



# Hazardous Trees

## Operational Protocol

### Scope

This Operational Protocol outlines the identification, marking and mitigation of hazardous trees in an incident area, and must be followed when working at or around an incident or during prescribed mitigation activities.

### Protocol

This NSW Rural Fire Service (RFS) protocol, provides a common and coordinated approach for interagency involvement in hazardous tree management, and aligns to the Joint Agency Guideline used by: NSW National Parks and Wildlife Service, Fire Rescue NSW, and Forestry Corporation NSW.

### 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.
- Consider if the incident area has previously been identified as high-risk for trees; or local knowledge, ground observations, and/or aerial observations (if available) indicate 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).

### Risk Management

- Only trained and experienced personnel should determine the method of control and priorities for managing hazardous trees. Consultation and notification to the IMT and Safety Advisor (SA) are essential in determining appropriate course of action for dealing with hazardous trees.
- 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, Incident Action Plans (IAP), Prescribed Burn Plans (PBP), 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.



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- 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 is safe and appropriate for the tree to be felled. Plant should be considered, with felling by hand (such as chainsaw) considered as a last resort. Refer to *RFS OPG - Chainsaw Operations*.
- Where it is determined 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. minimum two tree lengths) and burn out around the tree may be appropriate in some circumstances.
- 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 an exclusion zone 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. Refer to *Appendix Two*.

### Symbology and Exclusion Zone

- 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. Refer to *Appendix One*.



- 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:
  - Where possible, 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 1.5 m off the ground;
  - Paint must not be applied to rocks or rocky outcrops; and
  - If paint is 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.



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- If paint is 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, IAPs and PBPs.
- 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. Refer to *Appendix Three*.
- The exclusion zone of a hazardous tree is a minimum of 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.
- 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.

### 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 Incident Controller (IC) and SA, and recorded in log books and on relevant maps, IAPs and PBPs.
- Hazardous and/or culturally significant, historic, significant or habitat tree identification must be highlighted as part of ongoing 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.

### Special Considerations

#### Characteristics of Hazardous Trees

- 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.
- Signs and characteristics that may indicate a 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; and
  - Hang-ups.



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- 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; and
  - Exposure to vibration from heavy plant or machinery.
- Refer to *Appendix Four*.
- 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. Red and white striped tape must be used to mark an exclusion zone. If tape is not available, utilise other available materials to clearly mark an exclusion zone. Refer to *Appendix Three*.

## Conservation

### 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.

### 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.
- ICs 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 PBP;
  - 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



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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; and
- Strong preference given to extinguishing fires burning on cultural or historic trees rather than attempting tree removal.

### 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.
- ICs and firefighters 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 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 by 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 listed above.

### Related Information

[Joint Operational Guideline - Hazardous Trees](#)  
[NSW Biodiversity Conservation Act 2016](#)  
[Planning for Bush Fire Protection 2019](#)  
[RFS OPG - Chainsaw Operations](#)



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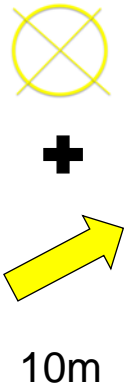

### Definitions

<b>Exclusion Zone</b>	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.
<b>IC</b>	Incident Controller
<b>IMT</b>	Incident Management Team
<b>IAP</b>	Incident Action Plan
<b>LACES</b>	Risk assessment checklist that stands for: lookout, awareness, communications, escape routes, and safety zones.
<b>PBP</b>	Prescribed Burn Plan
<b>PPC/PPE</b>	Personal Protective Clothing and Equipment - Protective clothing and equipment designed to protect a person from injury or infection, e.g. firefighting ensemble, respiratory protective equipment, boots, helmet, gloves, goggles, flash hood, mask.
<b>SA</b>	Safety Advisor



### Appendix One

#### 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 a control line, or the tree is too dangerous to mark.
Barrier tape for tree hazard (exclusion zones)		<b>NSW Standard Danger Tape</b> for tree hazard management. Other tapes should only be used only when red and white tape is not available.





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### Appendix Two

#### Risk Control Measures

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





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Phases of Incident	Risk Treatment					
	Hierarchy of Control					
	Level 1		Level 2		Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
<b>During – At the incident</b>	<ul style="list-style-type: none"> <li>• 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</li> <li>• Prevent ignition of potentially Hazardous trees and significant trees by minimising backburn and burnout fire intensity (e.g. the use of backing flanking fire)</li> <li>• Prevent potentially Hazardous trees and significant trees from catching alight, by:               <ul style="list-style-type: none"> <li>○ Clear fuel around trees (using hand tools or machinery).</li> <li>○ Candle (burn) tree to remove flammable bark during suitable conditions</li> <li>○ Application of ground based retardants or suppressants</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Adjust strategy on the day if required</li> </ul>	<ul style="list-style-type: none"> <li>• Withdraw from high tree hazard area under identified conditions (e.g. wind)</li> <li>• Establish exclusion zone around identified tree hazard</li> <li>• Move or abandon control line through identified high tree hazard areas or around significant trees</li> <li>• Relocate control line away from individual tree hazards or significant trees</li> <li>• Traffic management to isolate responders and public from risk</li> </ul>	<ul style="list-style-type: none"> <li>• Falling objects protection systems</li> <li>• Occupant protection guards</li> </ul>	<ul style="list-style-type: none"> <li>• Establish crew deployment procedures based on Dynamic Risk Assessment</li> <li>• Use lookouts, awareness, communications, escape routes and safety zones (LACES) to manage risk, (e.g. identification of escape routes)</li> <li>• Marking of Hazardous trees and significant trees when safe and appropriate</li> </ul>	<ul style="list-style-type: none"> <li>• PPE</li> </ul>



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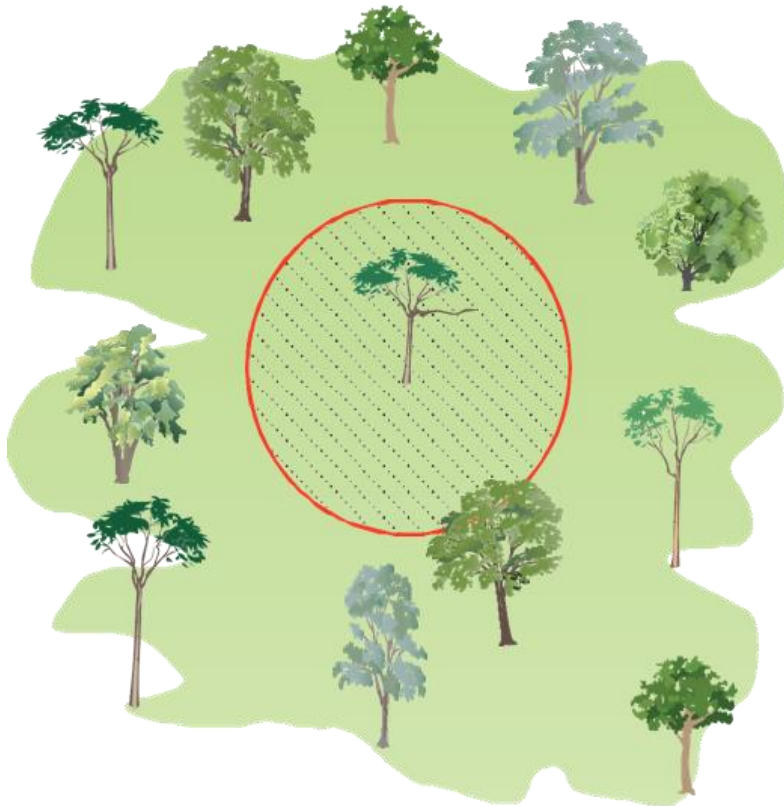
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Phases of Incident	Risk Treatment					
	Hierarchy of Control					
	Level 1		Level 2		Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
	<ul style="list-style-type: none"> <li>Wetting down of trees with water.</li> </ul>					
After	<ul style="list-style-type: none"> <li>Treat Hazardous trees (cross trees, ☒) by tree removal or limb/branch removal if appropriate and safe to do so</li> </ul>		<ul style="list-style-type: none"> <li>Relocate control line</li> <li>Traffic management</li> <li>Establish exclusion zones</li> </ul>	<ul style="list-style-type: none"> <li>Falling objects protection systems</li> <li>Occupant protection guards</li> </ul>	<ul style="list-style-type: none"> <li>Defer crew deployment until full tree hazard assessment has been conducted</li> <li>Use Dynamic Risk Assessment and LACES to manage risk during deployment</li> <li>Mark and communicate ongoing risks</li> </ul>	<ul style="list-style-type: none"> <li>PPE</li> </ul>



### Appendix Three

#### Exclusion Zone



#### Physical Barriers







### Appendix Four

#### 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, e.g. 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.





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#### 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.



#### 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.



#### 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.



#### 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.

