

Joint operational guideline hazardous trees

March 2023



RFS



Document control

Release history

Version	Date	Author	Summary of changes
0.1	16/05/2022	Josh Atkins	Initial Draft
0.3	05/12/2022	Josh Atkins	Draft following 2 nd consultation
0.4	27/02/2023	Josh Atkins	Draft following SAS consultation
1.0	31/03/2023	Josh Atkins	Final Version

Reviewed by

Name	Title	Date
IAOWG		24/07/2023

Approved by

Name	Title	Date
Peter McKechnie	Deputy Commissioner Field Operations	31/03/2023

Related documents

Document name	Version

Contents

- 1 INTRODUCTION 7
- 2 PURPOSE 7
- 3 HAZARDS 7
 - 3.1 Characteristics 7
- 4 CONSERVATION 8
 - 4.1 Tree conservation 8
 - 4.2 Culturally Significant, Historic and Significant trees 8
 - 4.3 Habitat Trees 9
- 5 OPERATIONAL PROCEDURES 9
 - 5.1 Hazardous Tree Identification..... 9
 - 5.2 Symbology 10
 - 5.3 Risk Management 10
 - 5.4 Exclusion Zone..... 11
 - 5.5 Notification and Handover 11
- 6 DEFINITIONS..... 12
- Appendix One 14
- Appendix Two 18
- Appendix Three 19
- Appendix Four 20

1 INTRODUCTION

Fire service and land management personnel may be exposed to a wide range of hazards and risks when working at or around an incident or during prescribed mitigation activities.

Trees, stumps, limbs and branches – all constituting a tree hazard – pose a potential health and safety risk for personnel undertaking activities at the incident area.

The incidence of tree hazard in forests and woodlands increases significantly with the effects of fire, flood and wind on the structural integrity of tree trunks, tree limbs and the root balls that anchor trees to the ground; particularly those with pre-existing structural defects.

These risks may persist for a considerable period after incident response operations are complete, posing risks to the public once the incident has passed.

Fire events can weaken the structure of trees and branches; flooding events can decrease root-ball stability; strong winds and heavy rainfall associated with storm events all increase the risk of tree, limb and branch fall.

While this Joint Operational Guideline provides a common approach to the management of Hazardous Trees, each agency is to have their own Operational Doctrine for Hazardous trees, specific to their agency.

It should be noted that some Land Managers use additional terminology and marking symbols for Hazard Trees as part of their standard practice. When required, personnel working across agencies will be inducted into the practices specific to that agency when working around hazardous trees.

2 PURPOSE

This interagency guideline outlines the identification, marking and mitigation of hazardous trees in an incident area. This will allow a common approach and methodology across all agencies at incidents or activities within NSW, to improve consistency and reduce confusion and potential adverse outcomes.

This guideline is applicable to all personnel from the NSW Rural Fire Service, NSW National Parks and Wildlife Service, Fire Rescue NSW and Forestry Corporation NSW, and personnel from Interstate/International agencies engaged to assist within NSW.

3 HAZARDS

3.1 Characteristics

Trees often have a number of signs and characteristics that may indicate they are potentially hazardous.

Some signs and characteristics that may indicate potential tree hazard:

- trees with hangers or damaged limbs that could fall and impact personnel in planned work areas or access routes
- trees affected by one or more of the following: excessive rot content; exposed root systems; root, trunk or stem damage; storm, snow or fire damage; impact by machinery, snagged logs or insect attack
- trees with shallow root systems in unstable, eroded or steep ground
- dead trees
- trees with excessive lean or an obvious lean towards the work area or trees with potential to fall on to other trees and impact the work area.
- Pipe
- Dry Side
- Hollowbutt
- Hollows

- Dead Crowns
- Widow Makers
- Dead Stags and Spars
- Hang-ups

Some trees with the above characteristics, if protected from fire, can be prevented from becoming hazardous. Wherever possible, prior to ignition, these trees should be protected by clearing around the base.

There are also external influences that may increase the potential for a tree to become hazardous. These include:

- impact of fire
- wind exposure, where there has been a change to exposure due to tree removal or potential for unusually increased wind exposure (speed and/or direction) due to weather or geography
- snow in tree canopy that may obscure stem damage and weight of snow may cause failure
- drought, leading to increased risk of tree hazard in some vegetation types
- stress and insect infestation
- excessive drainage problems from land management operations e.g. snig tracks in forestry operations
- exposure to vibration from heavy plant or machinery

Additional information can be found in Appendix 1.

4 CONSERVATION

4.1 Tree conservation

While safety of personnel in an incident area is paramount, at all times conservation of trees must be considered and managed appropriately. Trees should not simply be removed, unless a danger or risk is posed to personnel or operations in an incident area.

4.2 Culturally Significant, Historic and Significant trees

Trees that are culturally significant to Aboriginal people (e.g. modified trees such as scar trees and carved trees), trees with historic significance (e.g. Explorer trees or Surveyor trees), and Significant trees (e.g. trees identified on the National Trust Significant Trees Register or a Council Significant Trees Register) should be protected from the impact of fire, and actions taken to conserve the tree where possible.

Culturally significant trees will display attributes such as decoration to mark burial site, wounding and/or scarring of bark for coolamon, shield or canoe manufacture. Historic and Significant trees are likely to have similar scarring or markings. These trees may be old trees in declining health and vigour and be more susceptible to further damage from fire, flood and storms.

Incident Controllers and personnel on the fireground need to consider measures to protect culturally significant, historic and significant trees.

Such measures may include:

- Engaging local knowledge holders to assist the IMT with significant tree identification
- Identification of significant cultural and historic trees on IAPs and PBPs
- Clearing or use of foam around trees if safe and practical to do so prior to the passage of fire. For hazard reduction works, all cultural and historic trees must be assessed as part of the environmental assessment process and managed accordingly).
- Exclusion of fire, tree felling and track construction in areas near cultural and historic trees
- Strong preference given to extinguishing fires burning on cultural or historic trees rather than attempting tree removal

4.3 Habitat Trees

Hollow bearing trees including trees that are dead are used as habitat for many other lifeforms. Tree hollows are used by mammals, birds, reptiles, amphibians and invertebrates, many of which are threatened species. These habitat trees exhibit what are termed in arboriculture literature as 'tree defects'; i.e. large cavities and hollows, dead branches, wounding and decay.

Bushfire or prescribed fire can more easily become established in such trees due to the presence of these features and may exacerbate the hazard, requiring attention by fire crews if the tree is located near an asset or poses a risk to safety or the further spread of fire.

Removal of dead wood and dead trees is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016*, because it provides essential habitat for a wide variety of native animals and is important to the functioning of many ecosystems.

Firefighters and incident managers should consider measures prior to, during and after the passage of fire through an area containing Habitat Trees to minimise the likelihood of being impacted by fire and potential removal.

Such measures may include:

- Identification of Habitat Trees prior to the passage of fire
- Clearing around Habitat Trees if safe and practical to do so prior to the passage of fire. When implementing hazard reduction control lines, the litter around potential Habitat Trees should be cleared when safe and practical to do so.
- Protection of high value habitat trees or stands of trees from fire of using water or foam when environmentally safe to do so
- Strong preference given to extinguishing fires burning on cultural, historic or habitat trees rather than attempting tree removal
- If a tree is fire affected, provided it is safe and practical allow the tree to naturally self-extinguish. One of the impacts of fire in trees is to initiate or progress the establishment of hollows over time, creating new habitat niches. This measure may require marking of the tree and or indicator trees as per the procedures in Section 5.

5 OPERATIONAL PROCEDURES

5.1 Hazardous Tree Identification

Hazardous trees are defined as *a tree, limb or branch that is expected to fall within the timeframe of the current operation and impact personnel in its potential impact zone.*

The incident area should be inspected prior to the commencement of each shift where practical and appropriate, and continually reassessed throughout the incident. As conditions change and fire passes through an area, trees in the vicinity can quickly become hazardous, and personnel must remain vigilant, looking out for the next significant risk.

Some considerations may include:

- Has the area previously been identified as high-risk for trees?
- Does local knowledge indicate that the incident area is dominated by hazardous trees?
- Do ground observations of the incident area indicate that the area is dominated by hazardous trees?
- Do aerial observations (if available) of the incident area indicate that the area is dominated by hazardous trees?

It is the responsibility of all personnel within the incident area to identify any suspected hazardous trees. Once identified, hazardous trees should be marked, and where possible an Exclusion Zone established. The occurrence of identified Hazardous Trees must be communicated to all personnel in the incident area and escalated to the Incident Management Team (IMT).

Incident areas are constantly changing and there will be hazardous trees that have not been identified. It is important for all personnel to be vigilant and keep a watch out for hazardous trees at all times.

5.2 Symbolology

When a hazardous tree is identified, it must be marked with a circle with a cross through it. This is the only hazardous tree symbol that is to be used in NSW.



All identified hazardous trees must be marked, or be within an exclusion zone. Yellow paint should be used to mark hazardous trees, consistent with national standards. When safe to mark a hazardous tree, the following rules apply:

- Primarily, biodegradable paint should be used;
- Mark on two sides of the tree if it is safe to do so;
- If it is not safe to mark a tree, an indicator tree(s) should be marked;
- Tree marking should be 30 cm in diameter, if the tree size allows;
- The symbol should be clearly visible from the control line and all access routes;
- The symbol should be 1.5m off the ground;
- Paint must not be applied to rocks or rocky outcrops; and,
- If paint not available, tie one loop of tape around the tree at chest height.

If unsafe to mark a hazardous tree, an indicator tree is to be identified. When using an indicator tree, the following rules apply:

- Use the above symbol on an indicator tree (s) with an arrow pointing to the tree and a distance written.
- If paint not available, tie one loop of tape around each indicator tree at chest height then angle tape from the loop to the ground pointing to the location of the hazardous tree.

Identified Hazardous trees are to be marked on relevant maps and Incident Action Plans (IAPs) and Prescribed Burn Plans (PBPs).

Additional information can be found in Appendix 2.

5.3 Risk Management

Suitably trained and experienced personnel will determine the method of control and priorities for managing hazardous trees. Consultation and notification to the IMT and Safety Advisor are essential in determining appropriate course of action for dealing with hazardous trees. Individual agencies are responsible for identifying and assessing personnel to undertake these functions.

Control methods may include a combination of:

- Keep personnel away from the tree – mark the hazard and establish an exclusion zone. Consider physical barriers where appropriate.
- Education – ensure all personnel are aware of the location of all hazardous trees, and risks posed by them.
- Mark and update maps, IAPs and PBPs and other relevant materials to indicate locations of hazardous trees.
- Construct a mineral earth break around the hazardous tree where safe and appropriate.

- Move operations to avoid the tree – such as constructing a fire containment line if safe and appropriate.
- Extinguish the tree if safe and appropriate.
- Let the tree burn out if safe and appropriate.
- Remove the tree – by either heavy plant or tree felling methods if safe and appropriate.

If identified hazardous trees are also significant habitat trees or culturally significant trees, this should be taken into account when determining an appropriate control method. Consultation with local knowledge holders or specialists should also be considered.

Where a hazardous tree is on fire, a risk assessment must be conducted to determine if it safe and appropriate for it to be felled. Plant should be considered, with felling by hand (such as chain saw) be considered as a last resort. Personnel are to refer to their own agency doctrine for further guidance.

Where it is determined it is not safe or appropriate to fell a hazardous tree that is on fire, members must mark an exclusion zone and let the tree self-extinguish or fall. Construction of a wide break (e.g. two tree lengths) and burn out around the tree may be appropriate in some circumstances.

For tree felling operations, refer to the relevant Agencies' tree felling training and qualifications, and Heavy Plant policies.

For prescribed burns, the area should be inspected for hazardous trees prior to the introduction of fire, with special attention to hazardous trees with the potential to impact control lines if they were to fall or fail. These trees should be cleared around to minimise the potential for fire to impact them.

Potentially hazardous trees are to be pre-emptively marked, or exclusion area established with the hazardous tree symbology and if safe to do so, use fire suppression to limit further damage to the trees.

There are a number of risk control measures that can be undertaken prior to, during and after an incident. Appendix 4 has further information about Risk Control Measures.

5.4 Exclusion Zone

The exclusion zone is the area around a hazardous tree that is not safe, where the tree could fall at any time and may cause serious injury or death.

Where practical, all firefighters and personnel should avoid working or travelling through any exclusion zone until the risk from a hazardous tree has been treated.

The exclusion zone of a hazardous tree is at minimum two (2) tree lengths of the hazardous tree. In all situations, consideration must be given to increasing the zone depending on the site's unique circumstances, such as ground slope.

If an exclusion zone occurs across a trail or control line, a decision to close this route and use an alternate route or control line must be considered. Where it is not practical to avoid the area, safe work practices must be developed and communicated to limit firefighter risk exposure.

Tape should be used as a barrier to restrict access to the exclusion zone. All NSW agencies are to use the Red and White stripped tape to mark Exclusion Zones. If tape not available, utilise other available materials to clearly mark an exclusion zone.

Additional information can be found in Appendix 3.

5.5 Notification and Handover

When a hazardous and/or culturally significant, historic, significant or habitat tree is identified and assessed, it must be escalated to the relevant commander and Safety Advisor and recorded in log-books and on relevant maps IAPs and PBP.

Hazardous and/or culturally significant, historic, significant or habitat tree identification must be highlighted as part of on-going safety and shift briefings.

Consideration should be given for Safety Warnings to be broadcast to the incident area, highlighting the location of the hazard and any specific actions required.

At the completion of an incident, the landowner should be given an update on any hazardous trees and locations. Where safe and appropriate, a joint visual inspection of the tree may be conducted as part of the handover.

6 DEFINITIONS

Advanced or intermediate faller: a tree faller meeting the requirements of the relevant national units of competency, currently FWPFGM3213 Fall Trees Manually (advanced) or FWPFGM3212 Fall Trees Manually (intermediate).

Assess (tree hazard): to locate and evaluate the extent of tree hazard and to determine an appropriate risk control measure. Undertaken by tree hazard assessors with expertise and experience.

Back Burn: A fire started intentionally along the inner edge of a fire line during indirect attack operations to consume fuel in the path of a bushfire.

Blackening out: the process of extinguishing or removing burning material along or near the fire control line and trenching logs to prevent rolling to make the fire safe. Also referred to as 'mopping up'.

Culturally Significant Tree: trees that have been carved or scarred by Aboriginal people for various reasons; such as being used for tools or canoes, or for spiritual purposes.

Exclusion Zone: an area around an identified hazardous tree that is not safe to work in, and access should be limited. Usually this area is two times the height of the tree, depending on ground slope.

Falling objects protection systems (FOPs): falling objects protection systems provide protection for a vehicle's occupants using an engineered reinforcement installed onto a vehicle roof or ceiling structure to reduce possible injuries in the case of a falling object.

Habitat Tree: standing live or dead trees providing ecological niches (microhabitats) such as cavities, bark pockets, large dead branches, epiphytes, cracks, sap runs, or trunk rot; for a variety of animals, birds and plants.

Hangers: limbs which are hooked up or tangled in other limbs and can be dislodged by external factors (e.g. wind, the effects of machinery, other trees, fire) during an operation.

Hazardous Tree: a tree, limb or branch that is expected to fall within the timeframe of the current operation and impact personnel in its potential impact zone (may also be known as a Clear and Present Danger Tree).

Historic or Significant Tree: remnants of the bush, plantings by early settlers, important landscape or streetscape elements, or trees planted to commemorate important people or events.

Identify (tree hazard): the ability to recognise stands of or individual trees that present an increased risk to personnel (as included in basic bushfire hazard recognition training).

Indicator tree: a tree that is marked to indicate the presence and direction of a nearby tree hazard. An indicator tree may be used when the symbol on the hazard tree is obscured by vegetation, difficult to see from control line, or unsafe to mark.

LACES: risk assessment checklist that stands for: lookout, awareness, communications, escape routes, and safety zones.

Personal protective clothing and equipment (PPE): any clothing or equipment that is intended to be worn or held by a person at work and which protects them against risks to their health or safety and any addition or accessory designed to meet that objective.

Potential impact zone: the area underneath or surrounding a clear and present danger tree where the tree, limb or branch has potential to impact personnel.

Rollover protection systems (ROPs): rollover protection systems provide protection for the vehicle operator in the case of a rollover incident.

Prescribed Burning: The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives. It is undertaken in specified environmental conditions. Prescribed burning is also

referred to as planned burning; hazard reduction burning; controlled burning; prescription fire; fuel reduction burning; planned fire and prescription burning.

Storm: an atmospheric disturbance involving perturbations of the prevailing pressure and wind fields on scales ranging from tornadoes (1 km across) to extratropical cyclones (2,000-3,000 km across) and with wind at speeds between 89–102 km/h (Beaufort scale wind force 10).

Tree hazard(s): a general term which refers to trees, limbs or branches with potential to fall during the current operation. This includes trees with the potential to become hazardous through exposure to fire in a prescribed burning or back burning operation. Tree hazard is a term that may refer to the presence of a specific tree hazard associated with an individual tree, a set of tree hazards in an area or to large areas of tree hazard at the landscape scale.

Appendix One

Characteristics of Hazardous Trees

Pipe

A Pipe or Chimney is formed inside the trunk when fire is able to burn the decayed heart of a tree. The entry of fire occurs via burnt out roots, dry sides or hollowbutts. Complete pipes have visible flames coming out the top. Incomplete pipes may only be evident by smoke coming out of the crown.



Dry Side

Dry side is an area of dead wood on the trunk of a tree usually caused by a previous fire or other damage eg. another tree falling against it. In combination with decay or rot, dry side can result in hollowbutt.



Hollowbutt

A hollowbutt is a tree that has a hollow at the base due to disease or damage. It may have also been burnt. There are often other faults such as significant rot or heart decay providing a pathway for fire to travel up the tree.



Hollows

Hollows are formed by either rot or fire usually following structural damage of the tree, such as a limb breaking off. Hollows in the trunk or limbs vary in shape and depth.



Dead Crowns

Dead crowns are often the result of a tree becoming over mature or from fire damage, snow damage, insect attack or disease. These trees contain a significant amount of dead wood in their crowns. Trees with dead or damaged crowns are a key concern on the fire line as they are likely to burn longer, shower burning embers and part or all of the crown may fall.



Widow Makers

Widow Makers are limbs which are hooked up or tangled in other limbs. Widow Makers can be dislodged without warning and are more likely to fall during felling, when burning or during wind.



Dead Stags and Spars

Large dead trees are known as stags, while smaller dead regrowth are known as spars. When a stag is large it poses a significant threat, both in duration of burning and the amount of burning material in the crown, and are often difficult to extinguish.




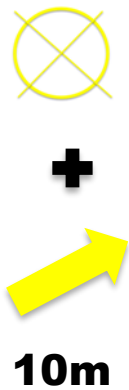

Hang-ups

Occasionally a tree may fall and 'hang-up' on another tree. Hang-ups are particularly dangerous if leaning across a road or track but can be just as dangerous to firefighters during mop-up. Hang-ups are often very difficult to get down safely by felling or pushing and if not leaning across a key work area the exclusion zone is best avoided.



Appendix Two

Symbology

Tree hazard class	Tree marking and mapping Symbology	Description
Hazardous tree		A tree or branch that is expected to fall within the time frame of the current operation and impact personnel in its potential impact zone.
Indicator tree Arrow + distance to tree below symbol		Used to indicate the presence of a tree hazard when the symbol on the hazard tree itself is obscured by vegetation, difficult to see from control line, or the tree is too dangerous to mark.
Barrier tape for tree hazard (exclusion zones)		NSW Standard Danger Tape for tree hazard management. Other tapes should only be used only when red and white tape not available.

Appendix Three

Exclusion Zone



Physical Barriers



Appendix Four

Risk Control Measures

Phases of Incident	Risk treatment					
	Hierarchy of control					
	Level 1		Level 2		Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
Before	<ul style="list-style-type: none"> Treat Hazardous trees by tree removal or limb/branch removal if appropriate and safe to do so from likely access routes and control lines. 	<ul style="list-style-type: none"> Build alternative control strategy capability (aircraft, plant, monitoring) 	<ul style="list-style-type: none"> Relocate likely access road or control line away from areas of high tree hazard or significant tree locations Prevent potentially Hazardous trees or significant trees from catching alight, by: <ul style="list-style-type: none"> Clear fuel around trees (using hand tools or machinery). Candle (burn) tree to remove flammable bark during suitable conditions Application of ground-based retardants or suppressants Wetting down of trees with water. 	<ul style="list-style-type: none"> Falling objects protection systems (FOPS) Occupant protection guards (OPGs) 	<ul style="list-style-type: none"> Marking of high tree hazard areas Marking of Hazardous trees where safe and appropriate Mapping of known Hazardous Trees Ensure availability of trained / experienced tree hazard assessors Mark and map significant trees as appropriate 	<ul style="list-style-type: none"> PPE
During – Enroute	<ul style="list-style-type: none"> Deploy crews via routes that have been assessed and treated Do not respond to non-emergency incident types until the tree hazard has been managed appropriately 	<ul style="list-style-type: none"> Use alternative control strategy (aircraft, plant, monitoring and planning) 	<ul style="list-style-type: none"> Deploy crews on routes which have pre-existing tree clearance on both sides 	<ul style="list-style-type: none"> Falling objects protection systems (FOPS) Occupant protection guards (OPGs) 	<ul style="list-style-type: none"> Notify oncoming crews and incident control about identified tree hazard 	<ul style="list-style-type: none"> PPE

<p>During – At the incident</p>	<ul style="list-style-type: none"> • Treat Hazardous trees by tree removal or limb/branch removal if appropriate and safe to do so. Extinguish hazardous and significant trees before fire can take hold • Prevent ignition of potentially Hazardous trees and significant trees by minimising backburn and burnout fire intensity (e.g. the use of backing flanking fire) • Prevent potentially Hazardous trees and significant trees from catching alight, by: <ul style="list-style-type: none"> ○ Clear fuel around trees (using hand tools or machinery). ○ Candle (burn) tree to remove flammable bark during suitable conditions ○ Application of ground based retardants or suppressants ○ Wetting down of trees with water. 	<ul style="list-style-type: none"> • Adjust strategy on the day if required 	<ul style="list-style-type: none"> • Withdraw from high tree hazard area under identified conditions (e.g. wind) • Establish exclusion zone around identified tree hazard • Move or abandon control line through identified high tree hazard areas or around significant trees • Relocate control line away from individual tree hazards or significant trees • Traffic management to isolate responders and public from risk 	<ul style="list-style-type: none"> • Falling objects protection systems (FOPS) • Occupant protection guards (OPGs) 	<ul style="list-style-type: none"> • Establish crew deployment procedures based on Dynamic Risk Assessment • Use lookouts, awareness, communications, escape routes and safety zones (LACES) to manage risk, (e.g. identification of escape routes) • Marking of Hazardous trees and significant trees when safe and appropriate 	<ul style="list-style-type: none"> • PPE
<p>After</p>	<ul style="list-style-type: none"> • Treat Hazardous trees (cross trees, ☒) by tree removal or limb/branch removal if appropriate and safe to do so 		<ul style="list-style-type: none"> • Relocate control line • Traffic management • Establish exclusion zones 	<ul style="list-style-type: none"> • Falling objects protection systems (FOPS) • Occupant protection guards (OPGs) 	<ul style="list-style-type: none"> • Defer crew deployment until full tree hazard assessment has been conducted • Use Dynamic Risk Assessment and LACES to manage risk during deployment • Mark and communicate ongoing risks 	<ul style="list-style-type: none"> • PPE