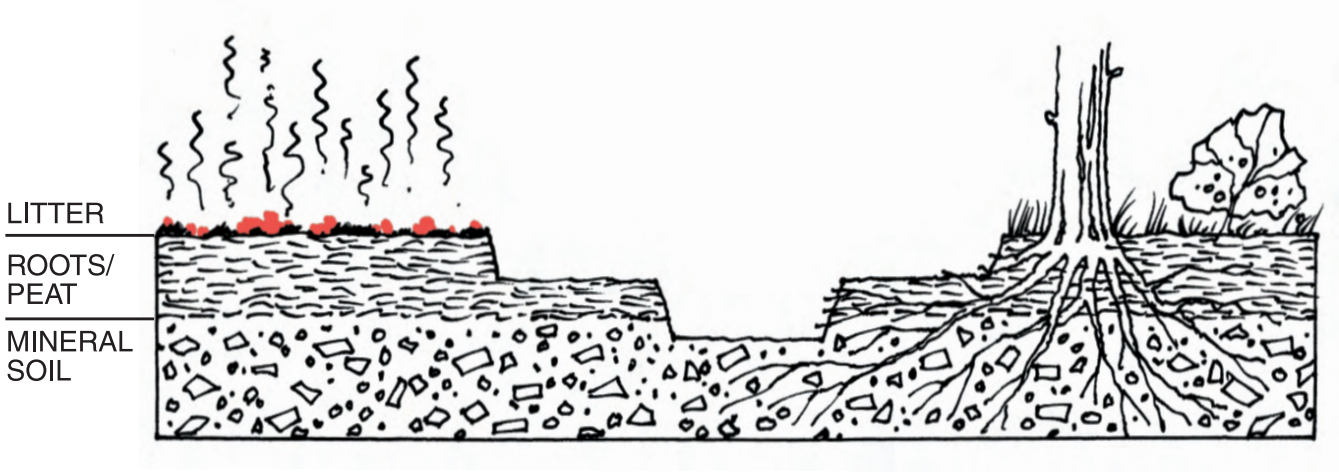

Illustration 3.3 Fireline construction - Cut / separate fuels and smouldering fire

Fireline width

Anything that affects how a fire burns must be considered in determining the width of line needed to hold or control the fire. The hotter or faster the fire burns, the wider the control line must be. There are six factors that determine the width of the fireline:

- **Fuel** - The type of fuel, its height, density, size and condition will dictate fireline width.

- **Slope or topography** - When a fireline is to be built above a fire burning on a slope, the steeper the slope the wider the line must be. This is because the fire usually burns faster and more intensely on steeper slopes. When a fireline is to be built below a fire burning on a slope, the width of the line is not dictated by the slope, but rather by the need for trenching. The steeper the slope, the deeper and wider the trench must be. Trenching is necessary to prevent rolling burning material from crossing the fireline.

- **Weather conditions** - Weather conditions affect the intensity of the fire. The hotter the fire is burning, the wider the line should be.

- **Part of the fire to be controlled** - A fire burns hottest, with a longer flame length, on the head of the fire. The flanks generally burn with less intensity. This dictates wider fireline on the head.

- Size of fire being controlled - The amount of heat generated by a large fire has a bearing on the width of the line necessary to control the fire. The larger the fire, the wider the line.

- Possibility of cooling - The width of the fireline can be reduced if water is available for cooling the fuels.

Table 4: Guidelines for width of fireline

Fuel type	Width of cleared area	Width in mineral soil
Grass /crops	0.5 – 1 m	0.5 – 1 m
Shrubs / brush	1 – 3.5 m	0.2 – 1 m
Timber	6 m	1 m
Peat / Roots	0.5 m	0.5 m

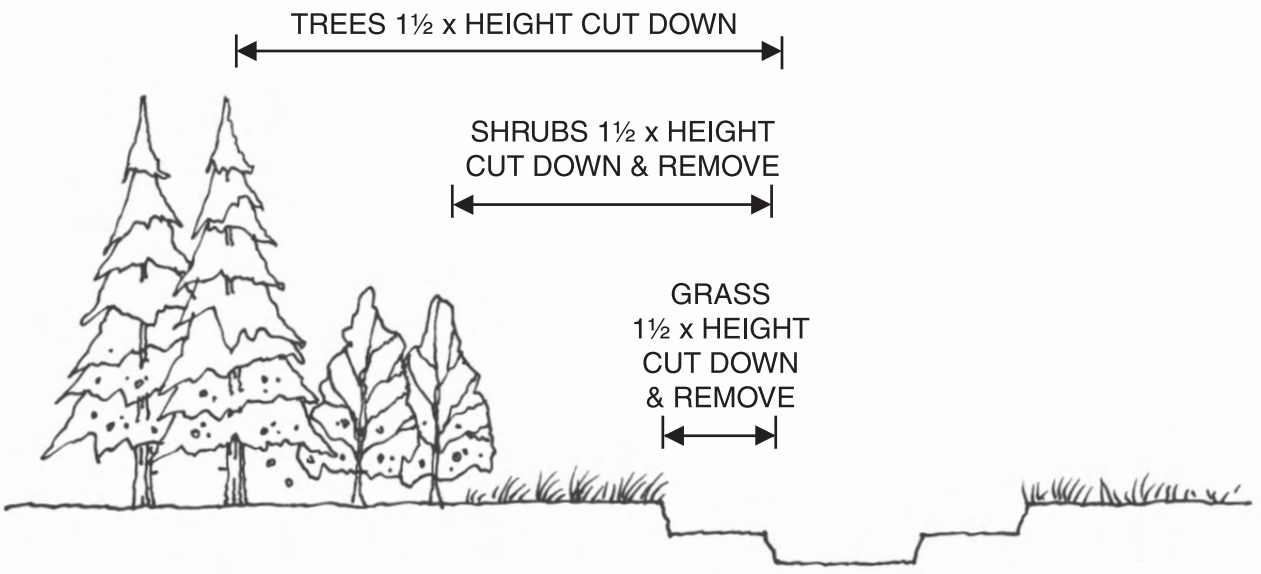

Illustration 3.4: Control line width

Table 5: The effect of fuels on fireline width

Consideration	Concern
Kind of fuel	Some fuels burn hotter than others because of their oil content. The hotter the fuel burns, the wider the control line needs to be.
Height and density of fuels	The higher and denser the fuel, the higher and hotter the flame will burn, and the wider the control line needs to be.
Size of the fuels	Heavier fuels, such as logs, heavy limbs, and thick-stemmed brush do not ignite easily. However, once ignited, they burn very hot for a long time and may require wide control lines.
Condition of the fuels	The condition of fuel (whether it is dead or alive or dry) affects fire intensity. The drier the fuel, the hotter it will burn, thus increasing the fire intensity and the fireline will have to be wider to contain the fire.

Fire Line Location

The location of a fire line will normally be decided by the Crew Leader, who will consider:

- Where should it be placed?
- How wide does it have to be?
- What method will you use?
- Do you have the firefighting resources to construct AND hold the line?
- Rate of fire spread (ROS) and fire intensity
- What lies ahead
- The easiest path for firefighters
- Existing firebreaks
- Type of vegetation and terrain

The success of your attack is often dependent on where the fireline is placed and how it is constructed.

Heavy fuels and steep slopes should be avoided if possible. Where the fire edge is irregular a short, straight fireline can be cut rather thanfollowing the fire edge.

The effectiveness of a fire line depends on its location in relation to fuel type and terrain.	
Know what lies ahead	Being aware of the conditions in advance of the fire line reduces the chance of wasting the crew's effort • Scouting ahead is often required
Follow the path of least resistance	Time is important and energy must be conserved • Usually the most important factor in line construction is depth to mineral soil • Seek areas of shallow organic layers
Use existing breaks	Creeks, tracks, roads or naturally sparse fuels – this saves time and increases efficiency.
Avoid heavy fuels	If possible locate the fire line between heavy fuels and the fire
Avoid the steepest part of slopes	Where trenching to stop rolling material must be deep and wide – some effort can be saved
Cut across fire edge bays	Where irregular fire growth has created bays of unburnt fuel find the easiest line from the tip of one finger of fire to the next • Unburnt fuel can be burned out and the overall fire line length reduced

Summary of General Rules

- Clear vegetation to a width of at x1.5 the height of surrounding vegetation and /or x2.5 the expected flame length of the main fire.
- The trench down the centre to expose mineral earth should be from 30-60cm wide
- In dense vegetation a wider clearance may be required
- In intense fires, a greater amount of surface fuel will need to be removed to make the fire line effective
- Spread mineral soil dug from the fire line on the side opposite the fire to help increase the width
- When building a fire line on the fire edge, scatter all the unburnt cut stems and branches on the side away from the fire and all the scraped surface material into the burnt area (minimises the chance that embers are spread into the unburnt side)
- If aerial fuels are likely to ignite, cut down and remove the lower branches of trees for several metres on both side of the line

Points to remember when constructing a fire line

- **Deal first** with those **areas** from where the **fire is likely to escape** (e.g. hot spots)
- When possible keep the fireline short
- Avoid sharp angles
- Existing natural or man-made barriers such as tracks, ridges, creeks etc. should be used when available
- When possible, construct fire line **through open areas** rather than fighting through dense or heavy fuels
- **Pay attention** to daily wind shifts
- Where possible, block off the more hazardous fuels such as wind thrown trees or slash heaps by leaving them outside the fire line
- **Encircle areas of numerous spot fires** if fire line construction around each spot is impractical
- **Dig a vee-trench** to catch rolling fuels
- **Turn logs parallel** with the slope to keep them from rolling across the fire line
- Beware of spars
- They can be highly flammable and unstable
- **Lines should be dug far from burning snags,** so when felled, the snag and any flying debris drops within the fireline perimeter
- **If it is not possible to fall the snag, remove all fuel around its base**
- Complete the control line by linking sections of fireline and when possible, **tie in existing barriers** to fire spread

Mop-Up and Patrol

Mop-up is the task of extinguishing a fire after it has been contained. It is important to make sure that a fire is fully extinguished before leaving the site.

This often involves the use of hand tools in mop-up tasks.

Once a fire is “contained” within a perimeter, patrolling should start immediately.

Patrolling

- Use all your senses (sight, hearing, smell and touch) to detect remaining fire, particular attention should be paid to smouldering ground fires.
- Working from the outside inwards, first check that no fires have crossed are or about to cross the fireline, then move inwards until an appropriate width of ground inside the fireline is completely extinguished.
- Use the buddy system and communicate and work as a team
- On patrol avoid stepping in “hotspots” and holes made by ground fires
- Continue patrolling for at least 48 hours in dry periods and make periodic visits over a longer period as well, especially if the wind gets up.

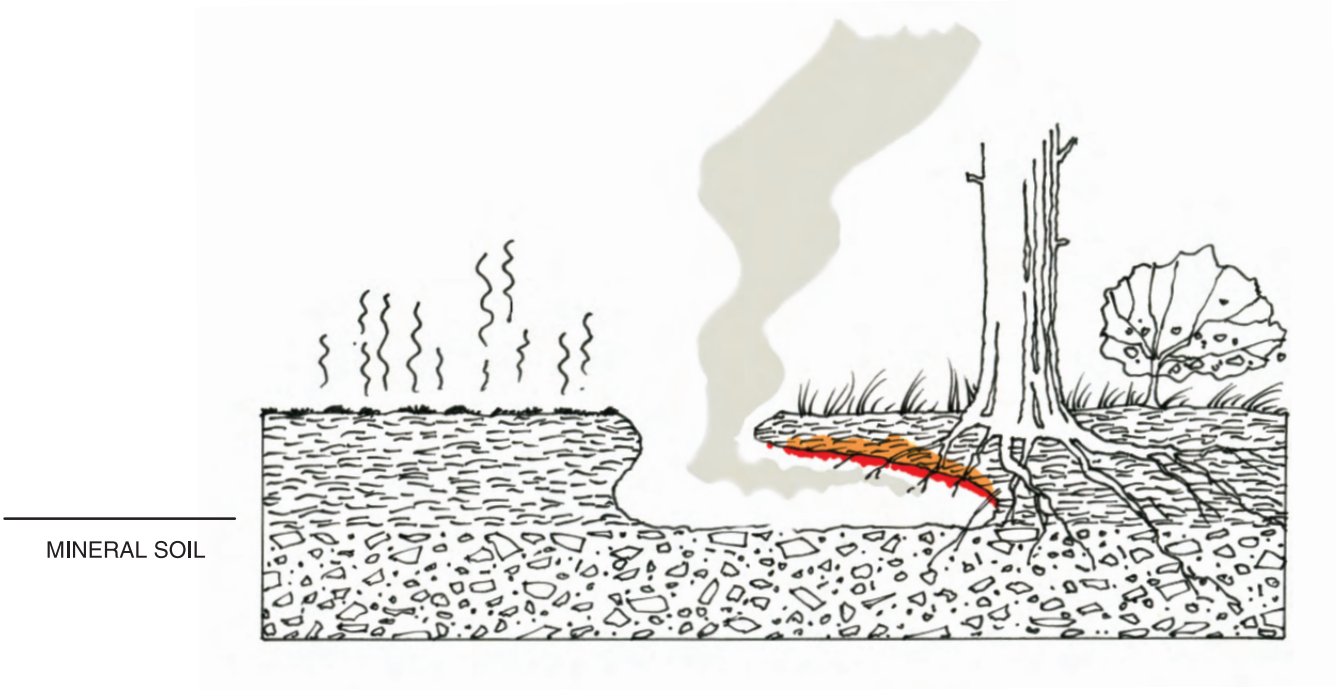

Illustration EF2 1.15a Smouldering ground fire hazard

Mop-up

The principle behind mopping up operations is to cool and extinguish the fire as quickly as possible. This is hard, dirty but important work. All 3 methods of breaking the fire triangle are used: separating the heat from the fuel, cooling the fuels, and smothering to remove oxygen. Improvements to the fireline can also be useful.

Working inwards from the fireline using digging, scraping, cutting, spraying and smothering tools:

- Clearing any remaining fuels from the fireline: removing dead wood, partially burnt grasses and shrubs and any nearby vegetation.
- Checking the fireline to make sure it is not crossed by roots.
- Removing any fuels remaining near the fireline by allowing them to burn out or igniting them and burning them out.
- Extinguishing hotspots near the fireline.
- Cutting down high smouldering embers
- Moving smouldering material from the fireline onto burnt ground
- Digging out and breaking up smouldering embers and ground fires. Then cooling the embers down with water or smothering them with soil
- Checking logs, stumps, roots, for fire below, inside, or underneath the bark
- Digging down to mineral soil around hotspots to isolate them from other fuels
- Using hand tools and water in combination to smother and cool
- Embed material on slopes so that it does note roll down across the fireline
- Check for heat before leaving the area

Summary on line location and construction*

Fireline Location Guidelines

Locate line, after consideration of the following:

- Provide for safety of personnel.
- Locate line adequate distance from fire so it can be completed, burned out and held with predicted rate of spread and fire behaviour.
- Allow adequate time to permit forces to build lines and also do other needed work, such as snag falling and burning out, in advance of severe burning conditions.
- Make line as short and straight as practical, use topography to your advantage.
- Use easiest routes for control without sacrificing:
    - Holding practicability.
    - Too much area or resource value.
- Eliminate possible hazards from fire area and provide adequate safe distance between lines and hazards that must be left in the fire area.
- Avoid undercut lines and sharp turns in the line.
- Use existing natural and person-made barriers.
- Use heavy equipment, where appropriate, for line construction.
- Encircle area where spot fires are so numerous that they are impractical to handle as individual fires. Burn out unburned fuels, if possible.
- Consider environmental effects and agency policy.

Fireline Construction Guidelines

- Make line no wider than necessary; consider height of vegetation.
- Clean all lines to mineral soil, where practical.
- Discard unburned line construction material outside of the fireline.
- Scatter charred or burning material inside burned area.
- Below the fire on steep slope, construct trenched lines to catch rolling material.
- Increase effectiveness of line width by cooling down adjacent fire with dirt or water.
- Cover uncharred, rotten logs and stumps just outside the line with dirt or wet down.
- Fall or line snags near fireline before burnout, if time permits.
- Build fireline as close to fire edges as conditions safely permit.
- Burn out fireline as control line proceeds (if legislation allows)
- When building fireline uphill, burn out from the top down after line is tied in.
- Keep one foot in the black, where possible.

*Source: Excerpts from the USA fireline handbook 3, PMS 410-1

References:

Australasian Fire Authorities Council Limited. (2005). Respond to wildfire. East Melbourne Victoria: AFAC Limited.

National Rural Fire Authority. (2005). Demonstrate knowledge of personal safety at vegetation fires. Wellington, New Zealand.

National Rural Fire Authority. (2006). Control vegetation fires using dry fire fighting techniques - use of hand tools (draft). Wellington, New Zealand.

National Wildfire Co-ordinating Group. (2004). Fireline handbook, NWCG handbook 3, PMS 410-1, United States of America

Teie, W.C. (2005). Firefigher's handbook on wildland firefighting (Strategy, Tactics, and Safety). Rescue, California, United States of America: Deer Valley Press.

Teie W.C. (1997), Fire officers handbook on wildland firefighting, Rescue, California,

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