

Threatened Species and Communities Risk Assessment

Tranche 2 Risk Assessment and Interim Protections



September 2022



Acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practises.

We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practises and their broader aspirations in the 21st century and beyond.



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1. Introduction

Under Victoria's modernised Regional Forest Agreements (RFAs), the Department of Environment, Land, Water and Planning (DELWP) must undertake a risk assessment for species or communities that are potentially at risk from forestry operations, within six months of a species or ecological community being listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). DELWP must also determine whether additional interim or permanent protections and management actions are necessary and implement interim protections and actions where relevant. More information on the details of this requirement can be found in the [October 2020 Threatened Species and Communities Risk Assessment document](#).

DELWP has completed a second substantial risk assessment of threatened species (Tranche 2) in accordance with the RFA requirements. The trigger for this risk assessment was the listing of more than 1,300 species as threatened under the FFG Act in May 2021. The risk assessment was informed by input from scientific experts, combined with other information sources including published literature and spatial analysis. The consequence and likelihood of each assessed hazard was determined to assess the overall level of risk posed to each listed species over the next 20 years, as they variously apply across the five Victorian RFA regions (Central Highlands, Gippsland, East Gippsland, North East and West), including consideration of the effectiveness of existing controls. The assessment considers whether any of the identified residual risks (those ranked significant or high) represent an immediate risk of serious or irreversible harm in the short term (by mid-2023). Finally, it states whether permanent protections may be required to mitigate the identified significant or high risks in the longer term, with hazards that are rated as a medium risk or higher recommended for consideration in future management planning.

Of the species listed under the FFG Act in May 2021, there are 62 species in this risk assessment that are considered to be, or have the potential to be, impacted by forestry operations. One of these species has since been removed. This decision was based on advice from experts, that records of this species in merchantable areas were mis-identified and therefore not at risk from forestry operations. There are now 61 species in the final group. The rest of the species listed in May were not deemed to require a risk assessment under the RFAs.

Of the 61 species assessed, a total of 19 species have been recommended for interim protections relating to forestry operations, including three Spiny Crayfish, seven rainforest affiliated species, and nine restricted and limited range plants.

The following key hazard themes were assessed across the 61 species:

- Climate change
- Fire
- Forestry operations
- Habitat modification
- Invasive species
- Threats to population health and resilience

Appendix 1 includes a table of the 61 species and the hazard themes per RFA region that were assessed as significant or high for each species.

Note: Not all hazards were assessed for every species. Experts were asked to assess the hazards that were likely to have the biggest impacts, as well as to assess potential threats posed by forestry operations for each species for which they had expertise. In some cases, however, hazards not related to forestry operations that were likely to have significant impacts on species were not assessed by experts during this process.

1.1 Assessing risk

In 2021, twenty-one species experts, including staff from DELWP, the Royal Botanic Gardens Victoria, Country Fire Authority and seven independent environmental consultants, were asked to assess the level of risk posed to species for which they had expertise, by hazards over the next 20 years as they variously apply across the five Victorian RFA regions. They determined the consequence and likelihood of each hazard, as well as considering the effectiveness of existing controls. The experts were asked to assess whether any of the identified risks (those ranked significant or high) represent an immediate risk of serious or irreversible harm in the short term (the next 18 months). They were also asked to propose feasible, realistic measures (including regulatory controls, active management and/or further knowledge acquisition) that should be considered to mitigate the identified significant or high risks over the longer term. A description of the risk assessment method is provided in Appendix 2.

1.2 Updated data

The original risk assessment was based on the 2015 forestry operations “net harvest area” spatial layer, which identified ~400,000 ha of available and merchantable forest across eastern Victoria. Estimates of each species’ potential “exposure” to timber harvesting was based on this data. New data, the 2022 “operable area” spatial layer, refined the potential suitable area for forestry operations to ~160,000 ha across eastern Victoria, based on forest type and forest age. DELWP has re-assessed the potential exposure to species from forestry operations using this layer. The risk rating from the original 2021 assessment has not been amended, except for seven rainforest affiliated species. Instead, we have reconsidered whether additional protections, either interim or permanent, are still required given the updated exposure information. Additional detail on the reassessment of the risk of forestry operations to the seven rainforest affiliated species (Bolwarra, Bristly Shield-fern, Creeping Shield-fern, Jungle Bristle-fern, Oval Fork-fern, Small Fork-fern, and White Supplejack) is provided in Appendix 2.

1.3 Past risk assessments

The “Tranche 1” risk assessment comprised of 79 species and communities that were listed under Victoria’s FFG Act or the Commonwealth EPBC Act, at the time of the commencement of the modernised RFAs. It included many high-profile species and communities including Leadbeater’s Possum; Southern Greater Glider; large forest owls; Long-footed Potoroo; Giant Burrowing Frog; Cool Temperate Rainforest; and aquatic species – freshwater crayfish and Galaxiids (small native fish). A risk assessment was completed for these species and communities in October 2020. Where required, interim protections were approved in April 2021. Permanent protections and management actions are being implemented concurrently with “Tranche 2” interim protections, with permanent protections recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland) which may also provide additional protection and may overlap with the rainforest affiliated species with recommended interim protections in section 2.

1.4 Requirement for interim or permanent protections

The RFAs require Victoria to use reasonable endeavours to implement interim enforceable protections and priority management actions, for those species for which this is necessary.

Species with a high or significant risk from forestry operations:

A total of **32** species have been identified to be at high or significant risk from forestry operations, including **9** species related to plantations and **23** species related to native forestry operations.

Protections and active management will be required to mitigate the impact of any hazard identified as a significant or high risk, and all hazards rated as a medium risk or higher will need to be considered in future management. In many cases, this will involve the maintenance of existing controls; in some cases, further augmentation or adjustment may be required, subject to appropriate evaluation. In a few cases, new protection measures and/or programs of active management may be required.

Species recommended for forestry operations interim protections:

Of the 61 species assessed, a total of **19** species have been recommended for interim protections relating to forestry operations. DELWP has conducted a moderation and peer review process to review differences in expert opinion and to ensure consistency in the application of ratings. Maps for these species are shown in Appendix 4.

These species are grouped in three themes as follows:

- a) Spiny Crayfish in East Gippsland (three species) – provide interim protections through the application of enhanced buffers in core catchments.
- b) Rainforest affiliated species (seven species) – improve protection for the rainforest habitat of these species in bushfire-affected areas where correct recognition and buffering of rainforest might be less reliable due to the removal or partial removal of the rainforest canopy, as well as improve protections where these species may occur outside of already protected areas.
- c) Restricted and Limited range plants (including long-lived understorey species) (nine species) – improve protection in areas lacking Code prescriptions.

Section 2 details the recommended interim protections for these species.

In the detailed risk assessments below, information is provided on the interim protections to be implemented immediately and the priority management actions to be implemented as soon as possible to mitigate the short-term risks. Information is also provided as to whether additional permanent protections may be required; finally, potential management actions based on the advice of the species assessors are listed – these would be considered for inclusion in action statements and management plans when they are prepared or updated.

1.5 Next steps

This risk assessment will be followed by the preparation or update of action statements for each species under the FFG Act, as required by the RFAs. These action statements will be based on a detailed assessment of the management actions necessary for the conservation of each species. All relevant social and economic factors will be considered in their preparation, and further consultation with relevant government agencies will be undertaken prior to their completion to ensure that the intended management actions are feasible and proportionate to the level of risk posed by the various hazards identified in this document. Any required permanent protections are due to be in place by May 2023.

2. Summary of Interim Protections

2.1 Aquatic Species

Table 1. Interim protections for aquatic species

Species Name	Interim Protection
Claytons Spiny Crayfish <i>Euastacus claytoni</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) (SMZ) to the catchment of the Claytons Spiny Crayfish with the following conditions:</p> <p>Where one or more individuals of Clayton's Spiny Crayfish have been verified:</p> <ul style="list-style-type: none"> • Environments with high soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 40 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography; see Figure 1); ○ Apply 30 metre (m) buffers plus 10 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • Environments with low soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 60 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); ○ Apply 40 metre (m) buffers plus 20 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • No new road, snig track, in-coupe road, coupe driveway, coupe infrastructure or stream crossing shall be constructed within or through any buffer without an approved exemption from the Secretary (See Map 1).

Species Name	Interim Protection
<p>East Gippsland Spiny Crayfish</p> <p><i>Euastacus bidawalus</i></p>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) (SMZ) to the catchment of the East Gippsland Spiny Crayfish, plus two recent VBA records that fall outside of the mapped catchment, with the following conditions:</p> <p>Where one or more individuals of East Gippsland Spiny Crayfish have been verified:</p> <ul style="list-style-type: none"> • Environments with high soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 40 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography; see Figure 1); ○ Apply 30 metre (m) buffers plus 10 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • Environments with low soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 60 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); ○ Apply 40 metre (m) buffers plus 20 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • No new road, snig track, in-coupe road, coupe driveway, coupe infrastructure or stream crossing shall be constructed within or through any buffer without an approved exemption from the Secretary (See Map 2).

Species Name	Interim Protection
Variable Spiny Crayfish <i>Euastacus yanga</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) to the catchment of the Variable Spiny Crayfish with the following conditions:</p> <p>Where one or more individuals of Variable Spiny Crayfish have been verified:</p> <ul style="list-style-type: none"> • Environments with high soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 40 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography; see Figure 1); ○ Apply 30 metre (m) buffers plus 10 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • Environments with low soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 60 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); ○ Apply 40 metre (m) buffers plus 20 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • No new road, snig track, in-coupe road, coupe driveway, coupe infrastructure or stream crossing shall be constructed within or through any buffer without an approved exemption from the Secretary (See Map 3).

2.2 Rainforest Affiliated Species

Table 2. Interim protections for rainforest affiliated species

Species Name	Interim Protection
Bolwarra <i>Eupomatia laurina</i>	Within the East Gippsland RFA region, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities, including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).
Creeping Shield-fern <i>Lastreopsis microsora</i> subsp. <i>microsora</i>	Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Map 5a). Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.
White Supplejack <i>Ripogonum album</i>	
Bristly Shield-fern <i>Lastreopsis hispida</i>	Within the East Gippsland RFA region, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities, including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4). Within the Central Highlands, East Gippsland and West RFA regions, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Maps 5a and 5b). Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.
Jungle Bristle-fern <i>Abrodictyum caudatum</i>	Within the East Gippsland and Gippsland RFA regions, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities, including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).
Oval Fork-fern <i>Tmesipteris ovata</i>	
Small Fork-fern <i>Tmesipteris parva</i>	Within the Central Highlands, East Gippsland and Gippsland RFA regions, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Maps 5a and 5b). Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.

2.3 Limited or Restricted Range Flora

Table 3. Interim protections for limited or restricted range flora

Species Name	Interim Protection
Errinundra Pepper <i>Tasmannia xerophila</i> subsp. <i>robusta</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a).
Finger Hakea <i>Hakea dactyloides</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over one Australian National Herbarium record (2002) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over one Australian National Herbarium record (2002). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a). DELWP will conduct a survey to confirm extent of the Stony Peak Road occurrence and any other undocumented occurrences in the general vicinity and ensure the National Herbarium record is included in the Victorian Biodiversity Atlas (VBA).
Forest Geebung <i>Persoonia silvatica</i>	<p>Within the East Gippsland and Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a).
Forest Phebalium <i>Phebalium squamulosum</i> subsp. <i>squamulosum</i>	<p>Within the Central Highlands, Gippsland and East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Maps 5a and 5b).
Leafless Pink-bells <i>Tetratheca subaphylla</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a).

Species Name	Interim Protection
Sandfly Zieria <i>Zieria smithii</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a).
Satinwood <i>Nematolepsis squamea</i> subsp. <i>squamea</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a).
Tullach Ard Grevillea <i>Grevillea polychroma</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a).
Wallaby-bush <i>Beyeria lasiocarpa</i>	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less) with the following conditions:</p> <ul style="list-style-type: none"> The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100m or less). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 5a).

3. Key hazards identified in this risk assessment

The sections below describe the nature of the dominant hazards identified in this risk assessment of 61 species, the nature of each hazard and the mechanisms by which the hazard might impact on vulnerable threatened species. Appendix 1 shows a summary table of the 61 species, with the hazard themes per RFA region that were assessed individually as significant or high.

The hazards described interact to varying extents. Examples of this include evidence that climate change is increasing the frequency and severity of droughts in south-eastern Australia, which in turn increases the frequency, extent, and severity of bushfires. Bushfires and forestry operations may combine to accelerate the loss of mature and senescent forest growth stages. Protracted severe droughts will affect stream flows with corresponding impacts on water quality, as will extensive areas of regrowth forest arising from bushfires and forestry operations, especially in ash-type forests. The impact of regrowth forest on water yield varies according to forest type but is similar whether resulting from bushfires or forestry operations; however, the contribution of bushfires is likely to be greater given the area typically affected. The permanent road system is thought to facilitate the movement of predators, and the movement of soils and gravel associated with roading may introduce weeds and pathogens.

3.1 Climate change

Climate change can impact threatened species in many ways, including:

- Increased temperatures, both average maximum and minimum temperatures and temperature extremes;
- Changes to patterns of precipitation (rainfall, snowfall, and dew): annual averages, seasonal patterns, droughts and floods;
- More frequent and severe storm events; and, indirectly
- More frequent, severe and/or extensive bushfires, including outside the “normal” bushfire season.

Rainforest gullies, the habitat of many species subject to this risk assessment, are less likely to be protected from fire due to increased drying. Drought, high temperatures and increased fire frequency and intensity can result in the sudden decline in the extent of structurally mature rainforest, which is critical habitat for species such as Bolwarra and fork-ferns. These species can be at risk of adult mortality and recruitment failure, and longer-term local extinction, due to repeat fire events and extreme drought stress.

Drying climate and drought can impact the watering cycles of wetlands and waterways for taxa such as the Lacey River Buttercup and will likely result in greater incidence of fire and the longer-term decline of habitat extent and quality. Continuing drying of wetlands can concentrate the destructive activities of invasive species in remaining wetlands. Drying out of habitat can also make it more fire prone, with impacts being more severe to fire sensitive taxa such as Finger Hakea.

Climate change has the propensity to reduce the reliability of winter rainfall events. Reduced winter rainfall impacts on the quality and amount of habitat available to taxa such as the Brackish Plains Buttercup and Violet Bladderwort. It also increases the risk of seedbank depletion, recruitment failure and local extinction. Introduced plant species are also then given increased capacity to competitively occupy habitat.

Drought can also impact species like the Eastern Pomaderris that rely on rain following fire for recruitment, and more drought-tolerant taxa like the Tall Plume-grass by hampering recruitment and increased likelihood of more frequent and intense fire. This can in turn lead to targeted herbivory by Sambar Deer (*Rusa unicolor*) or Black-tailed Wallaby (*Wallabia bicolor*), and local extinction.

For aquatic taxa like spiny crayfish species, extreme heat events warm streams and can cause range retractions and population declines. Prolonged droughts can also disrupt water flow, while large rainfall events following bushfires and soil disturbance can lead to run-off and sedimentation.

Climate change can alter and shift habitat, creating changes to vegetation structure that will cause loss of populations. Species like the Errinundra Shining Gum are at risk of losing preferred habitat and be outcompeted by taxa that are more suited to the changed conditions.

This risk assessment has identified 29 threatened species that are at high or significant risk because of climate change.

Measures to manage the risks to threatened species from fire-related hazards include:

- The *Climate Change Act 2017*, which provides Victoria with legislation to manage climate change risks, maximise the opportunities that arise from decisive action, and drive transition to a climate-resilient community and economy with net-zero emissions by 2050;
- Victoria's *Natural Environment Climate Change Adaptation Action Plan 2022-2026*, which is a system-level adaption action plan developed to respond to the priorities outlined in the Climate Change Act 2017, including an assessment of the extent to which existing policy addresses these priorities, and identifying actions to address key gaps;
- *Streamflow Management Plans*, developed under the *Water Act 1989*, define the total amount of water in a catchment and describe how it will be shared between the environment and water users; and
- The *Victorian Floodplain Management Strategy 2016*, which sets the direction for floodplain management in Victoria and evaluates Victoria's flood risks.

3.2 Fire

Fire is an important component of most terrestrial ecosystems in Victoria. In considering the variety of risks (and benefits) that fire creates for threatened species, it is valuable to separate the key elements of fire as a hazard. These are:

- The direct impacts of single bushfire events, including the mortality of individuals, the potential transformation of vegetation communities and the loss of habitat features;
- The indirect impacts of single bushfire events, such as sedimentation of waterways and reduced water quality;
- The impacts of multiple fires, including bushfires and planned burns over time (known as the fire regime) and the changes to the fire regime attributed mainly to climate change; and
- The impacts of bushfire management, including planned burning and other treatments to reduce fuel, roading and earthworks, removal of hazardous trees and the use of fire retardants.

Bushfire can severely impact many species, with events such as the Alpine Fires of 2003, the Great Divide Fires of 2006, the Black Saturday Fires of 2009 and the 2019-20 bushfires in eastern Victoria having the capacity to substantially modify the environment in affected areas for decades, even centuries.

Bushfires also degrade water quality and alter the dynamics of stream ecosystems. This occurs following heavy rainfall soon after a fire, as vegetation loss and altered soil structure make fire-affected soils more erodible. Runoff carries sediments and pollutants that affect aquatic species such as burrowing and spiny crayfish species and their habitats. Bushfires can also result in the loss of riparian vegetation, which impacts water temperature and food availability for aquatic species.

While an individual bushfire might have a massive impact, it is the increased frequency and intensity of fire, mainly due to climate change, that is likely to drive permanent changes in the distribution and abundance of threatened species. Fires more frequent than the tolerable fire interval for a species can result in direct mortality. Repeat disturbance can mean that recruiting plants fail to achieve sufficient maturity to flower and set seed, leading to seedbank depletion, recruitment failure and eventually local extinction. Other impacts include long-term changes to habitat and vegetation structure, increased browsing and trampling by invasive species such as Sambar Deer and increasing competition from both native and introduced species that are better adapted to the altered fire conditions.

Given the threat posed by bushfires to life, property and the environment, bushfire management is an essential and ongoing part of forest management in Victoria. Bushfire management is the primary control for reducing the risk of major bushfires to life, property, and the environment.

Bushfire management can be divided into phases of planning, prevention, preparedness, fuel management, response, recovery, and monitoring. Fuel management and response are the key phases that generate risks to threatened species, while noting the risks associated with bushfires as described above.

Fuel management most commonly involves planned burning, although other mechanical treatments have been introduced. While planned burning mitigates against bushfire risk for a range of values, it contributes to a total fire regime and may, in some circumstances and for some species, generate undesirable ecological changes.

Safety measures implemented to protect fire crews during planned burning typically involve track maintenance or widening to ensure safe access and the removal of hazardous trees. Machines may be used to create firebreaks around

the planned burn perimeter, leading to temporary vegetation loss and soil disturbance. The burn perimeter might also intersect with streams or drainage lines, increasing the risk of soil erosion and sedimentation. The use of machinery may also facilitate the spread of weeds and pathogens.

The risk assessment has identified 34 threatened species that are at high or significant risk from fire.

Threatened species that may be significantly affected by fire include:

- Fire-sensitive species such as Finger Hakea, Baw Baw Berry, and Beech Finger-fern;
- Species that depend on specific habitat features lost in fires (e.g., hollows) like the Lace Monitor;
- Rainforest species which are unable to recover sufficiently between fire events, such as Bolwarra, Creeping Shield-fern, and White Supplejack; and
- Wetland and waterway species vulnerable to sedimentation and run-off impacts, including the Floodplain Violet and crayfish species.

Measures to manage the risks to threatened species from fire-related hazards include:

- The Victorian Government's Safer Together approach, including fuel management, to reduce the severity of bushfires in Victoria;
- Bushfire suppression through coordinated action to limit the extent and severity of bushfires;
- Natural Values and Wildlife Officer roles in most Level 3 Incident Management Teams;
- Biodiversity risk assessment roles deployed in every Rapid Risk Assessment Team;
- Environmental considerations in Readiness and Response Plans;
- The Code of Practice for Bushfire Management on Public Land 2012;
- Strategic Bushfire Management Planning to identify fire management zones; and
- Values checking and delivery of mitigations at the operational delivery stage of bushfire management activities.

3.3 Forestry operations

Timber harvesting can occur at different scales and intensities and use different harvesting methods. While the history of native forest timber harvesting in Victoria is complex and variable across different forest types and regions, there has been a general shift towards more intensive harvesting systems since the mid-20th century, driven by a combination of silvicultural and commercial factors. More recently, there has been a shift towards adaptive management that retains significantly more individual trees and patches and with a greater emphasis on biodiversity and managing conservation values within coupes. There are also differences in the approaches to harvesting in ash and mixed species forests. Retention of understorey patches is also now common with typical coupes ranging between 20-40 hectares in size.

The site-level impacts of timber harvesting based on the standard “clear-fell” or “seed-tree” system include:

- Direct mortality;
- Removal, modification, and fragmentation of the forest structure;
- Soil disturbance and compaction due to machinery use, potentially also leading to soil erosion and sedimentation of waterways; and
- Edge creation, leading to changes in micro-climate characteristics such as light intensity, temperature, humidity, and wind strength in the adjoining forests.

Direct mortality occurs through timber harvesting operations, with tree species previously being available for harvesting now being listed as threatened.

The use of heavy machinery during and after the harvesting operation, particularly on snig tracks and log landings, can have a localised and detrimental impact on survival of many understorey species (e.g., Baw Baw Berry, Mountain Bird-orchid, Upright Pomaderris). Burrowing and spiny crayfish are vulnerable to sedimentation impacts arising from roads, stream crossings and unbuffered drainage lines. Small wetland plants are also vulnerable to sedimentation effects (e.g., Brackish Plains Buttercup, Forest Sedge).

Edge effects can impact adjacent rainforest. Many species subject to this risk assessment occur within or adjacent to rainforest habitats (e.g., Baw Baw Berry, Oval Fork-fern, White Supplejack). While these taxa are generally protected by rainforest prescriptions, occurrences of the species outside of these habitats will be subject to edge effects, including increased light and wind penetration, elevated temperatures, and reduced humidity. Following bushfire, these risks are exacerbated due to the impact on the rainforest canopy and consequent difficulties defining rainforest boundaries.

Following harvesting, hot regeneration burns are typically applied, to remove “slash” and create conditions suitable for germination and seedling establishment, noting that VicForests has incorporated lower impact regeneration options into their 2019 update of harvesting and regeneration systems and high conservation management systems. These burns impact recruits (e.g., Forest Geebung, Satinwood, Tullach Ard Grevillea) or surviving mature individuals (e.g., Tasmanian Wax-flower, Veined Pomaderris) either directly, or by facilitating competitive exclusion of threatened species (e.g., Leafless Pink-bells) by more common species.

Some species subject to this risk assessment are impacted by plantation forestry. Rapidly growing trees draw down on the water table and may reduce surface runoff. This can lead to the drying out of wetlands and damper habitats occupied by species like Black Bog-sedge, Bog Saw-sedge, and Lax Twig-sedge. Similar impacts on hydrology may also occur after native timber harvesting or wildfire, when large areas of vegetation rapidly regrow. Other species (e.g., Violet Bladderwort) may be impacted by chemical run-off and spray drift from adjacent plantations.

The risk assessment has identified 32 threatened species that are at high or significant risk from forestry operations. Species affected by the 2019-20 bushfires may have a higher risk rating than would otherwise be the case, due to the elevated uncertainty from the impacts of the bushfires and the implications for the additional impacts that forestry operations might have on those species and communities, as they recover.

Measures to manage the risks to threatened species from forestry operations include:

- The Code of Practice for Timber Production 2014 (the Code) which provides the framework for the regulation of commercial timber harvesting operations on both public and private land; The Code and the incorporated Management Standards and Procedures for Timber Harvesting Operations in Victoria's State Forests 2014 (MSPs) provide for the protection of biodiversity and mitigation of risks through mandatory actions, such as field-based prescriptions for species and their habitat, soil and water quality risk management and post-fire salvage risk management;
- The Comprehensive, Adequate and Representative (CAR) Reserve System which is excluded from forestry operations;
- The Forest Management Zoning System outlined in the Code of Practice for Timber Production 2014 classifies areas of State Forest for conservation, production, or multiple use. It comprises: Special Protection Zone (SPZ), managed for conservation values; Special Management Zone (SMZ), managed to conserve specific features while catering for timber production; and General Management Zone (GMZ) where multiple use management and timber production is generally permitted. Elements of FMZ are included in the CAR Reserve System;
- Modified harvesting and forest regeneration practises, which have been implemented in native forest to further mitigate the potential threat from forestry operations to threatened species and their habitats above the current Code of Practice requirements, e.g., greater retention harvesting and retention of habitat or hollow bearing trees; and
- Third party certification of forestry operators.

3.4 Habitat loss, degradation, and fragmentation

Habitat loss, degradation and fragmentation occur through numerous pathways. Climate change, fire and forestry operations all contribute to these processes. This risk assessment also identified that roading and the construction of fuel breaks, water management and use, and agricultural intensification are important pathways to habitat modification.

The permanent road network in Victorian public land forests is vital to bushfire management, timber production, recreation, and public safety. Road construction, upgrading and maintenance are routinely carried out across the public land forest estate, including in parks and reserves, although construction of new permanent roads is relatively rare. Construction of temporary roads for access to timber harvesting coupes is common. Species like Fingerwort are vulnerable to direct mortality through landslips associated with roading, while Long Pink-bells occurs on roadsides so is vulnerable to road widening activities. Values checking processes are usually adequate controls if the locations of

threatened species are known, although comprehensive information on the location of important populations is lacking for most threatened plant species.

The construction of strategic fuel breaks is like permanent roads in terms of its impacts on threatened species, and so is addressed in this section rather than as part of bushfire management. Pale Hickory-wattle is vulnerable to the construction of fuel breaks along electrical transmission lines, particularly where chemical herbicides are applied instead of mechanical treatment. The potential longer-term impact of strategic fuel breaks includes areas adjacent to the fuel breaks that are subject to planned burning below tolerable fire intervals, either as part of bushfire prevention or suppression activities, noting the trade-off with the risks of not managing the threat of bushfire.

Roading and constructing fuel breaks also involves the installation and maintenance of bridges, culverts, and drains. It should be noted that forest canopy gaps, soil disturbance and waterbodies created artificially due to drainage from roads, may trigger germination or provide habitat for some species, although it is unclear if this contributes significantly to the overall viability of the local populations.

The main impacts of roading and strategic fuel breaks include:

- Vegetation and habitat loss and fragmentation;
- Edge effects on adjoining vegetation;
- Soil disturbance;
- Sediment input to streams; and
- Spread of weeds and pathogens.

Dam and water management and use, including river regulation and the diversion of streams, can lead to altered hydrology, habitat degradation and population declines, potentially leading to local extinction. This can impact species like the Floodplain Violet, which grows in sedge-dominated swamp and riparian habitat. Loss of instream habitat and reduced flooding and flow volumes can impact on wetland species such as the Lacey River Buttercup and the Wavy Swamp Wallaby-grass, while similarly the draining of water impacts on species confined to wet heaths and swamps, like the Violet Bladderwort.

This hazard theme is closely linked to climate change, which has been increasingly drying habitat and altering rainfall patterns, resulting in drought and the drying of wetlands and waterways. Plantations or regenerating native forests with relatively high growth rates can lead to drying of wetlands and other waterways through elevated transpiration rates and canopy interception of precipitation. Weeds can more easily invade degraded habitats, and a reduction in wetland habitats can concentrate destructive activities of animals in remaining wetlands. Cropping, livestock grazing, and physical damage also contribute to the continued drying and loss of wetlands. The Victorian Waterway Management Strategy and associated Regional Waterway Strategies have been evaluated as satisfactory controls for the relevant taxa in this risk assessment, on the assumption that wetlands and waterways are managed responsibly in accordance with these plans.

Land use changes, including agricultural intensification, extension of cropping, wetland drainage, infrastructure expansion and maintenance, fire management, and livestock agistment lead to habitat modification. For species like Lax Twig-sedge, where much of the habitat has been subject to past clearing, the cumulative impacts are high. Climate change may increase the capacity of some introduced plant taxa to competitively occupy the habitat. Certain agricultural practises can lead to elevated nutrient levels and introductions of species such as Tall Wheat Grass (*Thinopyrum ponticum*) which threatens Brackish Plain Buttercup. The threat to residual private land populations will increase as agriculture becomes more industrial and climate change expands the potential to crop wetland habitats. Voluntary private land conservation programs, like Landcare and Wetland Tender, while limited in extent, are satisfactory controls where they are applied.

The risk assessment has identified 9 threatened species that are at high or significant risk from habitat modification.

Measures to manage the risks to threatened species from habitat modification-related hazards include:

- Streamflow Management Plans as required under the *Water Act 1989*, which define the total amount of water in a catchment and describe how it will be shared between the environment and water users;
- Sustainable Water Strategies, which are used to manage threats to the supply and quality of water resources to protect environmental, economic, cultural, and recreational values;

- The Victorian Waterway Management Strategy (VWMS), which provides the framework to maintain or improve the condition of rivers, estuaries and wetlands so that they can continue to provide environmental, social, cultural and economic values to Victorians;
- The Regional Waterway Strategies (RWSs), which are a single planning document for river, estuary and wetland management in each region and drive implementation of the management approach outlined in the VWMS;
- FFG Act Action Statement No. 177 – Alteration to the natural flow regimes of rivers and streams; action statements describe the nature of the potentially threatening process and set out what has been done and what will be done to manage its impacts on native flora and fauna;
- The Environment Protection Act 2017, which provides for policies and regulation to minimise harm to public health and the environment from pollution and waste;
- The Murray-Darling Basin Plan, which aims to bring the Basin back to a healthier and sustainable level, while continuing to support farming and other industries for the benefit of the Australian community;
- Environmental Entitlements under the Water Act 1989, which enable water to be taken and used to maintain an Environmental Water Reserve, or to improve the environmental values and health of water ecosystems;
- The regulation of the removal of native vegetation under the Victorian Planning Provisions and all planning schemes in Victoria;
- Support programs such as Landcare for landholders to protect and restore habitat, including remnant patches of native vegetation and isolated paddock trees;
- Values checking and mitigations at the operational delivery stage of roading actions within State Forest; and
- Native Vegetation removal on public land is managed in accordance with the Procedure for the removal, destruction or lopping of native vegetation on Crown land (Crown land procedure).

3.5 Invasive species

Victorian public land native forests have been progressively colonised by invasive species since European settlement. Predators such as foxes, omnivores such as pigs, and herbivores including deer and horses occur over wide areas, although not uniformly. Introduced trout are widespread in inland and coastal river systems, including some of the smallest headwater tributaries. Weeds are ubiquitous and include a wide range of life-forms from small forbs (herbs) to large, long-lived trees.

The impact of introduced predators results in elevated levels of direct mortality as well as competition for prey items. Native predators such as the dingo, spot-tailed quoll, large forest owls and other raptors compete with introduced predators, impacting on populations of threatened species. The lace monitor is impacted by competition and direct mortality of juveniles, particularly from foxes. Current controls, including widespread fox baiting through programs like Southern Ark program, have been rated as satisfactory, but require ongoing investment to be successful.

Introduced freshwater fish, particularly Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*), are widespread throughout Victorian waterways. These species prey on threatened juvenile freshwater spiny crayfish (e.g., Claytons and East Gippsland Spiny Crayfish). The impacts of trout are likely compounded where threatened spiny crayfish occur in small, isolated populations in already modified habitats. Controls for this hazard are poor because populations of introduced trout are encouraged to provide opportunities for recreational fishers.

Introduced herbivores impact on populations of threatened plant species, as browsing reduces growth and may impact on reproduction. Sambar deer are a particular concern as they prefer the moist, gully habitats occupied by many of the species subject to this risk assessment, such as Beech Finger-fern and Forest Geebung. Large ungulates such as deer, horses and pigs cause environmental impacts through trampling, rooting, and pugging. This opens wetland habitats occupied by species like Flat Raspwort and Wavy Swamp Wallaby-grass and expose them to further drying and degradation. Widespread lethal control of deer, pigs and horses is logistically very challenging, so controls for this hazard are frequently rated as poor.

Weeds simply out-compete native species in certain situations, especially following disturbance (e.g., from forestry operations, roading or fire), through vigorous growth and often rapid reproduction. Climate change may also alter habitat conditions to favour the establishment of weed species (e.g., Floodplain Violet). Species that occur in already fragmented landscapes (e.g., Brackish Plains Buttercup) are highly exposed to weed incursion. Weed control was often rated as poor

because like controlling introduced herbivores, it is logistically and financially challenging to apply consistently and across the landscape. Weed control programs in the aquatic habitats occupied by species like Wavy Swamp Wallaby-grass require specialist revegetation skills. Furthermore, many of the plants considered in this risk assessment were not the primary targets of weed control operations.

Native species may also pose a risk to threatened species and communities. Because Tall Plume Grass occurs in small populations, it is susceptible to severe impacts from macropod or Wombat grazing. Sticky Wattle is vulnerable to Black-tailed Wallaby browsing while regenerating from seed post-harvest. Due to the challenges of managing native species impacts, this hazard is usually uncontrolled except at a very localised scale.

The risk assessment has identified 30 threatened species that are at high or significant risk because of invasive species.

Measures to manage the risks to threatened species from invasive species-related hazards include:

- The Weeds and Pests on Public Land (WPPL) program, which funds landscape-scale invasive species projects, focusing on protecting Victoria's biodiversity, examples include Southern Ark in East Gippsland;
- The Good Neighbour Program is working to control invasive species on the interface of public and private land;
- The Victorian Deer Control Strategy, which outlines a process for a strategic and coordinated approach to deer control;
- Biodiversity Response Planning is an area-based planning approach to biodiversity conservation in Victoria. Phase 1 of BRP identified 85 on-ground projects that were funded by the Victorian Government through to 2021 covering a range of invasive species;
- The Bushfire Biodiversity Response and Recovery program includes actions funded by the Victorian Government, Australian Government and other sources including public donations. A total of \$64.3 million in funding is being delivered in Victoria, including targeted invasive species actions across fire-affected regions;
- The Catchment and Land Protection Act 1994 provides for the control of invasive species. Under this Act, species of plants and animals can be declared as noxious weeds and pest animals if they have or might have the potential to become a serious threat to primary production, Crown land, the environment or community health;
- Catchment Management Authorities and Local Government deliver a range of targeted invasive species programs; and
- The Commonwealth Government funds Regional Land Partnerships that encompass a range of targeted invasive species actions.

3.6 Threats to population health and resilience

This hazard theme incorporates risks associated with small and restricted populations, including genetic decline (loss of variability), genetic introgression and hybridisation of species, native plant competition, and diseases and pathogens such as Myrtle wilt and *Phytophthora cinnamomi*.

Species that occur in small and restricted populations, such as the Finger Hakea and Upright Pomaderris, are at risk of local extinction if a threatening process, such as bushfire, impacts the whole population. Small and restricted populations are threatened by various other hazards assessed in this report, such as Sambar Deer, climatic warming and drying, and forestry operations.

Myrtle Wilt occurs when the fungus *Chalara australis* infects Myrtle Beech (*Nothofagus cunninghamii*) trees, either through wounds such as when limbs break off, or from the roots of nearby diseased trees. When myrtles die from fungal infection, the surrounding forest ecology is altered when more light, heat and wind penetrate the vegetation. Species that rely on the enclosed, moist rainforest habitat, such as the Oval Fork-fern and the Small Fork-fern are then impacted. Any disturbance to a patch of Myrtle Beech, even knocking a single tree into a gully, can increase susceptibility to Myrtle Wilt. Prescriptions under the *Code of Practice for Timber Production 2014* to buffer rainforest effectively limit this type of disturbance if they are applied correctly.

Phytophthora cinnamomi impacts Leafless Pink-bells and Tasmanian Wax-flower in other states, resulting in direct mortality and damage to root systems. *P. cinnamomi* is widespread through Gippsland, and while impacts on these species have not been documented in Victoria, it's likely that they would be similarly affected. The impacts of *P. cinnamomi* may be exacerbated by drought, and forestry activities may lead to localised introductions of the pathogen.

Factors that contribute to its local spread are rainfall, drainage patterns and soil texture. Once it is introduced to a site, it is almost impossible to control or eliminate. Hygiene protocols are likely to limit the spread of *P. cinnamomi*, providing the protocols are correctly and consistently applied. While disease management occurs in some parks and reserves, it is not consistently applied by recreational visitors.

The risk assessment has identified 3 threatened species that are at high or significant risk from population dynamics hazards.

Measures to manage the risks to threatened species from population dynamics-related hazards include:

- The Code of Practice for Timber Production 2014, which provides the framework for the regulation of commercial timber harvesting operations on both public and private land;
- Indirect measures, such as improving connectivity of freshwater ecosystems, may provide a benefit to support genetic viability of a species;
- Disease management occurs in some Parks and Reserves; and
- The Royal Botanic Gardens Victoria (RBGV) Victorian Conservation Seedbank (VCS) stores the seeds and spores of native Victorian plants, particularly endemics and at-risk species, and forms the basis of research into effective long-term germplasm storage, germination characteristics, and the propagation of recalcitrant native species. The VCS forms part of RBGV's Victoria's Bushfire Plant Recovery and Care Unit, which aims to support the restoration of fire damaged landscapes and ecosystems.

4. Species assessments

4.1 Lace Monitor (*Varanus varius*)

The Lace Monitor was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the North East (18% of modelled habitat), Gippsland (17% of modelled habitat), West (13% of modelled habitat), East Gippsland (12% of modelled habitat) and Central Highlands (11% of modelled habitat) RFA regions, with 29% of modelled habitat in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.1.1 Risk Assessment

Table 4. Lace Monitor risk ratings in the Central Highlands RFA region:

	Bushfire	Planned burning	Roading	Forestry operations	Invasive vertebrate (foxes and cats)
Consequence	Moderate	Moderate	Minor	Moderate	Minor
Likelihood	Possible	Likely	Likely	Possible	Likely
Overall risk rating	Medium	Significant	Medium	Medium	Medium

Table 5. Lace Monitor risk ratings in the East Gippsland RFA region:

	Bushfire	Planned burning	Roading	Forestry operations	Invasive vertebrate (foxes and cats)
Consequence	Major	Moderate	Minor	Moderate	Minor
Likelihood	Possible	Likely	Likely	Possible	Likely
Overall risk rating	Significant	Significant	Medium	Medium	Medium

Table 6. Lace Monitor risk ratings in the Gippsland RFA region:

	Bushfire	Planned burning	Roading	Forestry operations	Invasive vertebrate (foxes and cats)
Consequence	Major	Moderate	Minor	Minor	Minor
Likelihood	Possible	Likely	Likely	Rare	Likely
Overall risk rating	Significant	Significant	Medium	Low	Medium

Table 7. Lace Monitor risk ratings in the North East and West RFA regions:

	Bushfire	Planned burning	Roading	Forestry operations	Invasive vertebrate (foxes and cats)
Consequence	Moderate	Moderate	Minor	Minor	Minor
Likelihood	Possible	Likely	Likely	Rare	Likely
Overall risk rating	Medium	Significant	Medium	Low	Medium

4.1.2 Fire

Bushfire

Bushfire can cause the population decline of the Lace Monitor during the fire event and can have continued negative effects due to loss and degradation of habitat and loss of food resources, especially following severe fires. Severe and too frequent bushfires can remove hollow bearing standing trees and fallen hollows on the ground, which removes habitat and shelter for juvenile and adult Lace Monitors. In addition to habitat loss and degradation, direct mortality by burning and heat stress likely occurs during the fire event, especially in the context of severe canopy fires. As the Lace Monitor is believed to be an obligate nester within active termite mounds, fire can kill live termitaria which in turn will kill any contained Lace Monitor eggs and make that mound unsuitable as a nesting site in future (Robertson and Coventry 2014). Roads widened for firefighting access can also remove termitaria from road verges, which are often ideally placed to be in part sun during the day and are therefore attractive sites for the Lace Monitor to bask while excavating nesting tunnels in the termite mounds.

Food availability for Lace Monitors following bushfires may also have significant impacts on the species' persistence in fire-affected areas. Jessop et al. (2010) examined the diet of Lace Monitors in south-eastern Australia, finding the Common Ringtail Possum (*Pseudocheirus peregrinus*) to be the dominant prey species ingested. These results indicate a substantial preference for a single semi-arboreal prey item. A recent post-fire study conducted in Far East Gippsland identified all arboreal mammal species except the Common Ringtail Possum, however prior to the 2019-20 bushfires they were regularly encountered across the fire area. Even in areas with low levels of canopy scorching, the loss of understory and mid-story vegetation can extirpate species such as the Common Ringtail Possum, which suggests that the preferred prey species of the Lace Monitor is very likely in far lower abundance following the fires, likely resulting in much-reduced food availability which could impact Lace Monitor survival and reproduction in burnt areas.

Lace Monitors occupying areas recently burnt from planned burning or bushfire will also likely be exposed to greater levels of predation and competition from Red Fox (*Vulpes vulpes*) (Hradsky et al. 2017) and feral cats (*Felis catus*). Bushfires combined with fragmentation and edge effects from land clearing for agriculture, roading works, hazardous tree removal and forestry operations can have complex effects on wildlife populations, like that of the Lace Monitor, often causing decline or localised extinctions (Driscoll et al. 2021). Cumulatively, these hazards result in less habitat refugia for viable populations to persist in, which can then create genetic issues where populations become isolated, more inbred and with less adaptive potential.

Fire has affected a moderate amount of species' habitat across the Central Highlands (33% of modelled habitat), North East (35% of modelled habitat) and West (20% of modelled habitat) RFA regions burnt since 2000. Fires have burnt relatively small areas of important populations in the North East (12%) and the West (16%) but have affected a significant proportion of important populations in the Central Highlands (50%). While only a moderate proportion of area has been affected by fire across these RFA regions, with a higher frequency of bushfires predicted in the wake of continued human-induced climate change (Sharpley et al. 2016), management action may be required to prevent the loss of important habitat from severe fire and prevent localised population declines. Fire has affected the species' habitat more severely in the East Gippsland RFA region (81% of modelled habitat; 86% of important populations) and Gippsland RFA region (46% of modelled habitat; 75% of important populations).

Current existing controls for this hazard include:

- Bushfire suppression. The risk to this species is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on this species.

- The Victorian Government's Safer Together approach, including fuel management. This has been evaluated as poor as planned burning is not necessarily targeted at protecting the Lace Monitor from large bushfires.
- Biodiversity risk assessment roles deployed in every Rapid Risk Assessment Team. The efficacy of this control at mitigating the impacts of bushfire was not assessed. However, the expert noted that it is important for assessing post-fire options to limit further impacts to this species (i.e., implementing predator control).
- The *Code of Practice for Bushfire Management on Public Land 2012*. This has been evaluated as satisfactory, however bushfires are an unplanned event and responses to it are generally driven by circumstances and factors that can change dynamically, so responses vary accordingly.

Table 8. Lace Monitor protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Assess the net benefit of fuel management in unburnt areas where important populations occur; • Research the effects of fire on the species, identifying sites used as refuge from fire, use of burnt habitat post-fire, and level of persistence in areas of different burn severity; • Undertake more extensive on-ground surveys for the species in fire-affected areas; • Undertake long-term monitoring to track changes over time; and • Investigate food availability such as Common Ringtail Possum abundance and termite mound nesting site availability in fire-affected regions.

Planned burning

Planned burning can cause population decline in this species through direct mortality during the fire event, can remove necessary hollow trees and hollow logs on the ground (Bluff 2016) that are shelter sites for the Lace Monitor, and can have continued negative effects on this species due to loss and degradation of habitat and loss of food resources. Some standing hollow trees are felled during or prior to planned burns after being deemed hazardous trees, and when felled can kill Lace Monitors directly.

Planned burning can also kill live termite colonies in terrestrial or arboreal termitaria which are the only egg laying sites used by the species in Victoria. Loss of these sites means adults have nowhere to lay eggs until new termitaria are formed to a suitable size, roughly 5-6 years. Damage to termitaria during planned burning operations risks killing any eggs currently in the termitaria, which takes away their ability to reproduce despite individual survivorship. Not all termitaria are affected in a fire, but even if a few are killed in each burn, the gradual decrease in numbers over time following successive planned burns could reduce suitable nesting termitaria numbers to a point where reproduction is negatively affected.

The clearing along roadsides for bushfire preparedness is also potentially destructive towards the habitat of this species. This hazard will combine with similar hazard drivers like roading works, hazardous tree removal, bushfires and forestry operations that combine to reduce the available shelter sites for adult Lace Monitors and reduce the numbers and viability of termitaria in a local area for oviposition sites. Lace Monitors occupying areas recently burnt from planned burns will likely be exposed to greater levels of predation and competition from the Red Fox (Hradsky et al. 2017) and feral cat.

Current existing controls for this hazard include:

- The *Code of Practice for Bushfire Management on Public Land 2012* has been assessed as poor at fully considering impacts on the Lace Monitor, as it is not clear how the need to avoid these impacts is balanced with other priorities during burn planning. This is particularly relevant considering the recent large-scale bushfires that burnt large tracts of forest across the East Gippsland RFA region. However, due to the large-scale variability of planned burns, even within RFA regions, some burns may be considered satisfactory, although the occurrence of important populations of the species may not have been considered during their implementation.

- Strategic Bushfire Management Plans and the Joint Fuel Management Program. These have been evaluated as satisfactory for considering many ecological values but may not adequately address all risks to the lace monitor.
- Values checking and mitigations at the operational delivery stage of bushfire management activities. This has been evaluated as a poor mitigation of risk to the Lace Monitor, as this species is a mobile animal with a large home range.

Table 9. Lace Monitor protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Consider and account for habitat values of the species during planning and implementing planned burns, including where practicable: • Flag live termitaria in burn area to clearly identify asset to be protected; • Rakehoe around mound perimeter to take vegetation away for mounds; and • Educate machinery operators involved to ensure termitaria are not destroyed/harmed.
Potential management actions	<ul style="list-style-type: none"> • Limit, where practicable, planned burning in Box Ironbark Forest; and • Research how fire effects the species, identifying refuge sites used during fires, post-fire use of burnt habitats, and persistence of Lace Monitor populations in areas with different levels of burn impact.

Road construction and maintenance

This hazard includes the removal of hollow trees and large trees next to roads and tracks that could disrupt firefighting vehicular traffic, which removes shelter for this species and could cause direct mortality by crushing from falling trees. Termitaria can be an activity hub of Lace Monitor populations during the breeding seasons, with both males and females seen to gather around favoured termite mounds prior to mating and egg laying (Pianka and King 2004), so road and track widening can kill live termitaria in the works zone that may contain Lace Monitor eggs or be used for laying of eggs in the future. This hazard will combine with similar hazard drivers like roading works, bushfires, planned burns and forestry operations to reduce the available shelter sites for adult Lace Monitors and reduce the numbers and viability of termitaria in a local area for egg laying sites. This hazard exists where these roading works are carried out in treed habitats.

Current existing controls for this hazard include:

- The *Code of Practice for Bushfire Management on Public Land 2012*. The effectiveness of this control for this species has been evaluated as satisfactory because it is consistently applied through time and space where the hazard exists and appears to be effective most of the time, however it does not always prevent impacts on key biodiversity values, with no importance given to retaining termitaria where possible.

Table 10. Lace Monitor protection requirements and recommendations for roading

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Train and educate at all levels of implementation regarding desirable biodiversity outcomes; • Educate machinery operators involved to ensure termitaria are not destroyed or harmed; and • Flag live termitaria along road and track edges to clearly identify assets to be protected.

4.1.3 Forestry operations

Forestry operations

The disturbance associated with forestry operations has localised impacts on Lace Monitor habitat, as they require large tree hollows for refuge and thermoregulation (Stebbins 1968). The Lace Monitor has been noted to likely be an obligate termite mound nester in the southern parts of its range (Kirshner 2007), and forestry operations may cause mechanical damage to nesting sites within termite mounds, which can contribute to direct mortality of young during their breeding season (Kirshner 2007). Forestry operations can also reduce available food resources for the species as they rely on a variety of arboreal mammals and birds in their diet (Weavers 1989). Current forestry operations do not require protection of termitaria (arboreal or terrestrial) which are the only oviposition sites used by the Lace Monitor in Victoria, though this may be considered on a site-by-site basis. If oviposition sites are lost, it takes roughly 5-6 years for new termitaria to be formed, meaning there is no effective recruitment of Lace Monitors at the site during this time, which represents 1/3 of the species' potential lifespan.

Current forestry operations and management practices may also increase the risks and exacerbate the effects of bushfires (e.g., Furlaud et al. 2021). However, the strength of this relationship is contested within the scientific community (e.g., Keenan et al. 2021), and the extent of this effect may be less significant in the face of mega fires driven primarily by extreme heat and drought caused by human-induced climate-change (e.g., Bowman et al. 2021). Cumulatively, these hazards may result in less habitat refugia for viable populations to persist in, which can create genetic issues where populations can become isolated, more inbred and with less adaptive potential. Fragmentation and disturbance caused by road establishment and forestry operations may expose native fauna like the Lace Monitor in these areas to a higher risk of predation (Hradsky et al. 2017) and greater competition (Hu et al. 2019) from invasive vertebrates like the Red Fox. These, along with the potential loss of termitaria, effectively reduce recruitment of young animals into the population, such that losses in the adult population are noticed because they are not readily replaced by younger animals, leading to a perceived fall in population level. Forestry operations may impact Lace Monitor populations across all RFA regions, however impact on populations is minimal in the West, North East, and Gippsland RFA regions. Forestry operations may have a higher impact on Lace Monitor populations in the Central Highlands (9% merchantable, 5% operable) and East Gippsland (17% merchantable, 6% operable) RFA regions.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as uncontrolled to poor as it only has prescriptions in parts of the West RFA region. Some habitat values preserved in other prescriptions may benefit the Lace Monitor, but currently there is no species-specific protection in place. The species has a very large home range and relies on extensive habitat for food and shelter, so localised management areas are unlikely to be effective mitigations.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 30% of the species' modelled distribution and 55% of important populations are within the reserve system.

Table 11. Lace Monitor protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk levels of low and medium.
Priority management actions	Not required for this hazard based on the overall risk levels of low and medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Monitor and survey populations in East Gippsland to better understand post-fire distribution and abundance post 2019-20 bushfires; • Limit forestry operations in the species' habitat impacted by those fires; • State-wide species-specific code prescriptions should be considered in any future Code amendments; • Use the species' habitat distribution model to identify suitable forest protection survey program (FPSP) survey sites across each RFA region; • Prevent destruction of live termitaria on forestry coupes and access roads; and • Provide education for machinery operators to ensure termitaria are not impacted.

4.1.4 Invasive species

Invasive vertebrate (foxes and cats)

Lace monitors may be in competition for food resources from invasive predators, and young Lace monitors are likely to be affected by predation from Red Foxes (Anson et al. 2013; Jessop et al. 2016; Hu et al. 2019) and feral cats. This can result in the direct mortality of juvenile animals, with indirect impacts on mature animals such as food competition leading to lack of body condition, which in turn may affect growth or breeding fitness. Lace Monitors occupying areas of disturbance caused by forestry operations and areas recently burnt from planned burning or bushfire may be exposed to greater levels of predation and competition from the Red Fox (Hradsky et al. 2017). The cumulation of hazards such as bushfire, planned burns, forestry operations and roading may reduce the structural complexity of forest habitats, providing less cover and facilitating fox and cat movements through the forest, exacerbating the predation risk of juvenile animals. Predation can result in the removal of some of the young Lace Monitors that manage to hatch if other hazards haven't impacted nesting sites, leaving even fewer neonates to add to the overall population. Red Foxes and feral cats occur in all the occupied habitat of the Lace Monitor in Victoria.

Current existing controls for this hazard include:

- The Southern Ark Fox control program. The effectiveness of this control for this species has been evaluated as satisfactory in the East Gippsland and Gippsland RFA regions. The Southern Ark fox control program has been underway for many years to lower the impacts of Foxes in East Gippsland, which covers the key areas of occupied habitat for the Lace Monitor. It includes a comprehensive monitoring program to assess abundance of foxes and target species.
- Weeds and Pests on Public Land program. The effectiveness of this control for this species has been evaluated as poor to satisfactory as fox baiting programs such as the Ark projects can be effective at controlling fox numbers, leading to an increase in abundance of the Lace Monitor (Hu et al. 2019) and their prey (Dexter and Murray 2009). Of note is the uptake of fox baits by the Lace Monitor (Woodford et al. 2012), which should be mitigated to ensure the efficacy of control programs.
- The Bushfire Biodiversity Response and Recovery program. The effectiveness of this control for this species has been evaluated as satisfactory as the expansion of current fox baiting programs in response to large scale fires of 2019-20 should improve outlook for native fauna in the face of increased fox predation following the fire event (Hradsky et al. 2017).

Table 12. Lace Monitor protection requirements and recommendations for invasive vertebrate (foxes and cats)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Continue Southern Ark program in East Gippsland and expand into other RFA regions, ensuring controls are maintained consistently across space and time; and • Investigate predation threat posed by cats on juvenile Lace Monitors and implement control measures accordingly.

4.2 Claytons Spiny Crayfish (*Euastacus claytoni*)

The Claytons Spiny Crayfish was listed as Endangered in Australia under the FFG Act in May 2021. The species occurs in the East Gippsland (100% of catchment) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.2.1 Risk Assessment

Table 13. Claytons Spiny Crayfish risk ratings in the East Gippsland RFA region:

	Climate change and severe weather	Bushfire	Forestry operations	Roading	Aquatic predators
Consequence	Extreme	Major	Major	Minor	Moderate
Likelihood	Likely	Likely	Likely	Likely	Likely
Overall risk rating	High	High	High	Medium	Significant

4.2.2 Climate change

Climate change and severe weather

This species is endemic to highland areas over 750m altitude, and so is likely highly specialised and restricted to cool waters. Warming of these streams through increased average temperatures and extreme heat events because of human-induced climate change will likely be a major driver of range retraction and population decline for this species, which will have impacts that effect its entire range. Increased severe weather events of high heat and prolonged droughts caused by human-induced climate change will also lead to an increase in the frequency and severity of bushfires (Sharples et al. 2016). Contrasting extremes from climate change, such as large rainfall events following fires, will lead to detrimental amounts of run-off and sedimentation that can cause declines in this species. Similarly, extreme rainfall events will likely exacerbate run-off and sedimentation caused by forestry operations.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 14. Claytons Spiny Crayfish protection requirements and recommendations for climate change and severe weather

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Establish a captive colony of this species.

4.2.3 Fire

Bushfire

Bushfires have the potential to degrade water quality and alter the dynamics of stream ecosystems. Most critical effects occur if there is heavy rain soon after fire, as loss of vegetation and altered soil structure can make fire-affected soils more erodible. Runoff can carry sediments and pollutants that affect aquatic environments and consequently aquatic species. Apart from impacts to water quality and sedimentation of streams following bushfires, burns can also result in the loss of riparian vegetation impacting water temperature and available food resources. This species is endemic to highland areas over 750m altitude, and so is likely highly specialised and restricted to cool waters. Any mechanism that leads to increased water temperatures like loss of riparian vegetation should be considered as a significant impact. In East Gippsland, bushfires have impacted a moderate proportion of the geographical range of this species with over 20% of catchments this species occurs in and 19% of all important populations being burnt since 2000. Along with sedimentation, soil erosion and water quality decline, habitat loss through the loss of riparian vegetation could also be considered a mechanism leading to decline. Increased severe weather events of high heat and prolonged droughts

caused by human-induced climate change will lead in an increase in the frequency and severity of bushfires (Sharples et al. 2016). Contrasting extremes from climate change, such as large rainfall events following fires, will lead to detrimental amounts of run-off and sedimentation that can cause declines in the species. Post-fire run-off and sedimentation, which cause declines in water quality and habitat value, may contribute to the cumulative impact of sedimentation, including any impacts resulting from forestry operations. Spiny crayfish likely rely on deep pools, and structurally complex habitat to survive fires (Bryant et al. 2012). Any impacts to these habitat components from environmental disturbances including fire and forestry operations, may be detrimental to the species.

Current existing controls for this hazard include:

- Bushfire suppression. The risk to this species is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on this species.

Table 15. Claytons Spiny Crayfish protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Target fire suppression activities to protect important populations and unburnt habitat.
Potential management actions	<ul style="list-style-type: none"> • Undertake extensive surveys to confirm population persistence and extant in the post fire landscape, with research into how fire effects habitat values and population persistence.

4.2.4 Forestry operations

Forestry operations and roading

Soil erosion and instream sedimentation can impact this species by negatively affecting the quality of the water they occur in, smothering the stream bed which reduces food supplies and preferred heterogeneous habitat, and eliminating key spawning areas. These outcomes can directly affect the species by increasing mortality by choking and starving, by making them more prone to aquatic predators and smothering of eggs, and indirectly by reducing population abundance, leading to lower resilience/less evolutionary potential and increased extinction risk. Timber harvesting activities of particular concern are those which facilitate soil disturbance and soil transport by rainfall/water flow into the catchment drainage network such as the wet and dry connected linear system of drainage lines and stream channels. Broadly, these relate to roading with direct sediment input at stream crossings and from road drainage and harvesting operations, with direct sediment input into unbuffered sections of drainage lines or via harvesting disturbance in filter strips, and indirectly through inappropriate buffers which lack the ability to prevent sediment reaching the drainage network during high rainfall events. This species is a 'species of concern' for forestry following the 2019-20 bushfires.

Based on the 2015 net harvest area layer, 25% of the species' catchment and important populations occur in merchantable areas. Using the revised operable area layer this has reduced to 7%. The impact of roading for forestry operations is related to the number and location of permanent, secondary, or temporary coupe tracks which cross the stream network (drainage lines to stream channels).

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription and ongoing uncertainty about the effectiveness of current waterway prescriptions leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as only 30% of the species' catchments and important populations are within the reserve system.

Table 16. Claytons Spiny Crayfish protection requirements and recommendations for forestry operations and roading

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) (SMZ) to the catchment of the Claytons Spiny Crayfish with the following conditions:</p> <p>Where one or more individuals of Clayton's Spiny Crayfish have been verified:</p> <ul style="list-style-type: none"> • Environments with high soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 40 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography; see Figure 1); ○ Apply 30 metre (m) buffers plus 10 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • Environments with low soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 60 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); ○ Apply 40 metre (m) buffers plus 20 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • No new road, snig track, in-coupe road, coupe driveway, coupe infrastructure or stream crossing shall be constructed within or through any buffer without an approved exemption from the Secretary (See Map 1).
Priority management actions	None currently identified.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments; • Use the aquatic catchments for this species to identify suitable FPSP survey sites and implement and encourage surveys for this species for FPSP contractors; and • Review and refine measures to limit stream sedimentation associated with road construction and operation.

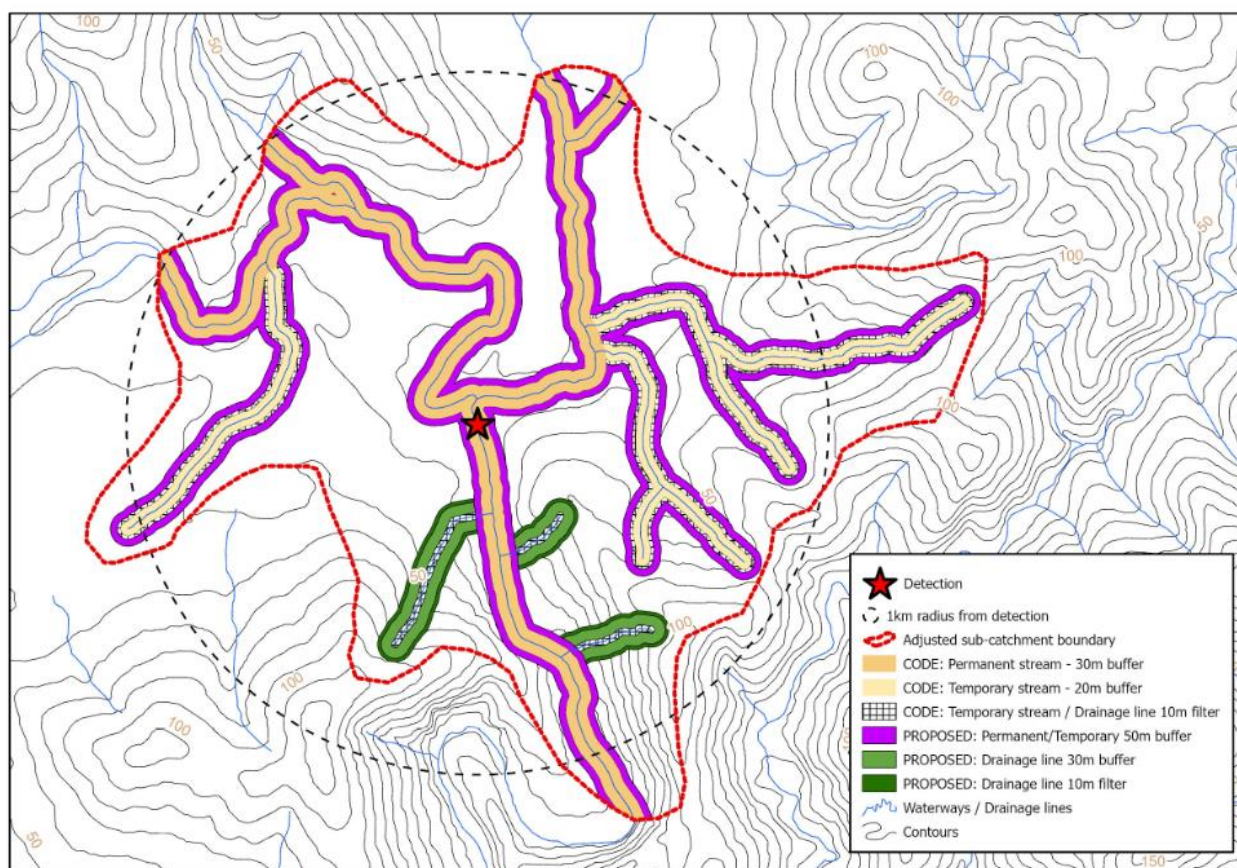


Figure 1. Example detection of a threatened aquatic species, existing Code minimum buffers and filter strips (example from sites with low water quality risk), and additional buffering from proposed prescriptions (example from galaxiid species in environments with high soil absorption capacity). Dashed line indicates 1 km radius around detections, red line shows how the 1 km radius has been modified in response to local hydrological conditions.

4.2.5 Invasive species

Aquatic predators

The introduction of exotic biota could be a threat due to predation, competition, or the spread of disease. Introduced fish, including Brown Trout, occur throughout many of the river systems within the species' range, and may have a detrimental impact on populations of the crayfish. Rainbow Trout are also present in the river systems that Claytons Spiny Crayfish is distributed in, and along with Brown Trout may contribute to declines via predation (Merrick 1995, Tay et al. 2007), particularly of juvenile crayfish (Englund and Krupa 2000). Indeed, predation from trout has been highlighted as a key threat to other *Euastacus* species with restricted ranges (McCormack 2013), and anecdotal declines of related species have been associated with the presence of Brown Trout (Lieschke et al. 2014). Based on VBA and Atlas of Living Australia (ALA) records of both Brown and Rainbow Trout, at least 65% of this species' range will be impacted by these aquatic predators. The impacts of invasive species on populations of this species are likely compounded in areas of highly modified habitat (McCormack 2013).

There are no current control measures to manage this risk at the scale required to mitigate its impact on this species.

Table 17. Claytons Spiny Crayfish protection requirements and recommendations for aquatic predators

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Establish a captive colony of this species.
Potential management actions	<ul style="list-style-type: none"> • Identify and evaluate policy and operational measures to limit the impacts of Brown Trout and Rainbow Trout; and • Determine the extent of trout over the range of the species and research these invasive species effects on their occupancy and persistence.

4.3 East Gippsland Spiny Crayfish (*Euastacus bidawalus*)

The East Gippsland Spiny Crayfish was listed as Vulnerable in Australia under the FFG Act in May 2021. The species occurs in the East Gippsland (100% of catchment) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.3.1 Risk Assessment

Table 18. East Gippsland Spiny Crayfish risk ratings in the East Gippsland RFA region:

	Climate change and severe weather	Bushfire	Forestry operations	Aquatic predators
Consequence	Extreme	Major	Moderate	Moderate
Likelihood	Likely	Likely	Likely	Possible
Overall risk rating	High	High	Significant	Medium

4.3.2 Climate change

Climate change and severe weather

This species is characterised by inhabiting deep burrow systems that may buffer it for some time against the effects of severe droughts, however long-term disruption to water flow and temperature will likely result in its decline. Increased severe weather events of high heat and prolonged droughts caused by human-induced climate change will lead to an increase in the frequency and severity of bushfires (Sharples et al. 2016). Contrasting extremes from climate change, such as large rainfall events following fires, will lead to detrimental amounts of run-off and sedimentation that can cause declines in this species. Similarly extreme rainfall events may increase the risk of run-off and sedimentation from forestry operations and roads. Climate change will have impacts that affect the entire range of this species.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 19. East Gippsland Spiny Crayfish protection requirements and recommendations for climate change and severe weather

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> Establish a captive colony of this species.
Potential management actions	<ul style="list-style-type: none"> Research the effects climate change on the species, particularly its thermal tolerance. Modelling water temperature changes in response to future climate change may identify cool refuge areas for this species.

4.3.3 Fire

Bushfire

Apart from impacts to water quality and sedimentation of streams following bushfires, burns can also result in the loss of riparian vegetation impacting water temperature and available food resources. Most critical effects occur if there is heavy rain soon after fire, as loss of vegetation and altered soil structure can make fire-affected soils more erodible. Runoff can carry sediments and pollutants that affect aquatic environments and consequently aquatic species. Along with sedimentation, soil erosion and water quality decline, habitat loss through the loss of riparian vegetation could also be considered a mechanism leading to decline. Increased severe weather events of high heat and prolonged droughts caused by human-induced climate change will lead to an increase in the frequency and severity of bushfires (Sharples et al. 2016). Contrasting extremes from climate change, such as large rainfall events following fires, will lead to detrimental amounts of run-off and sedimentation that can cause declines of this species. Post-fire run-off and sedimentation, which

cause declines in water quality and habitat value, may contribute to the cumulative impact of sedimentation, including any impacts resulting from forestry operations. Spiny crayfish likely rely on deep pools, and structurally complex habitat to survive fires (Bryant et al. 2012). Any impacts to these habitat components from environmental disturbances including bushfire and forestry operations, may be detrimental to the species. In East Gippsland, bushfires have impacted a very significant proportion of the geographical range of this species with over 90% of catchments it occurs in and 92% of all important populations burnt since 2000.

Current existing controls for this hazard include:

- Bushfire suppression. The risk to this species is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on this species.

Table 20. East Gippsland Spiny Crayfish protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Target fire suppression activities to protect important populations and unburnt habitat.
Potential management actions	<ul style="list-style-type: none"> • Undertake extensive surveys to confirm population persistence and extant in the post fire landscape, with research into how fire effects habitat values and population persistence.

4.3.4 Forestry operations

Forestry operations

Threats may be driven by a range of land and water management activities, including road construction and maintenance and forestry operations. Loss of food resources due to soil disturbance or loss of riparian vegetation can lead to various ecological changes, particularly sedimentation affecting instream processes, increased water temperature from greater incidence of light, and reduction in the type and amount of debris accumulation in streams, changes which generally reduce the suitability of streams as habitat for *Euastacus* species. The coarse woody debris provides important crayfish habitat, and the finer debris would provide an important food source for the species. Based on the 2015 net harvest area layer 19% of the species' catchment occurs in merchantable areas. Using the revised operable area layer this has reduced to 6%. Since 1970, forestry operations have impacted 13% of the species' catchment. During extreme flood or rainfall events, disturbance from forestry operations likely exacerbates run-off and sedimentation effects that degrade streams which the species uses as habitat. Current forestry operations and management practices may also increase the risks and exacerbate the effects of bushfires (e.g., Furlaud et al. 2021). However, the strength of this relationship is contested within the scientific community (e.g., Keenan et al. 2021), and the extent of this effect may be less significant in the face of mega fires driven primarily by extreme heat and drought caused by human-induced climate-change (e.g., Bowman et al. 2021). Sedimentation, soil erosion and decline in water quality from instream sedimentation can be exacerbated during wet periods (i.e., during localised intense rainfall events, wetter months, and La Niña events). Instream sedimentation, particularly sediment which settles on the streambed, may remain for long periods of time and cause negative impacts to freshwater invertebrates (e.g., Campbell and Doeg, 1989). Filter strips may be ineffective in protecting this species in the riparian zone of drainage lines as burrows may extend further from the stream system.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. These prescriptions do not account for specific species requirements such as effective filter strips and buffer width to avoid mechanical damage to burrow systems and to stop debris flow and instream sedimentation and have therefore been evaluated as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 57% of the species' catchments and important populations are within the reserve system.

Table 21. East Gippsland Spiny Crayfish protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) (SMZ) to the catchment of the East Gippsland Spiny Crayfish, plus two recent VBA records that fall outside of the mapped catchment, with the following conditions:</p> <p>Where one or more individuals of East Gippsland Spiny Crayfish have been verified:</p> <ul style="list-style-type: none"> • Environments with high soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 40 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography; see Figure 1); ○ Apply 30 metre (m) buffers plus 10 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • Environments with low soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 60 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); ○ Apply 40 metre (m) buffers plus 20 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • No new road, snig track, in-coupe road, coupe driveway, coupe infrastructure or stream crossing shall be constructed within or through any buffer without an approved exemption from the Secretary (See Map 2).
Priority management actions	None currently identified.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments; • Use the aquatic catchments for this species to identify suitable FPSP survey sites and implement and encourage surveys for this species for FPSP contractors; and • Review and refine measures to limit stream sedimentation associated with road construction and operation.

4.3.5 Invasive species

Aquatic predators

Brown Trout may contribute to declines of the species via predation (Merrick 1995; Tay et al. 2007), particularly of juvenile crayfish (Englund and Krupa 2000). Anecdotal declines of closely related species have also been associated with the presence of Brown Trout (Lieschke et al. 2014). The impacts of invasive species on populations of this species are likely compounded in areas of highly modified habitat (McCormack 2013). Based on VBA and ALA records of both Brown and Rainbow Trout, at least 35% of this species range will be impacted by these aquatic predators.

There are no current control measures to manage this risk at the scale required to mitigate its impact on this species.

Table 22. East Gippsland Spiny Crayfish protection requirements and recommendations for aquatic predators

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Identify and evaluate policy and operational measures to limit the impacts of Brown Trout and Rainbow Trout; and • Determine the extent of trout over the range of the species and research these invasive species effects on their occupancy and persistence.

4.4 Tubercle Burrowing Crayfish (*Engaeus tuberculatus*)

The Tubercle Burrowing Crayfish was listed as Endangered in Australia under the FFG Act in May 2021. The species occurs in the Central Highlands (100% of VBA points) RFA region. While it is acknowledged that other hazards impact on this species, as per the Common Assessment Method (CAM) assessment, the expert/s only assessed forestry operations as part of this risk assessment. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.4.1 Risk Assessment

Table 23. Tubercle Burrowing Crayfish risk ratings in the Central Highlands RFA Region:

Forestry operations	
Consequence	Major
Likelihood	Possible
Overall risk rating	Significant

4.4.2 Forestry operations

Forestry operations

This species is a burrowing crayfish which is found well away from the stream network and floodplain, and therefore away from many vegetated buffers if present, extending well up slopes at mid to higher elevations. It lives in burrows which contain a pool of water in a chamber, which is derived mainly from rainfall, and burrow systems extend to about 0.3 to 0.5 m underground. During forestry operations burrows can be impacted by soil disturbance from machinery or dragging trees along the ground, which can either kill the crayfish, or cause the water source within the burrow to evaporate. Opening of the burrows exposes the crayfish to predation and to higher air temperatures than are usually found down in the burrow system. Damage to burrow systems will leave burrows unoccupied and it is unknown whether a surviving crayfish will even try to dig another burrow system, which is a huge undertaking. 50-70% of estimated proportion of habitat/population could be exposed to the hazard within timber harvesting areas which can result in direct or relatively rapid indirect mortality, direct loss of habitat, sedimentation, and soil erosion. This hazard can be more pronounced during drought when there is less rainfall/soil seepage and higher temperatures – consequently during these times it is expected that the exposure/loss of moist habitat will cause a much higher level of crayfish mortality. Soil erosion/sedimentation is also exacerbated during wet periods (i.e., during localised intense rainfall events, wetter months, and La Niña events). Physical soil disturbance will continue to impact on this burrowing crayfish on hill slopes as no effective control measures are being applied and may well lead to major decline in populations within coupes where burrows are not deep enough to avoid being damaged/exposed.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. These prescriptions do not account for specific species requirements and have therefore been evaluated as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 39% of the species' important populations and 40% of post-1970 VBA points are within the reserve system.

Table 24. Tubercle Burrowing Crayfish protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	<ul style="list-style-type: none"> • Conduct surveys across known range in likely habitat to improve understanding of distribution, abundance, and exposure to forestry operations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Investigate prevalence and density of burrows in coupes, the level of within coupe impact on populations, the level of post-impact survival, and post-impact recovery; and • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.5 Variable Spiny Crayfish (*Euastacus yanga*)

The Variable Spiny Crayfish was listed as Endangered in Australia under the FFG Act in May 2021. The species occurs in the East Gippsland (100% of catchment) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.5.1 Risk Assessment

Table 25. Variable Spiny Crayfish risk ratings in the East Gippsland RFA Region:

	Climate change and severe weather	Bushfire	Forestry operations and roading
Consequence	Extreme	Extreme	Major
Likelihood	Likely	Likely	Likely
Overall risk rating	High	High	High

4.5.2 Climate change

Climate change and severe weather

This species may inhabit burrow systems that may buffer it for some time against the effects of severe droughts, however long-term disruption to water flow and temperature will likely result in its decline, and climate change will have impacts that effect its entire range. Increased severe weather events of high heat and prolonged droughts caused by human-induced climate change will lead to an increase in the frequency and severity of bushfires (Sharples et al. 2016). Contrasting extremes from climate change, such as large rainfall events following fires, will lead to detrimental amounts of run-off and sedimentation that can cause declines in this species. Similarly, extreme rainfall events will likely exacerbate run-off and sedimentation caused by forestry operations.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 26. Variable Spiny Crayfish protection requirements and recommendations for climate change and severe weather

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> Establish a captive colony of this species.
Potential management actions	<ul style="list-style-type: none"> Research the effects climate change on the species, particularly its thermal tolerance. Modelling water temperature changes in response to future climate change may identify cool refuge areas for the species.

4.5.3 Fire

Bushfire

Bushfires have the potential to degrade water quality and alter the dynamics of stream ecosystems. Most critical effects occur if there is heavy rain soon after fire, as loss of vegetation and altered soil structure can make fire-affected soils more erodible. Runoff can carry sediments and pollutants that affect aquatic environments and consequently aquatic species. Apart from impacts to water quality and sedimentation of streams following bushfires, burns can also result in the loss of riparian vegetation impacting water temperature and available food resources. In East Gippsland, bushfires have had a very significant impact over the geographical range of this species, with burns having occurred over 92% of modelled habitat and 93% of all important populations of the species since 2000. Along with sedimentation, soil erosion and water quality decline, habitat loss through the loss of riparian vegetation could also be considered a mechanism leading to decline. Increases in severe weather events of high heat and prolonged droughts caused by human-induced climate change will lead in an increase in the frequency and severity of bushfires (Sharples et al. 2016). Contrasting

extremes from climate change, such as large rainfall events following fires, will lead to detrimental amounts of run-off and sedimentation that can cause declines in this species, which can also be exacerbated by the disturbances caused by forestry operations. Spiny crayfish likely rely on deep pools, and structurally complex habitat to survive fires (Bryant et al. 2012). Any impacts to these habitat components from environmental disturbances including fire and forestry operations, may be detrimental to the species.

Current controls for this hazard include:

- **Planned burning.** This control may be effective in reducing the risk of severe bushfires in this species' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this species and its habitat from severe bushfires.
- **Bushfire suppression.** This risk is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always prevent impacts on key biodiversity values.

Table 27. Variable Spiny Crayfish protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Target fire suppression activities to protect important populations and unburnt habitat.
Potential management actions	<ul style="list-style-type: none"> • Conduct extensive surveys to confirm population persistence and extent in the post-fire landscape; and • investigate the impacts of bushfires on habitat values and population persistence.

4.5.4 Forestry operations

Forestry operations and roading

Threats to the species may be driven by a range of land and water management activities including road construction and maintenance and forestry operations. Soil erosion and instream sedimentation can impact this species by negatively affecting the quality of the water they breathe and move through, and smothering the stream bed which reduces food supplies, preferred heterogeneous habitat, and eliminates key spawning areas. These outcomes can directly affect the species by increasing mortality by choking and starving, being more prone to aquatic predators and the smothering of eggs, and indirectly by reducing population abundance, leading to lower resilience/less evolutionary potential and increased extinction risk. Timber harvesting activities of particular concern are those which facilitate soil disturbance and soil transport by rainfall/water flow into the catchment drainage network (the wet and dry, connected linear system of drainage lines, and stream channels). Broadly, these relate to roading by direct sediment input at stream crossings and from road drainage, and to harvesting operations by direct sediment input into unbuffered sections of drainage lines or via harvesting disturbance in filter strips.

Spiny crayfish likely rely on deep pools, and structurally complex habitat to survive fires (Bryant et al. 2012). Any impacts to these habitat components from environmental disturbances including fire and forestry operations, may be detrimental to the species. This species is a 'species of concern' for forestry following the 2019-20 bushfires as post-fire reconnaissance identified the catchment was severely impacted bushfires and limited individuals of the species found. Based on the 2015 net harvest area layer 18% of the species' catchment and important populations occur in merchantable areas. Using the revised operable area layer this has reduced to 10%.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways and filter strips on drainage lines which may provide some protection to the species. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 47% of the species' catchment and 48% of important populations are within the reserve system.

Table 28. Variable Spiny Crayfish protection requirements and recommendations for forestry operations and roading

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland FMA, the Secretary will establish a Special Management Zone to the catchment of the Variable Spiny Crayfish with the following conditions:</p> <p>Where one or more individuals of Variable Spiny Crayfish have been verified:</p> <ul style="list-style-type: none"> • Environments with high soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 40 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography; see Figure 3); ○ Apply 30 metre (m) buffers plus 10 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • Environments with low soil absorption capacity (refer to Appendix 3): <ul style="list-style-type: none"> ○ Apply 60 metre (m) buffers either side of all mapped and unmapped permanent streams and temporary streams upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); ○ Apply 40 metre (m) buffers plus 20 metre (m) filter strips to either side of drainage lines upstream and downstream of the value to the watershed boundary (on average 1km but responsive to local topography); • No new road, snig track, in-coupe road, coupe driveway, coupe infrastructure or stream crossing shall be constructed within or through any buffer without an approved exemption from the Secretary (See Map 3).
Priority management actions	None currently identified.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments; • Use the aquatic catchments for this species to identify suitable FPSP survey sites and implement and encourage surveys for this species for FPSP contractors; and • Review and refine measures to limit stream sedimentation associated with road construction and operation.

4.6 Baw Baw Berry (*Wittsteinia vacciniacea*)

The Baw Baw Berry was listed as Vulnerable in Australia under the *FFG Act* in May 2021. The species has modelled habitat in the Central Highlands (99% of modelled habitat) and Gippsland (1% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.6.1 Risk Assessment

Table 29. Baw Baw Berry risk ratings in the East Gippsland RFA region:

	Increased fire frequency and intensity	Forestry operations and roading	Invasive vertebrate (deer)	Invasive plant (weeds)
Consequence	Extreme	Moderate	Moderate	Moderate
Likelihood	Possible	Possible	Likely	Possible
Overall risk rating	High	Medium	Significant	Medium

4.6.2 Fire

Increased fire frequency and intensity

This hazard includes the increased frequency and intensity of bushfire because of climate change. Both the species and its habitat are moderately fire sensitive, with the species requiring high moisture and moderate shade. Fire may result in significant direct mortality and habitat damage. Major damage to the peaty soil will leave the habitat subject to erosion and drying for many years after fire. Fire may also facilitate the invasion of weeds and deer. This hazard applies to 95% of the species' habitat in Victoria.

Current existing controls for this hazard include:

- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 30. Baw Baw Berry protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> Undertake <i>ex-situ</i> management such as seed banking and live plants; and Conduct values input into incident control processes.

4.6.3 Forestry operations

Forestry operations and roading

Forestry operations, including roading and regeneration burning, have the potential to impact on the species in marginal sites. The species lives mainly around the bases of trees and boulders. It suckers and takes root where branches hit the ground, so it can tolerate a small amount of disturbance reasonably well. Due to habitat preferences, less than 10% of habitat is exposed to this hazard. Rainforest gullies and mapped waterways are protected by prescriptions under the Code, but any plants more than 20 metres from a clearly defined waterway could be impacted by the hazard, especially due to track construction and by slash heaping. Forestry operations can lead to direct mortality via mechanical disturbance and soil instability upslope due to roading operations.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 81% of the species' modelled distribution and 71% of important populations are within the reserve system.

Table 31. Baw Baw Berry protection requirements and recommendations for forestry operations and roading

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments.

4.6.4 Invasive species

Invasive vertebrate (deer)

Deer impact the species by trampling and degrading the habitat, however any browsing would probably be incidental. Deer potentially impact 80% of habitat. Degraded habitat is more likely to burn, is more sensitive to drought impacts and is less likely to regenerate successfully.

Current existing controls for this hazard include:

- Exclusion fencing. The effectiveness of this control for this species has been evaluated as good based on the existing exclusion fencing specifically around this habitat at Lake Mountain. However, exclusion fencing is not effective at an overall population level and therefore would be evaluated as poor in those circumstances.
- Deer control programs. The effectiveness of this control for this species has been evaluated as poor because most control has occurred in the North East and East Gippsland RFA regions, and not as much in the Central Highland RFA region where this species occurs.

Table 32. Baw Baw Berry protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Undertake additional deer control, particularly in the Central Highlands RFA region; • Include additional exclusion fencing if practicable in key habitats; and • Undertake <i>ex-situ</i> conservation actions including seed banking and live plant maintenance.

Invasive plant (weeds)

Blackberry (*Rubus* spp.), introduced pasture grasses such as Yorkshire Fog (*Holcus lanatus*) and Willow (*Salix* spp.) impact the species by smothering, reducing habitat and outcompeting the species. This hazard applies to 40% of habitat. Weed invasion may be promoted by deer impacts and by forestry operations, and to some extent, bushfire.

Current existing controls for this hazard include:

- Weed control. The effectiveness of this control for this species has been evaluated as poor because it has a very limited application and is estimated to occur at less than 1% of the 40% of populations exposed to weeds. Any weed control is unlikely to be carried out with the protection of the species as a specific objective.
- Hygiene controls for road maintenance and forestry operations. The effectiveness of this control for this species has been evaluated as poor because it is inconsistently applied.
- Biological controls (including Blackberry rust). The effectiveness of this control for this species has been evaluated as poor because it has limited efficacy at higher altitudes.

Table 33. Baw Baw Berry protection requirements and recommendations for invasive plant (weeds)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Improve the application of existing weed control and hygiene protocols; and • Raise awareness of the species in the surrounding areas, encouraging weed management actions.

4.7 Beech Finger-fern (*Notogrammitis angustifolia* subsp. *nothofageti*)

The Beech Finger-fern was listed as Endangered in Victoria under the FFG Act in May 2021. The subspecies has modelled habitat in the West (54% modelled habitat), Central Highlands (31% of modelled habitat), and Gippsland (15% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.7.1 Risk Assessment

Table 34. Beech Finger-fern risk ratings in the Central Highland, Gippsland and West RFA regions:

	Drought	Increased fire frequency and intensity	Planned burning
Consequence	Extreme	Extreme	Moderate
Likelihood	Almost Certain	Almost Certain	Possible
Overall risk rating	High	High	Medium

Table 35. Beech Finger-fern risk ratings in the Central Highland RFA region only:

	Forestry operations	Invasive vertebrate (deer)
Consequence	Moderate	Moderate
Likelihood	Possible	Likely
Overall risk rating	Medium	Significant

Table 36. Beech Finger-fern risk ratings in the Gippsland RFA region only:

	Plantations	Invasive vertebrate (deer)
Consequence	Major	Moderate
Likelihood	Possible	Likely
Overall risk rating	Significant	Significant

4.7.2 Climate change; Fire

Drought and increased fire frequency and intensity

Drought and increased fire frequency and intensity have been combined here due to the close relationship between the two hazards. The subspecies is unusual amongst Victorian epiphytic ferns in being commonly reported growing on the stems of Musk Daisy-bush (*Olearia argophylla*) rather than Soft Tree-fern (*Dicksonia antarctica*) which is the favoured host of almost all other Victorian epiphytes. Since Musk Daisy-bush typically occupies drier, upslope and often ecotonal rainforest sites, as well as moist sites in Wet Forest, Montane Wet Forest or Riparian Forest, Beech Finger-fern is at risk of greater exposure to fire, desiccating winds, and insolation than all other *Notogrammitis* taxa. Habitat loss from accrued impacts of decades of drought, high summer temperatures and catastrophic bushfires can result in the sudden decline in the extent of structurally mature Cool Temperate Rainforest and old growth stands of Wet Forest which are the critical habitat of the subspecies. When a large fire hits a rainforest or mature stand of Wet Forest with sufficient intensity to destroy the rainforest canopy or understorey tree stratum, there is a high chance of sclerophyll invasion (typically eucalypts) or stand replacement by more fire-tolerant sclerophyll taxa. Many examples of this have been seen where stands of rainforest have been impacted by severe fire events. Whilst the subspecies has the capacity to resprout from established rhizomes immediately post-fire, clones in sites which undergo succession to drier eucalypt forest are projected to undergo significant desiccation and dramatically increased insolation, both projected to result in the wilting and death of these occurrences. The subspecies is at high stochastic risk of elimination and local extinction given its

solitary rather than colonial habit, and the observation that it usually occurs singly or as a few plants. Altered fire regimes under climate change are projected to continue to threaten this subspecies and its habitat, with each catastrophic fire event resulting in incremental impacts which accrue over decades. The subspecies is likely to be threatened by trampling and antler rubbing from Sambar deer which tend to congregate in mesic habitats in gullies and on lower slopes, particularly following intense landscape-scale bushfires. These hazards extend across all populations of the subspecies.

Current existing controls for this hazard include:

- Planned burning. This control is considered ineffective in this case as the subspecies' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this subspecies and its habitat from severe bushfires.

Table 37. Beech Finger-fern protection requirements and recommendations for drought and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for these hazards as they are longer-term threats.
Potential management actions	<ul style="list-style-type: none"> • Undertake targeted removal of eucalypts invading former rainforest within the first 1 to 3 years following an intense bushfire.

4.7.3 Fire

Planned burning

Traditionally, planned burns in the general vicinity of rainforest and other riparian vegetation have been reliant on differential moisture gradients to reduce the intensity and impact of fire on all fire-sensitive vegetation types in the riparian environment. Whilst this approach has often worked satisfactorily in the past, recent climate change projections (CSIRO & Bureau of Meteorology 2020) demonstrate the increasing risk of even well-controlled planned burns entering rainforest and its buffers.

All fire in the ecotonal environment threatens to expose fire-sensitive plants to mortality and local extinction. At greatest risk are elevated epiphytes such as filmy ferns and fork ferns which can be killed even by exposure to sun and wind. Fire in the ecotonal environment, with the risk of fire entering mature rainforest stands, risks the destruction of the closed canopy and invasion of sclerophyll taxa such as eucalypts and acacias, although the subspecies may recover vegetatively from established rootstocks protected within the bark of host trees or rock crusts. Immediately post-fire, surviving plants are likely to decline in health as the maturing eucalypts draw moisture out of the soil, open the understorey to light and drying winds and shed highly flammable leaf and small woody litter which increases the risk of intense future fire.

Planned burning acts synergistically with increasing drought stress to increase the risk of mortality or crown death of fire-sensitive plants or fragile rock crusts. This threat extends across 10-25% of the subspecies' populations.

Current existing controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this subspecies. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 38. Beech Finger-fern protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Provide a generous exclusion zone in all planned burning corridors in the vicinity of known occurrences of the subspecies; and • Conduct field surveys in Wet Forest habitats prior to planned burning activity.

4.7.4 Forestry operations

Forestry operations

Given the subspecies occurs in rainforest, it could only be exposed to forestry operations where rainforest is mis-identified in the field and buffers are not correctly applied or where roads are constructed through rainforest. This is of particular concern following bushfire due to the impact on the rainforest canopy and consequent difficulties in applying the rainforest identification criteria. Rainforest is highly sensitive to fire and action is required to minimise the risk of future disturbance and ensure rainforest has the capacity to recover. Current prescriptions in the Code may not provide sufficient guidance to protect this community following bushfires and to allow its regeneration. A significant proportion of occurrences are also reported in a range of non-rainforest habitats, and these are far more susceptible to forestry operations. This hazard is sporadic across the range of the subspecies. In the Central Highlands RFA region 18% of the subspecies' modelled habitat is in merchantable area, with 7% state-wide, based on the 2015 net harvest area layer. Using the revised operable layer, this reduced to 8% in the Central Highlands RFA region, and 5% state-wide.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this subspecies in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this subspecies.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as satisfactory as 51% of the subspecies' modelled distribution and 80% of important populations are within the reserve system.

Table 39. Beech Finger-fern protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard given level of risk is medium.
Priority management actions	Not required for this hazard given level of risk is medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data. • Species-specific code prescriptions should be considered in any future Code amendments.

Plantations

Two incidental site records, north of the Tarra-Bulga National Park in the Strzelecki Ranges, plot within public land managed for plantation forestry purposes and are potentially at risk from forestry operations associated with plantation management. The subspecies usually occurs singly or as a few plants (VicFlora 2014) and is difficult to survey or model adequately and hence difficult to protect through prescription. This hazard extends across all populations in the Gippsland RFA region.

Current existing controls for this hazard include:

- *The Code of Practice for Timber Production 2014*. This risk has been evaluated as uncontrolled due to poor understanding of the subspecies' distribution and abundance and the lack of a subspecies-specific prescription.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as satisfactory as 51% of the subspecies' modelled distribution and 80% of important populations are within the reserve system.

Table 40. Beech Finger-fern protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard as the risk is longer-term.
Priority management actions	<ul style="list-style-type: none"> • Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Establish exclusion zones around known site records; and • Conduct field surveys in Wet Forest habitats prior to harvesting, regeneration burning, replanting or herbicide application.

4.7.5 Invasive species

Invasive vertebrate (deer)

Sambar deer have been increasing in population across the Central Highlands and Gippsland RFA regions in the last decade (Watter et al. 2020), infiltrating all districts and forest types, often observed congregating in damper habitats including Cool Temperate Rainforest and other riparian habitats. For many taxa, targeted browsing of juveniles or resprouts has eliminated all recruits which will inevitably result in local extinction. It is unclear how frequently Sambar are likely to target the subspecies' host trees such as the Musk Daisy-bush for antler rubbing, however vegetative regeneration of established plants from rhizomes protected within the trunks of host plants post-fire are likely to be at elevated risk of antler rubbing, which can dislodge epiphytic occurrences. Sambar have the capacity to completely ringbark numerous understorey shrubs and trees, which would eliminate entirely one of the most frequently documented hosts of the subspecies. Sambar are also likely to destabilise fragile lithophytic habitats, namely thin crusts comprising soil, litter, bryophytes, lichens, other fungi and algae, through trampling or even wallowing. Sambar often target regenerating stands following bushfire, planned burns and regenerating timber harvesting coupes, resulting in recruitment failure of seed recruits or resprouting individuals at their most vulnerable stage of development. This hazard extends across all the subspecies' populations in the Central Highlands and Gippsland RFA regions.

Current existing controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this subspecies has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from.

Table 41. Beech Finger-fern protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard unless a major event occurs.
Potential management actions	<ul style="list-style-type: none"> • Monitor representative populations following timber harvesting, planned burning and bushfire to look for evidence of antler rubbing on host trees; and • Target Sambar for control after major decline events.

4.8 Black Bog-sedge (*Schoenus melanostachys*)

The Black Bog-sedge was listed as Vulnerable in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.8.1 Risk Assessment

Table 42. Black Bog-sedge risk ratings in the East Gippsland RFA region:

	Drying climate	Increased fire frequency and intensity	Forestry operations
Consequence	Moderate	Moderate	Minor
Likelihood	Possible	Likely	Possible
Overall risk rating	Medium	Significant	Medium

4.8.2 Climate change

Drying climate

The greatest impacts of a drying climate for this species are those on the watering cycles of wetlands and wet heath. This hazard applies to 90% of the species' habitat and leads to altered hydrology, habitat degradation and habitat loss. A drying climate will likely result in greater incidence of fire which may remove or reduce peaty soils which forms part of the species' habitat requirements.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 43. Black Bog-sedge protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium, and because it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Investigate options to manage watering requirements of near coastal swamps, wet heaths and similar habitat under predicted warmer temperatures and lower rainfall conditions; Determine if populations can be protected with fencing of riparian habitat; Monitor selected populations in near coastal habitats, to determine changes in ground water, recruitment, and extent of occupancy; and Propagate and establish new populations in the margins of constructed wetlands.

4.8.3 Fire

Increased fire frequency and intensity

Climatic drying and warming are projected to increase the risk of more frequent and intense fire events and may contribute in some circumstances to the lowering of water tables and drying out of wetland habitats, resulting in a contraction in the local extent of suitable habitat. Inappropriate fire regimes may also lead to lowered water tables and drying wetland habitats. The effects of fire on the species are uncertain, however it is likely to tolerate moderate periodic fire if habitats (mainly substrate and hydrology) are not significantly degraded in the process. In one study, germination somewhat increased with heat and smoke treatment, however not significantly (Penman et al. 2008). Resprouting from rhizomes is the species' most likely regeneration response following fire, although intense fire has the capacity to consume peaty organic substrates, thus destroying the tough rhizome of the species. Fire at intervals that approach the species' tolerable fire interval can eliminate recruiting stands permanently, and as the species has no mechanism for

long-distance dispersal, there is little opportunity for recolonisation. This hazard impacts approximately 50% of the species' habitat.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 44. Black Bog-sedge protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Determine if populations can be protected with fencing of riparian habitat, with the assistance of grants for private property; • Monitor selected population in near coastal habitats to determine changes in ground water, recruitment, and extent of occupancy; and • Propagate and establish new populations in the margins of constructed wetlands.

4.8.4 Forestry operations

Forestry operations

Forestry operations in forests adjacent to the species' habitat may contribute in some circumstances to the lowering of water tables and drying out of wetland habitats, resulting in a contraction in the local extent of suitable habitat although the degree of any impact is unclear. Based on the 2015 net harvest area layer, the expert/s estimated that the hazard applied to approximately 10% of the species' habitat, and may lead to altered hydrology, habitat loss and habitat degradation. Based on the revised operable layer, this is now less than 6%. Landscape subject to harvesting may also experience altered fire regimes.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species, however the general protections for wetland habitat under the Code, including a prohibition on harvesting, the application of buffers and design standards for roads, crossings and coupe infrastructure, have been assessed as satisfactory for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 56% of the species' modelled distribution and 60% of important populations are within the reserve system.

Table 45. Black Bog-sedge protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.9 Bog Saw-sedge (*Gahnia subaequiglumis*)

The Bog Saw-sedge was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.9.1 Risk Assessment

Table 46. Bog Saw-sedge risk ratings in the East Gippsland RFA region:

	Drying climate	Forestry operations	Plantations
Consequence	Major	Major	Major
Likelihood	Possible	Unlikely	Possible
Overall risk rating	Significant	Medium	Significant

4.9.2 Climate change

Drying climate

This hazard extends across all the species' habitat, which occurs in swampy sites, and includes the long-term decline in its extent and quality. It is exacerbated by the direct and indirect impacts of climatic warming and drying as well as inappropriate fire regimes, which increases the risk of more frequent, intense, and landscape-scale fires.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 47. Bog Saw-sedge protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Monitor hydrological changes to this species' habitat and broader catchment area; and • Implement feasible mitigations as required.

4.9.3 Forestry operations

Forestry operations

There are no known important populations of this species in areas available for timber harvesting, although 35% of its modelled habitat occurs in areas that are merchantable based on the 2015 net harvest area layer. Using the revised operable area layer this has reduced to 9%. As has been suggested for similar wetland species, forestry operations may influence changes in catchment hydrology that lead to drying out of habitats. However, the main drivers of such alterations are climate change and fire rather than forestry operations. The magnitude of this is likely to vary according to forest type, the extent of recent harvesting and any recent bushfires.

Current existing controls for this hazard include:

- Harvest scheduling considerations of catchment hydrology. The effectiveness of this control for this species has been evaluated as poor as data is difficult to obtain to make decisions on reducing hydrological impacts in a catchment.
- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as satisfactory as species-specific protections for the species are included in the Code, as well as other more general prescriptions such as protection and buffering of waterways which also provide protection from forestry operations.

- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory because although only 39% of the species' modelled habitat is in the reserve system, 86% of its important populations are within the system.

Table 48. Bog Saw-sedge protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard as risk level is medium.
Priority management actions	Not required for this hazard as risk level is medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Assess the impacts of hydrological changes associated with forestry operations; and • Implement feasible mitigations where the impacts are assessed as significant.

Plantations

In comparison to native forestry operations, plantations occur in closer proximity to the species' habitat where the growth of the trees can cause hydrological impacts on that habitat. Young, actively growing trees have greater evapotranspiration which reduces stream and groundwater inputs to the remainder of the catchment. 11% of the species' modelled habitat and 35% of its important populations are within 200m of plantations, however the hydrological impacts across a catchment are likely to affect higher proportions. This hazard interacts with climatic drying and may be further exacerbated by fire regimes in some circumstances.

Current existing controls for this hazard include:

- Harvest scheduling considerations of catchment hydrology. The effectiveness of this control for this species has been evaluated as poor as data is difficult to get hold of to make decisions to reduce hydrological impacts in a catchment.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory because although only 39% of the species' modelled habitat is in the reserve system, 86% of its important populations are within the system.

Table 49. Bog Saw-sedge protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	Identify key locations and liaise with relevant plantation managers.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Work with plantation managers to assess the impacts of hydrological changes associated with plantation forestry; and • Implement feasible mitigations where the impacts are assessed as significant.

4.10 Bolwarra (*Eupomatia laurina*)

The Bolwarra was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.10.1 Risk Assessment

Table 50. Bolwarra risk ratings in the East Gippsland RFA region:

	Drought; Increased fire frequency and intensity	Planned burning	Forestry operations	Invasive vertebrate (deer)
Consequence	Extreme	Moderate	Moderate	Moderate
Likelihood	Likely	Possible	Likely	Likely
Overall risk rating	High	Medium	Significant	Significant

4.10.2 Climate change; Fire

Drought and increased fire frequency and intensity

Drought and increased fire frequency and intensity have been combined here due to the close relationship between the two hazards. Drought stress and increasing fire risk, with altered fire regimes under climate change, are likely to continue to threaten this species and its habitat. Many locations have already been severely burnt as an early climate change signal, with most sites burnt in the last 40 years (e.g., Ash Wednesday fire 1983). In the longer term, the risks of adult mortality and recruitment failure increase due to repeat fire events and extreme drought stress. The habitat loss that occurs has a slower effect as the vegetation that regenerates after each fire event fails to recover the structural characteristics of mature rainforest, which is the critical habitat for the species. If patches of rainforest that support mature individuals that flower are lost, the seed set is also lost and therefore the ability of individuals to grow in more open forest is reduced. When a large fire hits a rainforest or rainforest margin with sufficient intensity to destroy the canopy there is a high chance of invasion and stand replacement by eucalypt forest. Most *Eupomatia* canopies are likely to be fire killed in a severe bushfire event, with many examples of this seen where stands of rainforest have been impacted by severe fire events. Each catastrophic fire event results in incremental impacts, which accrue over decades. Climate change leads to increased fire risk, with recruiting stands exposed post-fire to the hazards of drought-induced mortality and targeted browsing by Sambar which are likely to target lush recruiting juvenile plants. This hazard extends to 100% of the species' distribution in Victoria.

Current controls for the hazard include:

- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 51. Bolwarra protection requirements and recommendations for drought and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Target the removal of eucalypts invading former rainforest following intense bushfire.

4.10.3 Fire

Planned burning

Traditionally, planned burns in the general vicinity of rainforest and other riparian vegetation have been reliant on differential moisture gradients to reduce the intensity and impact of fire on all fire-sensitive vegetation types in the riparian environment. Whilst this approach has often worked satisfactorily in the past, recent experience and climate change projections (CSIRO & Bureau of Meteorology 2020) demonstrate the increasing risk of even well-controlled planned burns entering rainforest and its buffers.

All fire in the ecotonal environment threatens to expose fire-sensitive plants to mortality and local extinction. The precise impact on the species is unclear since the plant is observed both in intense shade and in the protection of small canopy gaps both within the rainforest stand and sometimes extending into the surrounding ecotone. In the long term, most of these plants rarely achieve sufficient maturity to flower and set seed. In 50 years of field observation, the species has been only very rarely observed in flower or fruit, a phenomenon typical of many rainforest plants across the globe, many of which exhibit mast flowering of the most mature individuals synchronously at rare and unpredictable intervals. Fire in the ecotonal environment, with the risk of fire ingress into the mature rainforest stand, risks mortality or at least crown death of these rare mature individuals, as well as the far greater proportion of juvenile and transgressive individuals. Planned burning acts synergistically with increasing drought stress to increase the risk of mortality or crown death of fire-sensitive plants. This hazard occurs across approximately 10-25% of the species' distribution.

Current controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 52. Bolwarra protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none">• Provide a generous exclusion zone in all planned burning corridors in the vicinity of all Warm Temperate Rainforest stands; and• Continue to expand and improve on rainforest mapping for use in planned burning.

4.10.4 Forestry operations

Forestry operations

This species generally occurs in association with rainforest. An analysis of VBA records showed that ~60% occurred within mapped rainforest or its buffers. In this situation, occurrences should be adequately protected from forestry operations due to the requirements of the Code. The risk to this species from forestry operations in the East Gippsland RFA region was re-assessed in light of new information about the exposure to forestry operations. The experts concluded that, where the species occurred on the margins or outside rainforest and/or its buffers, and especially where the rainforest habitat might have been burnt by bushfires or otherwise disturbed, protection could not be assumed. The experts emphasised the need for additional protections that targeted both the known occurrences and the rainforest habitat where it had been disturbed and stressed the importance of greater survey effort to improve understanding of the distribution and abundance of this species.

This hazard occurs sporadically across the range of the species within State Forest available for timber production with 9% of post-1970 VBA points and 25% of the species' habitat distribution model potentially available for harvesting, based on the 2015 net harvest area layer. Using the revised operable area layer, this is reduced to 9% of the species' modelled habitat and 7% of VBA points. It is important to note that the VBA points could be biased by survey effort of rainforest in protected areas with greater access.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 57% of the species' modelled distribution and 82% of important populations are within the reserve system.

Table 53. Bolwarra protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).</p> <p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Map 5a).</p> <p>Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections for the rainforest habitat of this species are likely to be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Improve information on the location of important populations in State Forest; • Monitor population size and health of individuals, and assess threats; • Investigate response to disturbance; and • Provide training and support to field staff in rainforest recognition and management.

4.10.5 Invasive Species

Invasive vertebrate (deer)

Sambar Deer have been increasing in population across the East Gippsland region in the last decade (Watter et al. 2020), infiltrating all districts and forest types, often observed congregating in damper habitats including Warm Temperate Rainforest. Although it is unclear whether Sambar actively target the species, they have been documented in lowland and coastal rainforest communities, targeting a wide range of tree and shrub taxa such as Yellow-wood (*Acronychia oblongifolia*) which has similar foliage texture to the Bolwarra. Numerous taxa have been documented as being targeted by Sambar in Victoria, many of which are confined to rainforest.

Sambar have the capacity to eliminate seedlings and juveniles by targeted browsing, ringbarking, trampling, and wallowing, and death of saplings and adult individuals by targeted antler rubbing. The species is particularly susceptible to antler rubbing, and deer have been observed dragging sub-canopy crowns to the ground using their antlers to consume the foliage of trees, shrubs and the numerous vines which typically entangle the understorey vegetation. The species has an almost unique architecture among Victorian trees and shrubs of being both an upright self-supporting plant and having semi-scandent branches often supported by surrounding vegetation. These scandent branches are particularly susceptible to being dragged down and snapped by Sambar even if they are not intentionally targeted for

browsing. Sambar often target regenerating timber harvesting coupes and stands following bushfire and planned burns, resulting in recruitment failure of seed recruits or resprouting individuals at their most vulnerable stage of development. This hazard extends across all the species' populations.

Current controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 54. Bolwarra protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Monitor representative populations following timber harvesting, planned burning and bushfire, as well as in healthy mature stands, to see evidence of browsing; and • Target Sambar for control particularly after major decline events such as fire or extremely severe drought.

4.11 Brackish Plains Buttercup (*Ranunculus diminutus*)

The Brackish Plains Buttercup was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the West (95% modelled habitat), Central Highlands (2% of modelled habitat), Gippsland (1% of modelled habitat) and North East (1% of modelled habitat) RFA regions, with 1% occurring in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.11.1 Risk Assessment

Table 55. Brackish Plains Buttercup risk ratings in the Gippsland, North East and West RFA regions:

	Drying climate	Plantations	Agriculture	Invasive plant (weeds)
Consequence	Major	Minor	Major	Extreme
Likelihood	Likely	Possible	Likely	Almost certain
Overall risk rating	High	Medium	High	High

Table 56. Brackish Plains Buttercup risk ratings in the Central Highlands RFA region:

	Drying climate	Agriculture	Invasive plant (weeds)
Consequence	Major	Major	Extreme
Likelihood	Likely	Likely	Almost certain
Overall risk rating	High	High	High

4.11.2 Climate change

Drying climate

In the longer term the species is threatened by climatic drying which could reduce the reliability of winter rainfall events, therefore impacting on the quality and amount of habitat available to the species, as well as increasing the risk of seedbank depletion, recruitment failure and local extinction. Climate change may also increase the capacity of some introduced plant species to competitively occupy the habitat and increase the likelihood of attempted agricultural intensification such as ploughing and cropping within the habitat. This hazard extends across 100% of the species' distribution.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 57. Brackish Plains Buttercup protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Undertake <i>in-situ</i> propagation and maintenance of seed bank.

4.11.3 Forestry operations

Plantations

Large-scale plantation establishment may pose a threat to this species; however, it mainly occupies brackish lakebeds and creek-lines that are unlikely to be targeted for plantations. During harvesting there can be significant damage to

small wetlands if they are not protected from machinery, which can also lead to runoff and erosion into wetlands reducing water quality. An increase in water-use by plantations, especially by regenerating young trees, may increase the impact of a drying climate and be exacerbated by reduced rainfall, particularly where remnant wet habitat is less well buffered. Harvesting operations can also increase weed invasion.

This hazard extends across 11% of the species' modelled habitat, however the modelling may miss small wetlands that could support this species. On-ground assessment or a simple analysis of aerial photography may be required to detect wetland habitat within coupes. There is also some uncertainty about how much of the soils (often heavy clays) of land surrounding the habitat of this species would be suitable for plantations (other than sometimes of Sugar Gum (*Eucalyptus cladocalyx*)). This extent of plantations could change under future land uses, therefore an estimate of the potential extent of hazard is consequently somewhat conjectural.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as poor, because while it is being assessed in at least some regions, the history of management for protection of included or abutting remnant vegetation has varied across the extent of plantations. The potential for damage from issues such as spray drift and run-off from track networks may also not yet be fully dealt with.
- Victorian Planning Provisions and planning schemes. The effectiveness of this control for this species has been evaluated as poor, as it is considered in relation to development of new plantations on private land. While the habitat of this species is generally unsuitable for plantations, the control does not prevent incremental damage to wetland habitat abutting plantations from desiccation or fertilizer/herbicide drift if the plantations are established on already cleared land.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as only 3% of the species' modelled distribution and 14% of important populations are within the reserve system.

Table 58. Brackish Plains Buttercup protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protection	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Minimise any off-site or off-target impacts of chemicals used as part of plantation management, as required by the Code; and • Improve protection for remnant habitat in establishment of new plantations.

4.11.4 Habitat

Agriculture

All sites of the species are at risk from continuing habitat degradation through agricultural intensification including extension of cropping, wetland drainage, basal harvesting, vehicle traffic, infrastructure maintenance, fire management activity, stock agistment, site conversion to woodlot and farm forestry. Climate change may increase the capacity of some introduced plant taxa to competitively occupy the habitat and increase the likelihood of attempted agricultural intensification such as ploughing and cropping. Agricultural practices can lead to elevated nutrient levels and introductions of very high threat species such as Tall Wheat Grass. Mechanisms to protect the relevant habitat on private land are very limited, as are resources and the required specialist skills for management of populations on public land. While around 40% of known populations occur on public land reserves of some kind, these typically comprise of small poorly buffered remnants within agricultural landscapes and are consequently subject to edge effects from adjacent land uses.

Current existing controls for this hazard include:

- Victorian Planning Provisions and planning schemes. The effectiveness of this control for this species has been evaluated as poor because it has limited capacity to prevent habitat loss and degradation associated with the

conversion from grazing to cropping. The relevant habitat is treeless and often includes a substantial component of introduced species; it therefore might not be recognised as having any value for native flora conservation by land managers. The control also does not prevent incremental damage resulting from land-use practises such as grazing or fertilizer drift.

- Support programs such as Landcare. The effectiveness of this control for this species has been evaluated as poor because participation is voluntary, and while it has the potential to be highly effective where implemented, it is very much dependant on goodwill and local community support.
- Local wetland management programs such as 'Wetland Tender' that fund fencing of wetlands from stock. The effectiveness of this control for this species has been evaluated as poor because although it is potentially effective, it is very limited in extent.

Table 59. Brackish Plains Buttercup protection requirements and recommendations for agriculture

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Conduct surveys to locate extant populations and identify strategic refugia; and • Engage with relevant landholders and explore options for management.
Potential management actions	<ul style="list-style-type: none"> • Cease promotion of Tall Wheat-grass for planting in brackish habitats to increase recognition of the plant as a serious environmental weed; • Raise awareness about the range of threatened flora adapted and endemic to mineralised and sub-saline damp to wet habitats on the volcanic plains; and • Provide financial incentives to landowners to fence off the species' habitat.

4.11.5 Invasive Species

Invasive plant (weeds)

A current and future threat is weed invasion of stands supporting the species, particularly by exotic annuals and perennials. The small remnant stands of native vegetation from which all Victorian records of the species occur are in highly fragmented rural landscapes which are severely degraded by edge effects. A wide array of invasive exotic weeds has been recorded in all quadrat samples undertaken and make up a large proportion of the recorded taxa. The species is a habitat specialist restricted to sites of high fertility and deep, waterlogged soils which are amongst the most susceptible to weed invasion in the state. Climate change may increase the capacity of some introduced plant taxa to competitively occupy the habitat and increase the likelihood of attempted agricultural intensification such as ploughing and cropping. Agricultural practices can also lead to elevated nutrient levels and introductions of very high threat species such as Tall Wheat-grass. The species is to some extent resilient to the effects of grazing by sheep but pugging by cattle can have a high impact on this low growing stoloniferous species.

This hazard extends across all the species' populations, with most of the species restricted to the West RFA region. The only known occurrence in the Central Highlands RFA region is from the Craigieburn Grasslands (in wetland habitat adjacent to Curly Sedge Creek) where its ongoing persistence requires confirmation due to the impacts of negligent management, notably major invasion by Spiny Rush (*Juncus acutus*) and modifications to surrounding land-use. Increased urbanisation of surrounding areas will reduce the chances of persistence of any remaining populations in the catchment of Curly Sedge Creek. In the Gippsland region it is of very restricted distribution, and only known with certainty from Lake Omeo.

Current existing controls for this hazard include:

- The *Catchment and Land Protection Act 1994*. The effectiveness of this control for this species has been evaluated as poor, as selective and effective control of ground-layer species such as introduced grasses is extremely difficult, especially over broader areas, and consequently outside of the scope and resources of most weed control programs.
- Targeted pest and weed programs. The effectiveness of this control for this species has been evaluated as poor, as selective and effective control of ground-layer species such as introduced grasses is extremely difficult and time consuming, especially over broader areas, and consequently outside of the scope and resources of most weed control programs. High-level plant identification skills are also needed to selectively treat the relevant weed species without eliminating the associated ground flora. Very few weed control programs are undertaken in wetland

communities that support the species, and many weeds impacting the species are rarely subject to control programs.

Table 60. Brackish Plains Buttercup protection requirements and recommendations for invasive plant (weeds)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Cease the promotion and active dispersal of new and existing serious environmental weeds into saline areas on the Western Volcanics, such as Tall Wheat-grass, and create broader recognition of these plants as serious environmental weeds; and• Monitor weeds and conduct weed control programs where needed.

4.12 Bristly Shield-fern (*Lastreopsis hispida*)

The Bristly Shield-fern was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the West (75% of modelled habitat) and Central Highlands (25% of modelled habitat) RFA regions, however it also occurs in the East Gippsland RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.12.1 Risk Assessment

Table 61. Bristly Shield-fern risk ratings in the Central Highlands, East Gippsland and West RFA regions:

	Increased fire frequency and intensity	Planned burning
Consequence	Extreme	Moderate
Likelihood	Almost Certain	Possible
Overall risk rating	High	Medium

Table 62. Bristly Shield-fern risk ratings in the Central Highlands and East Gippsland RFA regions only:

	Forestry operations	Invasive vertebrate (deer)
Consequence	Moderate	Moderate
Likelihood	Likely	Likely
Overall risk rating	Significant	Significant

4.12.2 Fire

Increased fire frequency and intensity

Altered fire regimes under climate change are projected to continue to threaten this species and its habitat. Many locations have already been severely burnt as an early climate change signal with many sites in the Central Highlands and East Gippsland having been burnt in the last 40 years (e.g., 1983 Ash Wednesday fire, 2009 Black Saturday fires and, most recently, the Black Summer fires of 2019-20). The threat incorporates drought stress and includes increasing fire risk, with each catastrophic fire event resulting from incremental impacts which accrue over decades. The species is likely to have been significantly depleted because of the documented contraction and elimination of Cool and Warm Temperate Rainforest stands, which is the critical habitat of the species, across its range in response to decades of drought and high summer temperatures, and catastrophic bushfire. When a large fire hits a rainforest or rainforest margin with sufficient intensity to destroy the canopy there is a high chance of sclerophyll invasion (typically eucalypts) and stand replacement by eucalypt forest. Whilst the species has the capacity to resprout from established rhizomes immediately post-fire, clones of the species in sites which undergo succession to eucalypt forest are projected to undergo significant drying out of the soil and dramatically increased insolation, both projected to result in the eventual decline and death of these clones. Vegetative regeneration of established mature stands post-fire is also likely to be at elevated risk of trampling and, potentially also, targeted or incidental browsing by Sambar which tend to congregate in mesic habitats in gullies and on lower slopes, particularly following intense landscape-scale bushfires. This hazard extends across all the species' habitat.

Current existing controls for this hazard include:

- **Planned Burning.** This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 63. Bristly Shield-fern protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Undertake targeted removal of eucalypts invading former rainforest following intense bushfire.

Planned burning

Traditionally, planned burns in the general vicinity of rainforest and other riparian vegetation have been reliant on differential moisture gradients to reduce the intensity and impact of fire on all fire-sensitive vegetation types in the riparian environment. Whilst this approach has often worked satisfactorily in the past, recent experience and climate change projections (CSIRO & Bureau of Meteorology 2020) demonstrate the increasing risk of even well-controlled planned burns entering rainforest and its buffers.

All fire in the ecotonal environment threatens to expose fire-sensitive plants to mortality and local extinction. At greatest risk are elevated epiphytes such as filmy ferns and fork ferns which can be killed even by exposure to sun and wind, however the precise impact on the Bristly Shield-fern is unclear since the plant is observed both in intense shade and in the protection of small canopy gaps within mature rainforest stands. Fire in the ecotonal environment, with the risk of fire ingress into the mature rainforest stand, risks the destruction of the closed canopy and invasion of sclerophyll species such as eucalypts and acacias. Although the species can recover vegetatively from established rhizomes immediately post-fire, such stands are likely to decline in health and extent as the maturing eucalypts draw moisture out of the soil, open the understorey to light and drying winds and shed highly flammable leaf and small woody litter which increases the risk of intense future fire. Planned burning acts synergistically with increasing drought stress to increase the risk of mortality or crown death of fire-sensitive plants. This hazard extends across 10-25% of the species' populations.

Current existing controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 64. Bristly Shield-fern protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> Provide a generous exclusion zone in all planned burning corridors in the vicinity of all Cool and Warm Temperate Rainforest stands; and Continue to expand and improve on rainforest mapping for use in burn planning, aiming to update mapping considering rainforest loss through destruction of closed canopy and invasion by sclerophyll species.

4.12.3 Forestry operations

Forestry operations

This species generally occurs in association with rainforest. An analysis of VBA records showed that ~54% occurred within mapped rainforest or its buffers. In this situation, occurrences should be adequately protected from forestry operations due to the requirements of the Code. The risk to this species from forestry operations in the East Gippsland RFA region was re-assessed in light of new information about the exposure to forestry operations. The experts concluded that, where the species occurred on the margins or outside rainforest and/or its buffers, and especially where the rainforest habitat might have been burnt by bushfires or otherwise disturbed, protection could not be assumed. The experts emphasised the need for additional protections that targeted both the known occurrences and the rainforest

habitat where it had been disturbed and stressed the importance of greater survey effort to improve understanding of the distribution and abundance of this species.

This hazard is sporadic across the range of the species within state forest, with 45% of important populations and 20% of the habitat distribution model in the Central Highlands potentially available to forestry operations, based on the 2015 net harvest area layer. Using the revised operable area layer, this is reduced to 11% of important populations and 10% of the species' modelled habitat. This model does not take account of the 2015 Kuark record in East Gippsland which was identified in a coupe, which is why the East Gippsland RFA region is included for this hazard.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 50% of the species' modelled distribution and 82% of important populations are within the reserve system.

Table 65. Bristly Shield-fern protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).</p> <p>Within the Central Highlands, East Gippsland and West RFA regions, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Maps 5a and 5b).</p> <p>Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections for the rainforest habitat of this species are likely to be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments; • Improve information on the location of important populations in State Forest; • Monitor population size and health of individuals and assess threats; • Investigate the species' response to disturbance; and • Provide training and support to field staff in rainforest recognition and management.

4.12.4 Invasive species

Invasive vertebrate (deer)

Sambar deer have been increasing in population across the East Gippsland region in the last decade (Watter et al. 2020), infiltrating all districts and forest types, often observed congregating in damper habitats including Cool and Warm

Temperate Rainforest. Although it is unclear whether Sambar actively target the species, they have been documented to impact lowland and coastal rainforest communities, targeting a wide range of obligate rainforest taxa either by browsing, antler rubbing, trampling, or wallowing which will likely result in the reduction of current populations and their local extinction. While it is unclear whether Sambar are likely to browse ground ferns such as *Lastreopsis*, they have the capacity to trample understorey vegetation and wallow in the dampest sites which are often the critical habitat of obligate rainforest ground ferns. Sambar often target regenerating stands following bushfire, planned burns and regenerating timber harvesting coupes, resulting in recruitment failure of seed recruits or resprouting individuals at their most vulnerable stage of development. This hazard extends across all the species' populations.

Current existing controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 66. Bristly Shield-fern protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Monitor representative populations following timber harvesting, planned burning and bushfire, as well as in healthy mature stands, to see evidence of browsing or the impact of trampling and wallowing on the species; and • Target Sambar for control particularly after major decline events such as fire or extremely severe drought.

4.13 Creeping Shield-fern (*Lastreopsis microsora* subsp. *microsora*)

The Creeping Shield-fern was listed as Endangered in Victoria under the FFG Act in May 2021. The subspecies has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.13.1 Risk Assessment

Table 67. Creeping Shield-fern risk ratings in the East Gippsland RFA region:

	Increased fire frequency and intensity	Planned burning	Forestry operations	Invasive vertebrate (deer)
Consequence	Extreme	Moderate	Moderate	Moderate
Likelihood	Almost Certain	Possible	Likely	Likely
Overall risk rating	High	Medium	Significant	Significant

4.13.2 Fire

Increased fire frequency and intensity

Altered fire regimes under climate change are likely to continue to threaten this subspecies and its habitat. Many locations have already been severely burnt as an early climate change signal with a vast majority of sites likely burnt in the last 40 years (e.g., Ash Wednesday fire 1983). The threat incorporates drought stress and includes increasing fire risk, with each catastrophic fire event resulting from incremental impacts which accrue over decades. The subspecies is likely to have been significantly depleted because of the documented contraction and elimination of Warm Temperate Rainforest stands, the critical habitat of the subspecies, across its range in response to catastrophic bushfire. This threat extends across all the subspecies' population, and results in habitat loss from an accrued impact of decades of drought and high summer temperatures resulting in sudden quantum decline in the extent of structurally mature Warm Temperate Rainforest. Vegetative regeneration of established mature stands from extensive rhizome systems post-fire are likely to be at elevated risk of trampling and, potentially targeted or incidental browsing by Sambar which tend to congregate in mesic habitats in gullies and on lower slopes, particularly following intense landscape-scale bushfires.

Current existing controls for this hazard include:

- **Planned Burning.** This control is considered ineffective in this case as the subspecies' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this subspecies and its habitat from severe bushfires.

Table 68. Creeping Shield-fern protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • The overall risk would need to be addressed to mitigate this hazard, such as trying to keep climate change below certain thresholds; and • Undertake targeted removal of eucalypts invading former rainforest following intense bushfire.

Planned burning

Traditionally, planned burns in the general vicinity of rainforest and other riparian vegetation have been reliant on differential moisture gradients to reduce the intensity and impact of fire on all fire-sensitive vegetation types in the riparian environment. Whilst this approach has often worked satisfactorily in the past, recent experience and climate change projections (CSIRO & Bureau of Meteorology 2020) demonstrate the increasing risk of even well-controlled

planned burns entering rainforest and its buffers. All fire in the ecotonal environment threatens to expose fire-sensitive plants to mortality and local extinction. At greatest risk are elevated epiphytes such as filmy ferns and fork ferns which can be killed even by exposure to sun and wind, however the precise impact on the Creeping Shield-fern is unclear since the plant is observed both in intense shade and in the protection of small canopy gaps within mature rainforest stands. Fire in the ecotonal environment, with the risk of fire ingress into the mature rainforest stand, risks the destruction of the closed canopy and invasion of sclerophyll species such as eucalypts and acacias. Although the subspecies can recover vegetatively from established rhizomes immediately post-fire, such stands are likely to decline in health and extent as the maturing eucalypts draw moisture out of the soil, open the understorey to light and drying winds and shed highly flammable leaf and small woody litter which increases the risk of intense future fire. Planned burning acts synergistically with increasing drought stress to increase the risk of mortality or crown death of fire-sensitive plants. This hazard extends across 10-25% of the subspecies' populations.

Current existing controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this subspecies. Values checking relies on existing site records and modelled distribution, and for some subspecies site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known species.

Table 69. Creeping Shield-fern protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Provide a generous exclusion zone in all planned burning corridors in the vicinity of all Warm Temperate Rainforest stands; and • Continue to expand and improve on rainforest mapping for use in burn planning with an aim to update mapping considering rainforest loss through destruction of closed canopy and invasive by sclerophyll taxa.

4.13.3 Forestry operations

Forestry operations

This subspecies generally occurs in association with rainforest. An analysis of VBA records showed that ~72% occurred within mapped rainforest or its buffers. In this situation, occurrences should be adequately protected from forestry operations due to the requirements of the Code. The risk to this subspecies from forestry operations in the East Gippsland RFA region was re-assessed in light of new information about the exposure to forestry operations. The experts concluded that, where the subspecies occurred on the margins or outside rainforest and/or its buffers, and especially where the rainforest habitat might have been burnt by bushfires or otherwise disturbed, protection could not be assumed. The experts emphasised the need for additional protections that targeted both the known occurrences and the rainforest habitat where it had been disturbed and stressed the importance of greater survey effort to improve understanding of the distribution and abundance of this subspecies.

The hazard is sporadic across the range of the subspecies within State Forest with 5% of VBA points and 15% of modelled habitat potentially available for harvesting based on the 2015 net harvest area layer. Using the revised operable area layer this is reduced to 5% of the subspecies' modelled habitat and 2% of VBA points. VBA points could be biased by survey effort targeting rainforest in protected areas with greater access.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this subspecies in the Code, however the Code includes general protections for rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this subspecies.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as satisfactory as 73% of the subspecies' modelled distribution and 86% of important populations are within the reserve system.

Table 70. Creeping Shield-fern protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this subspecies where it has been recently disturbed (See Map 4).</p> <p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this subspecies with 100 m or better accuracy and any new records (See Map 5a).</p> <p>Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections for the rainforest habitat of this subspecies are likely to be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments; • Improve information the location of important populations in State Forest; • Monitor population size and health of individuals and assess threats; • Investigate the subspecies' response to disturbance; and • Provide training and support to field staff in rainforest recognition and management.

4.13.4 Invasive species

Invasive vertebrate (deer)

Sambar deer have been increasing in population across the East Gippsland region in the last decade (Watter et al. 2020), infiltrating all districts and forest types, often observed congregating in damper habitats including Warm Temperate Rainforest. Although it is unclear whether Sambar actively target the subspecies, they have been documented to impact lowland and coastal rainforest communities, targeting a wide range of obligate rainforest taxa. Numerous plant species have been documented to be targeted by Sambar, either by browsing, antler rubbing, trampling, or wallowing, with targeted browsing of juveniles or resprouts which has eliminated all recruits or transgressive individuals which will inevitably result in the demise of current populations and their local extinction. This hazard extends across all the subspecies' populations, and while it is unclear whether Sambar are likely to browse ground ferns, they have the capacity to trample understorey vegetation and wallow in the dampest sites which are often the critical habitat of obligate rainforest ground ferns. Sambar often target regenerating stands following bushfire, planned burns and regenerating timber harvesting coupes, resulting in recruitment failure of seed recruits or resprouting individuals at their most vulnerable stage of development.

Current existing controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this subspecies has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs

should not be considered inappropriate if program funding is sustainable and the target flora subspecies for protection face significant threat from deer activity.

Table 71. Creeping Shield-fern protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Monitor representative populations following timber harvesting, planned burning and bushfire, as well as in healthy mature stands, to see evidence of browsing or the impact of trampling and wallowing on the subspecies; and • Target Sambar for control particularly after major decline events such as fire or extremely severe drought.

4.14 Eastern Pomaderris (*Pomaderris discolor*)

The Eastern Pomaderris was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (91% of modelled habitat) and Gippsland (9% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.14.1 Risk Assessment

Table 72. Eastern Pomaderris risk ratings in East Gippsland RFA region:

	Drought	Forestry operations
Consequence	Moderate	Moderate
Likelihood	Possible	Possible
Overall risk rating	Medium	Medium

4.14.2 Climate change

Drought

The species is threatened by extreme drought stress across its range caused by climatic warming and drying, which works synergistically with bushfire management regimes to increase the risk of recruitment failure. Increased drought will likely increase fire risk, which may reduce the extent of mesic vegetation types and rainforest ecotones which this species occupies. The species is classified as having obligate pyrogenic dormancy (Ooi et al. 2014) as is the case for some other species of *Pomaderris*. Given its habitat preferences, it is likely to require recruitment where fire allows enough heating for seed imbibition, which requires sufficient rainfall to follow and allow germination and recruitment of seedlings into mature plants. The persistence of significant populations of the species is possibly maintained by a low fire frequency and generally cool climate. It may have low water use efficiency and would be limited as such by droughts rather than impacts from occasional fire. Heat wave conditions do not significantly affect seed germination (Ooi et al. 2014).

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 73. Eastern Pomaderris protection requirements and recommendations for drought

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat, and the overall risk level is medium.
Potential management actions	<ul style="list-style-type: none"> • Propagate plants and establish in new areas of habitat to increase population size and area of occupancy; • Maintain environmental watering into drainage lines and creeks to improve resilience of rainforest stands and ecotones which are occupied by the species; and • Undertake low intensity burns within part of a population during non-drought cycles, to allow increased germination and establishment of additional mature stands.

4.14.3 Forestry operations

Forestry operations

Where plants are not detected pre-harvest due to limited survey efforts, forestry operations can lead to direct mortality or recruitment failure of the species. Where it is a component of the understorey, loss of part or all the population can occur through harvesting itself or if regeneration burns impact on protection areas. Based on the 2015 net harvest area layer, the modelled habitat contains 14-22% of merchantable timber. Using the revised operable layer, this is reduced to 7%.

The species tends to require fire and then rainfall for recruitment, therefore increased fire frequency, or burning during a drought period, may create an unsuitable fire regime which makes species unable to persist post-harvesting.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as good as a 200m radius is effective to buffer the impacts of forestry operations on the species.
- Pre-harvest surveys. The effectiveness of this control for this species has been evaluated as good, provided surveyors can accurately identify the species and gather appropriate data.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 52% of the species' modelled distribution and 60% of important populations are within the reserve system.

Table 74. Eastern Pomaderris protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Where possible, incorporate planning for the species in regeneration burns so that they occur in a manner that increases recruitment; and • Propagate species and plant in other areas (<i>ex-situ</i>).

4.15 Errinundra Pepper (*Tasmannia xerophila* subsp. *robusta*)

The Errinundra Pepper was listed as Endangered in Australia under the FFG Act in May 2021. The subspecies has modelled habitat in the East Gippsland (60% of modelled habitat), Gippsland (29% of modelled habitat) and North East (10% of modelled habitat) RFA regions, however the modelled habitat in the North East, Gippsland and Upper Snowy in the East Gippsland RFA regions are not supported by any specimen records or confirmed site records, so have not been included in this assessment. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.15.1 Risk Assessment

Table 75. Errinundra Pepper risk ratings in the East Gippsland RFA Region:

	Drying climate; Increased fire frequency and intensity	Forestry operations
Consequence	Extreme	Moderate
Likelihood	Almost Certain	Likely
Overall risk rating	High	Significant

4.15.2 Climate change; Fire

Drying climate and increased fire frequency and intensity

Drying climate and increased fire frequency and intensity have been combined here due to the close relationship between the two hazards. Climatic warming and drying increases the risk of extreme drought stress resulting in recruitment failure following timber harvesting, slash burning, planned burns or high intensity bushfire. A warmer and drier climate also increases fire risk resulting in increasing frequency, intensity, and landscape scale of uncontrolled bushfires at intervals shorter than the tolerable fire interval for the subspecies, which is inferred to be in the 50–80-year range or more. Although the subspecies can recruit vegetatively by resprouting and root suckering following a single fire event of moderate intensity, high intensity repeat fire events and extreme drought stress are likely to increase the risk of adult mortality and recruitment failure, resulting in a progressive decline in population density. Both vegetative resprouts and seed-based recruits are exposed to the risk of targeted browsing by Sambar. The subspecies occupies an ecologically comparable habitat range to the Forest Geebung since both taxa occur in Cool Temperate Rainforest, including most notably the state's most extensive surviving stands of mature Cool Temperate Mixed Forest, both FFG-Listed threatened communities, and Wet Forest or Montane Wet Forest, attaining full maturity in unique old-growth stands of Montane Rainforest thicket dominated by Errinundra Plum-pine (*Podocarpus lawrencei*). The two taxa are therefore at comparably high risk of seedbank depletion and local extinction through the elimination of old-growth forest in response to the collective impacts of climatic warming and drying. This hazard extends across all the subspecies' distribution.

Current existing controls for this hazard include:

- Climate change mitigation. Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this subspecies at the scale relevant to its conservation at this stage.
- Planned burning. This control is considered ineffective in this case as the subspecies' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this subspecies and its habitat from severe bushfires.

Table 76. Errinundra Pepper protection requirements and recommendations for drying climate and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Collect seed for the VCS from across the subspecies' range as insurance against catastrophic loss; and • Consider options to conserve this subspecies under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.15.3 Forestry operations

Forestry operations

The subspecies is threatened by forestry operations in parts of its range, including the disturbance and removal of understorey species and invasion by weeds. Forestry operations in high elevation native forests in high rainfall zones have generally involved the seed-tree silvicultural system to maximise regeneration success. This is increasingly being replaced by various forms of retention harvesting. Such operations are likely to have a significant impact on understorey trees and shrubs, including mature stands of Errinundra Pepper. Although the subspecies is capable of root-suckering and resprouting from surviving rootstocks, the subspecies also responds by copious germination of soil-stored seed. Both resprouting and newly germinated juveniles are at elevated risk of recruitment failure through extreme drought stress, intense competition by fire-adapted sclerophyll species and exotic weeds, most notably Forest Blackberry (*Rubus polyanthemus*) and, potentially, targeted browsing by Sambar deer or Black-tailed Wallaby. The subspecies is a highly localised endemic reliably recorded only on the Errinundra Plateau south of Bendoc in Far East Gippsland. Based on the 2015 net harvest area layer, 11% of the subspecies' VBA points, 23% of its important populations and 24% of its modelled habitat are potentially available for harvesting. Using the revised operable layer, this is reduced to 1% of VBA points, 3% of important populations and 4% of modelled habitat.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this subspecies has been evaluated as poor as the species-specific prescriptions are for the Gippsland RFA region, and not the East Gippsland RFA region where the subspecies occurs. If it was to be applied in the East Gippsland region, it would rely on the ability of field staff to correctly identify the subspecies which can be easily confused by unskilled observers with the widespread and far more common Mountain Pepper (*Tasmannia lanceolata*) which often abuts stands of Errinundra Pepper.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as satisfactory as 67% of the subspecies' modelled distribution and 75% of important populations are within the reserve system.

Table 77. Errinundra Pepper protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better, including new detections). Conduct a site inspection and detailed planning in consultation with the Department to ensure the subspecies is adequately protected during timber harvesting operations (See Map 6a).
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider amending the Code to apply the current prescription for the subspecies to the East Gippsland Forest Management Area (FMA), to which the subspecies is endemic, and not to the Gippsland FMA which does not support the subspecies.

4.16 Errinundra Shining Gum (*Eucalyptus denticulata*)

The Errinundra Shining Gum was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (69% of modelled habitat) and Central Highlands (31% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.16.1 Risk Assessment

Table 78. Errinundra Shining Gum risk ratings in the Central Highlands, East Gippsland and Gippsland RFA regions:

	Habitat shifting and alteration	Increased fire frequency and intensity	Forestry operations
Consequence	Moderate	Moderate	Moderate
Likelihood	Possible	Possible	Possible
Overall risk rating	Medium	Medium	Medium

4.16.2 Climate change

Habitat shifting and alteration

The species' unique adaptation to higher frost incidents is exemplified by slower growth rates and retention of juvenile foliage, compared with Shining Gum (*Eucalyptus nitens*), and renders this species potentially at competitive risk as temperature thresholds change. Increased temperatures are also considered likely to expose this species to competitive risk from Shining Gum with episodic recruitment of hybrid individuals following fire. This hazard extends across all the species' distribution.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 79. Errinundra Shining Gum protection requirements and recommendations for habitat shifting and alteration

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Enhance fire mitigation at early stages of fires; Undertake VCS seed collection, prioritising multiple sites from a wide geographic range for a variety of genes; and Review the use of Shining Gum when reseeding fire-affected or harvested areas that previously supported the Errinundra Shining Gum.

4.16.3 Fire

Increased fire frequency and intensity

The species occurs in two main areas, one being in East Gippsland, the other in the Central Highlands. Climate change acts synchronously on the entire range, or alternatively if fire events are seen as a trigger for climate change impact, only two discrete fire events will be able to affect the bulk of the population. There has been a decline of the species because of the past and current threats, and this has been exacerbated by the 2019-20 bushfires where 21% of its HDM was burned with high severity fire. The chance of repeat major fires would appear low in the short term, particularly during La Niña conditions, however if conditions are sufficiently severe to burn into montane wet forest, then control of bushfires becomes highly problematic until weather conditions become more favourable. Due to increased fire frequency and intensity the species will not disappear immediately but there will be an incremental decrease in the distribution over the

long-term. Occurrences on the Errinundra Plateau are in a fire refugia and if the refugia becomes more accessible over time to fire, then there could be very little habitat remaining and the species may become restricted to deeper gullies. The interaction between fire and timber harvesting can exacerbate recruitment failure, as well as browsing by animals. Browsing animals are often implicated in recruitment failure which is part of the overall risk of regeneration failure.

Current existing controls for this hazard include:

- Bushfire suppression. This has been evaluated as satisfactory under less severe fire conditions; however, the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on Errinundra Shining Gum during more severe bushfires.
- Planned burning and strategic bushfire management program. This has been evaluated as poor to satisfactory in mitigating risk to Errinundra Shining Gum. It is likely that bushfires would increase without planned burning, particularly around the edges of its distribution. However, fuel management is more challenging to achieve in montane wet forest.

Table 80. Errinundra Shining Gum protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Identify and manage refuges; • Research recruitment levels and genetic purity of the species within fire affected and harvested areas given the issues of potential seed bottlenecks and genetic introgression with Shining Gum; and • Target fire prevention and suppression activities to prevent as far as possible high intensity bushfire on the Errinundra Plateau.

4.16.4 Forestry operations

Forestry operations

Errinundra Shining Gum may have declined to some degree because of historic forestry operations. The species is highly merchantable and is a forest timber product prioritised by the forestry sector. It is desirable and targeted for harvest where possible and was previously confused with the commercially valuable Shining Gum. Recruitment is dependent on seedling regeneration so there is a risk of an inadequate seed source. If a severe bushfire occurs immediately following harvesting there will be little seed in the retained trees and regeneration burns down to the ground could result in very little epicormic growth, so there is an increased risk of recruitment failure from multiple disturbances. It is a very competitive species and not likely to be outcompeted by Brown-barrel (*Eucalyptus fastigata*) or Messmate Stringybark (*Eucalyptus obliqua*). Cumulative impacts on remaining harvestable areas and bushfires increase pressure on this species. Based on the 2015 net harvest area layer, 20% of the species' modelled habitat is within merchantable areas, including 18% in the East Gippsland RFA region, and higher in more restricted occurrences in Gippsland and Central Highlands RFA regions. Using the revised operable layer, this is reduced to 5% state-wide, including 6% in the East Gippsland RFA region.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for rainforest and riparian areas, old-growth, other flora and fauna species occurring in the vicinity, and modified harvesting regimes to retain stags, hollow bearing trees and seed trees. These include a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory, as 70% of the species' modelled distribution and 74% of important populations are within the reserve system.
- Direct seeding post-harvest. The effectiveness of this control for this species has been evaluated as good, as the species is part of the seed mix post-harvest. The regeneration failure rate on high-elevation mixed species has

been high in the past, associated with drought years, and in some seasons up to 20% may fail; however, there is a retreatment program to respond to this.

Table 81. Errinundra Shining Gum protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Collect seed for the VCS, prioritising collections from multiple sites from a wide geographic range to sample a variety of genes that might better support climate adaptation work on the species; • Species-specific code prescriptions should be considered in any future Code amendments; • Avoid harvesting in areas that include the species especially in smaller populations disjunct from the main distribution in the vicinity of Errinundra, or reduce harvesting intensity in areas of older stands of the species within State Forest; and • Review silvicultural guidelines related to the regeneration of coupes associated with this species, such as for seed mix.

4.17 Finger Hakea (*Hakea dactyloides*)

The Finger Hakea was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.17.1 Risk Assessment

Table 82. Finger Hakea risk ratings in the East Gippsland RFA Region:

	Drying climate; Increased fire frequency and intensity	Planned burning	Forestry operations	Invasive vertebrate (deer)	Small/restricted population (flora)
Consequence	Major	Major	Extreme	Major	Extreme
Likelihood	Likely	Likely	Unlikely	Likely	Almost Certain
Overall risk rating	High	High	Significant	High	High

4.17.2 Climate change; Fire

Drying climate and increased fire frequency and intensity

Climatic warming and drying are projected to result in an increasing risk of bushfire frequency, intensity and landscape scale which expose all stands of fire-sensitive species such as the Finger Hakea to the rigours of seed-based recruitment, namely recruitment failure due to intense drought or targeted herbivory by Sambar or Black-tailed Wallaby, seedbank depletion, exhaustion, and the risk of local extinction. VicFlora (2021) describes the species as an erect lignotuberous bushy shrub or small tree, suggesting it may be capable of basal resprouting following intense bushfire, however limited field observations do not necessarily support this inference.

Current existing controls for this hazard include:

- The *Climate Change Act 2017* and associated mitigation strategies. These controls are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 83. Finger Hakea protection requirements and recommendations for drying climate and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.17.3 Fire

Planned burning

Repeat fire events (through bushfire or planned burning) at intervals below the tolerable fire interval for the species carry the risk of depleting the population to the point of local extinction through adult mortality, recruitment failure through exposure of juvenile plants to targeted browsing and extreme drought events, and seedbank depletion and exhaustion. The extent of this hazard is 25-50% of the species' Victorian population given that prominent ridgeline tracks such as the Stony Peak Road are routinely used as boundaries for fuel reduction corridors since they provide convenient barriers to fire spread when supplemented by fuel suppression activities such as mineral earth breaks or slash breaks. The recorded habitat range of the species in Victoria, namely rocky ridges and peaks (VicFlora 2021), is likely to expose any

Victorian occurrences to maximum fire intensity since all fires, whether planned or uncontrolled, increase intensity as they approach ridgelines and summits where fuels are driest.

Current existing controls for this hazard include:

- Values checking in preparation for Planned burning. This has been evaluated as uncontrolled to satisfactory at mitigating risk to this species from bushfire since the only record of the species in state forest in Victoria is a 2002 specimen housed at the Australian National Herbarium in Canberra which is not available in the VBA. However, reliable site records within Coopracambra and Croajingolong National Parks and on private inholdings facilitate exclusion zones established to protect known occurrences of this fire-sensitive species from the impact of site preparation works and planned burning itself.

Table 84. Finger Hakea protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Undertake targeted field surveys to confirm the extent of all known occurrences and any other undetected occurrences in the general vicinity; and • Add the incidental record at the Stony Peak Road site to the VBA.
Potential management actions	<ul style="list-style-type: none"> • Implement an appropriate exclusion zone from all planned burning activity in the general vicinity of all known occurrences.

4.17.4 Forestry operations

Forestry operations

The only confirmed record of the species in Victoria that is not in a national park is a single mature 7m tall tree on Stony Peak Road nine kilometres west of Genoa in State Forest. This individual and any associated specimens which may occur in the immediate vicinity are highly susceptible to road maintenance activity, timber harvesting and planned burn preparation, and is at risk of accidental loss and local extinction through intensive mechanical disturbance. In the event of local extinction, the likelihood of recolonisation is negligible since the dispersal range of seed is unlikely to exceed 100 metres.

Current existing controls for this hazard include:

- Values checking in preparation for any relevant forestry activities. The effectiveness of this measure in managing the risk to this species has been evaluated as poor, as values checking relies on existing site records, and the only record of the species in state forest in Victoria is a 2002 specimen housed at the Australian National Herbarium in Canberra which is not available in the VBA.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 59% of the species' modelled distribution and 97% of important populations are within the reserve system.

Table 85. Finger Hakea protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over one Australian National Herbarium record (2002) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over one Australian National Herbarium record (2002). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 6a). • DELWP will conduct a survey to confirm extent of the Stony Peak Road occurrence and any other undocumented occurrences in the general vicinity and ensure the National Herbarium record is included in the VBA.
Priority management actions	<ul style="list-style-type: none"> • Undertake a targeted field survey to confirm the extent of the Stony Peak Road occurrence; • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	No further management actions have been recommended for this hazard.

4.17.5 Invasive species

Invasive vertebrate (deer)

Sambar Deer have been increasing in population density and penetration across the region (Watter et al. 2020) with increasing evidence of targeted browsing of a diversity of tree and shrub taxa including several taxa with tough leathery leaves which had been previously assumed to be unlikely targets for browsing. This growing list of susceptible taxa includes those in unexpectedly dry, rocky, elevated sites, such as the Finger Hakea, where Sambar had not previously been noted as active. This hazard extends across all the species' Victorian populations, with browsing observed of both mature adult plants and juvenile recruits for a wide variety of trees and shrubs. If browsing is sustained over successive seasons the likelihood of adult mortality is substantially increased, exposing recruiting subpopulations to recruitment failure and local extinction. Prolonged or repeated browsing is also likely to reduce flowering and seedset. The species typically occurs in very small, isolated stands with little or no likelihood of recolonisation in the event of local extinction with the only plausible vectors of seed being ants (myrmecochory) which operate at the metre scale. Small and isolated subpopulations are at particular risk of recruitment failure through targeted browsing by Sambar or Black-tailed Wallaby following intense bushfire, planned burning, post-harvest regeneration or extreme drought events.

Current existing controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.
- Deer deterrents such as urine pots and sensor lights. The effectiveness of these controls for this species have been evaluated as poor as they have been trialled on the Bogong high-plains (Pers. Comm. W. Papst) and found to operate only effectively for a short-time period as the deer become acclimatised. They are useful for small areas with high concentrations of extremely threatened species; however, it is poor for this species.

Table 86. Finger Hakea protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is an ongoing hazard operating stochastically.
Potential management actions	<ul style="list-style-type: none"> • Monitor recruiting populations in the first two years following timber harvesting, planned burning and bushfire (these are the three events that will trigger recruitment) to see evidence of browsing.

4.17.6 Population dynamics

Small/restricted population (flora)

The species is currently known in Victoria only in several dry rocky upslope sites in remote forest between Mount Kaye and Cape Howe in far East Gippsland. Whilst the forest habitat is not uncommon in the district, the likelihood that other occurrences occur elsewhere in the district cannot be predicted. This hazard extends potentially up to 100% of the species' populations. All occurrences are potentially threatened by planned burning, including the only confirmed record of the species in Victoria that is not in a national park which is a single mature 7m tall tree on Stony Peak Road nine kilometres west of Genoa in State Forest. This hazard operates synergistically with the impact of Sambar and climatic warming and drying.

There are no current control measures for this hazard that manage the risk to this species.

Table 87. Finger Hakea protection requirements and recommendations for small/restricted population (flora)

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Undertake targeted field surveys to confirm the extent of all known occurrences and any other undetected occurrences in the general vicinity.
Potential management actions	<ul style="list-style-type: none"> • Establish <i>ex-situ</i> populations.

4.18 Fingerwort (*Lepidozia procera*)

The Fingerwort was listed as Critically Endangered in Victoria under the FFG Act in May 2021. The species occurs in the Central Highlands (100% of VBA points) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.18.1 Risk Assessment

Table 88. Fingerwort risk ratings in the Central Highlands RFA region:

	Increased fire frequency and intensity	Forestry operations	Stochastic events
Consequence	Extreme	Moderate	Major
Likelihood	Likely	Possible	Possible
Overall risk rating	High	Medium	Significant

4.18.2 Fire

Increased fire frequency and intensity

Loss of specialised Cool Temperate Rainforest habitat because of climate change is a major threat to the species, with the concomitant increased risk of fire and consequent recruitment failure. Conditions are predicted to increase towards greater incidence of bushfire within the Central Highlands over the next 50-year period (Clarke et al. 2019), which presents a direct threat to the persistence of habitat and populations of the species. It is possible that a single fire event could destroy the only known Victorian population of this species, by way of increasing conditions suitable for eucalypt forest over Cool Temperate Rainforest. Disturbance to canopy from fire or landslip will likely further expose the habitat to impacts from Myrtle Wilt, sedimentation of the waterway, drying of understorey vegetation and potential weed invasion. This hazard impacts recruitment as well as causing direct mortality and extends across 100% of the species' populations.

Current existing controls for this hazard include:

- The *Climate Change Act 2017* and associated mitigation strategies. These controls are not effective in managing the risk to this species at the scale relevant to its conservation.
- Strategic bushfire management planning. The effectiveness of this control for this species has been evaluated as poor as the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts to this species.

Table 89. Fingerwort protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Remove eucalypt recruits from Cool Temperate Rainforest patches. Young eucalypts (<20 cm diameter at breast height) may be removed to allow conditions for Cool Temperate rainforest canopy taxa to be dominant, and to reduce the susceptibility of habitats to bushfire; and • Ensure that important populations are mapped, recorded, and made available for fire management planning purposes.

4.18.3 Forestry operations

Forestry operations

The only known Victorian site of the species is threatened by forestry operations, however it is understood the only known plants are not in a timber harvesting area, but nearby. This means that direct mortality is unlikely, and impacts are

more likely to be secondary from landscape change such as fire behaviour, weed spread, or Myrtle Wilt spread, or from landslips from the access road. Surrounding timber harvesting activities may lead to changes to landscape fire behaviour which adversely affects the population and its habitat.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as only 37% of the species' important populations and 54% of post-1970s VBA points are within the reserve system.

Table 90. Fingerwort protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments; • Improve information on the location of important populations in State Forest; • Monitor population size and health of individuals, and assess threats; and • Investigate response to disturbance.

4.18.4 Habitat loss, degradation, and fragmentation

Stochastic events

Landslips can be caused by unstable earth along roads and drains, resulting in direct mortality of the species. Landslips may increase Cool Temperate Rainforest exposure to Myrtle Wilt, eucalypt encroachment, stream sedimentation and bushfire risk. This hazard extends across 50% of the species' populations.

Current existing controls for this hazard include:

- Values checking and delivery of mitigations at the operational delivery stage of roading actions within State Forest. It is uncertain whether the control is applied along roads in the vicinity of habitat.
- Native Vegetation removal on public land. This has been evaluated as poor as the procedure does not include a sufficient process for decision making on the removal of critical habitats. If native vegetation removal was permitted, the counter balancing measures would unlikely be suitable for mitigating losses to the species.
- The regulation of the removal of native vegetation under the Victorian Planning Provisions and all planning schemes in Victoria. This has been evaluated as poor as exemptions to Clause 52.17 of the planning scheme for road maintenance (or alternative arrangement via a memorandum of understanding) present a risk of inadequate assessment prior to vegetation removal. This exposes populations of the species and its habitat to the risk of inadvertent impacts following roadworks.

Table 91. Fingerwort protection requirements and recommendations for stochastic events

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Undertake population surveys and monitoring as the occurrence of the species in Victoria is based on a very small number of observations at one site. Additional surveys should be undertaken to search more widely within the Baw Baw area for additional populations.
Potential management actions	<ul style="list-style-type: none"> • The known population and any new populations may be visited every five years to re-assess the condition of the populations, types of threats and any impacts which have occurred between surveys; • Use engineering and/or buffer planting to further reduce the risk of land slip and stream sedimentation caused by storm events or persistent high rainfall; • Monitor stream flows long term to determine baseline flows over 10 years and whether there are long term changes attributable to climate change. Use additional data to guide management of Cool Temperate Rainforest; and • Inspect road standard and engineering issues to determine land slip risk.

4.19 Flat Raspwort (*Gonocarpus serpyllifolius*)

The Flat Raspwort was listed as Vulnerable in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.19.1 Risk Assessment

Table 92. Flat Raspwort risk ratings in the East Gippsland RFA region:

	Drying climate	Plantations	Invasive vertebrate (ungulates)
Consequence	Moderate	Minor	Extreme
Likelihood	Likely	Possible	Almost Certain
Overall risk rating	Significant	Medium	High

4.19.2 Climate change

Drying climate

In the longer term, the habitat of the species is threatened by climatic drying and warming, resulting in a projected incremental contraction in the local extent of suitable habitat. It is unclear whether the projected increase in fire intensity and frequency poses a significant current or future threat to the species since, like many species of *Gonocarpus* or *Haloragis*, the species is likely to respond favourably to individual fire events which are likely to promote pulse seed recruitment from a long-persistent soil-stored. This threat extends across 70% of the species' populations.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 93. Flat Raspwort protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.19.3 Forestry operations

Plantations

Approximately 21% of the species may be threatened by habitat loss and degradation through softwood or hardwood plantation establishment in Victoria.

Current controls for this hazard include:

- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as only 36% of the species' modelled distribution and 20% of important populations are within the reserve system.

Table 94. Flat Raspwort protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> Establish <i>ex-situ</i> propagation to conserve local genotypes as insurance against loss of particular populations.

4.19.4 Invasive species

Invasive vertebrates (ungulates)

The habitat of the species is highly susceptible to pugging and targeted browsing by pigs, feral horses, and increasingly by Sambar, throughout the restricted Victorian range of the species, exposing the habitat to weed invasion. This hazard is likely to interact with climatic drying as plants that are already stressed due to disturbance by invasive vertebrates would be less likely to recover in a drying climate. This hazard extends across around 90% of the species' populations.

Current controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 95. Flat Raspwort protection requirements and recommendations for invasive vertebrates (ungulates)

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> Comprehensively search likely habitat and map important populations; Establish monitoring sites and collect baseline data.; and Assess impacts of invasive vertebrates.
Potential management actions	<ul style="list-style-type: none"> Assess the feasibility of fencing important populations as the habitat of this species is a refugia environment in the drying climate, therefore the hazard of invasive vertebrates is only likely to increase unless drastic control measures are undertaken.

4.20 Floodplain Violet (*Viola betonicifolia* subsp. *novaguineensis*)

The Floodplain Violet was listed as Endangered in Victoria under the FFG Act in May 2021. The subspecies has modelled habitat in the Gippsland (32% of modelled habitat), West (29% of modelled habitat) and North East (28% of modelled habitat), RFA regions and has 10% of modelled habitat in the non-RFA regions. Experts identified that the subspecies is distributed outside of the areas of modelled habitat, so some hazards were assessed and reported on in the Central Highlands and East Gippsland RFA regions also. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.20.1 Risk Assessment

Table 96. Floodplain Violet risk ratings in the Central Highlands, East Gippsland, Gippsland, North East and West RFA regions:

	Altered rainfall patterns	Plantations	Invasive vertebrate (ungulates)	Invasive plant (non-woody weeds)
Consequence	Moderate	Minor	Minor	Major
Likelihood	Likely	Possible	Likely	Likely
Overall risk rating	Significant	Medium	Medium	High

Table 97. Floodplain Violet risk ratings in the East Gippsland, Gippsland, North East and West RFA regions:

	Increased fire frequency and intensity	Dams and water management/use
Consequence	Minor	Moderate
Likelihood	Possible	Unlikely
Overall risk rating	Medium	Medium

Table 98. Floodplain Violet risk ratings in the West RFA region:

	Forestry operations
Consequence	Minor
Likelihood	Likely
Overall risk rating	Medium

4.20.2 Climate change

Altered rainfall patterns

The major threat to the subspecies is climate change, which is likely to lead to decreased rainfall, increased evaporation, extreme temperatures, extreme rainfall events (1 in 100-year flooding) causing flash floods, soil erosion and/or severe scouring of riparian environments and smothering by flood debris, drying of springs and soaks and increased frequency and intensity of fires and peat fires. Prolonged drought also increases the impacts of large grazing animals. This hazard applies to 100% of the subspecies' habitat and is likely to lead to habitat degradation and reduced population sizes.

Current existing controls for this hazard include:

- Streamflow Management Plans. The effectiveness of this control for this subspecies has been evaluated as poor to satisfactory as it only applies to areas used for irrigation and does not deal with many of the populations on smaller streams. However, in some instances Streamflow Management Plans have ensured areas receive water in years where they might not have been allocated water.

- Victorian Floodplain Management Strategy. The effectiveness of this control for this subspecies has been evaluated as poor because it is focussed on avoiding major flooding events and does not mitigate against lack of water.

Table 99. Floodplain Violet protection requirements and recommendations for altered rainfall patterns

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • <i>In-situ</i> propagation; and • Additional <i>ex-situ</i> conservation collections, such as seed storage of populations not yet stored in the VCS.

4.20.3 Fire

Increased fire frequency and intensity

Increased frequency and intensity of fires, including peat fires, applies to 100% of the subspecies' habitat. While plants that occur in riparian habitats are unlikely to be impacted directly by fire, they may be impacted by post-fire impacts including increased run-off and sedimentation of water. All hazards are likely to cause reduction or degradation of the streamside habitats required by this subspecies. These hazards are not likely to be cumulative, but all have the potential to reduce or degrade habitat.

Current existing controls for this hazard include:

- Bushfire management phases of planning, prevention, preparedness, fuel management, response, recovery, and monitoring. The effectiveness of this control in managing risk for this subspecies has been evaluated as poor because despite these controls, the impacts of bushfire on this subspecies have increased over the past 20 years. This is likely in part because of climate change and inappropriate forest management.

Table 100. Floodplain Violet protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	No potential mitigations were nominated for this hazard by the experts.

4.20.4 Forestry operations

Forestry operations

Threats to hydrology from forestry operations may include the drying/destruction of wetlands by groundwater take-up and canopy interception of precipitation by regrowing forests, however native forest timber harvesting in the West RFA region is currently small in scale. This hazard applies to the West RFA region only and can lead to reduced population sizes. While modelling indicates that there is no overlap between occurrences of this subspecies and forestry operations, experts stated that records were missing from the model in the West RFA region and therefore forestry operations could still impact on the subspecies. Forestry operations are likely to further exacerbate effects of climate change in terms of habitat degradation from drying of watercourses.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this subspecies in the Code, however the Code includes general protections for waterways and riparian vegetation including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this subspecies.

- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as poor as 39% of the subspecies' modelled distribution and 57% of important populations are within the reserve system.

Table 101. Floodplain Violet protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Additional <i>ex-situ</i> conservation collections, such as seed storage of populations not yet stored in the VCS.

Plantations

This hazard has very limited relevance over most of the known distribution of the subspecies in the State. The known habitat along the Snowy River in the East Gippsland RFA region is flood-prone and unsuitable for plantations, as are the riverine populations along the Murray River and tributaries (North East RFA and non RFA regions). The very few collections from elevated sites in highland areas are within reserves (North East RFA and Gippsland RFA regions). The collections from the West RFA region are from a sedge dominated swamp and a riparian habitat. This hazard therefore applies to less than 10% of habitat. Where they occur, plantations may lead to altered hydrology, habitat degradation and reduced population sizes. The hazards from plantations interact with climate change, potentially leading to increased risk of habitat desiccation.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this subspecies has been evaluated as poor because the history of management for protection of included or abutting remnant vegetation has varied across plantations. The potential for damage from spray drift and run-off from track networks may not yet be fully dealt with, and the impact of increased water use by regenerating trees may be exacerbated by reduced rainfall, particularly where remnant wet habitat is less well buffered.
- Victorian Planning Provisions and planning schemes. These were assessed as poor in relation to this subspecies as loss of native vegetation may be permitted and offsets may not provide like for like protection.

Table 102. Floodplain Violet protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Review strategies to minimise spray drift during plantation management especially at re-establishment; • Survey potential habitat within existing plantations and planned expansions; • Review Code requirements for protection of biodiversity values, including remnant habitat within or adjoining plantations, to ensure effectiveness; and • Expand and potentially revegetate buffers in any locations where this would improve security of habitat.

4.20.5 Habitat loss, degradation, and fragmentation

Dams and water management/use

Water management practises, including river regulation and diversion of streams, apply to 100% of the subspecies' habitat. This can lead to altered hydrology, habitat degradation and reduced population sizes.

Current existing controls for this hazard include:

- The Victorian Waterway Management Strategy. The effectiveness of this control for this subspecies has been evaluated as satisfactory because the riparian habitat is in reasonable quality where most populations occur.

Table 103. Floodplain Violet protection requirements and recommendations for dams and water management/use

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	No potential mitigations were nominated for this hazard by the experts.

4.20.6 Invasive species

Invasive vertebrate (ungulates)

Sambar Deer are increasing in numbers, and cause damage to hydrology, soils, wetland and dryland vegetation and structural damage to plants by trampling. Cattle, both feral and domestic, feral horses, goats and pigs also damage soils and vegetation by browsing and pugging and facilitating weeds. Damage to vegetation caused by herbivores, especially by large, hooved animals, is potentially compounded by drought conditions. This hazard applies to 100% of the subspecies' habitat and can also lead to reduced population sizes.

Current existing controls for this hazard include:

- Victorian Deer Control Strategy. The effectiveness of this control for this subspecies has been evaluated as poor in highland areas with greater potential in lowland riparian areas. While this strategy is a good start to controlling this problem, deer remain in high numbers throughout the state, occurring in often very remote areas. They also are very quick at re-establishing in areas following control.
- Regional invasive species control. The effectiveness of this control for this subspecies has been evaluated as poor because while it is effective on a very localised scale, it is unable to control the overall problem.
- The *Catchment and Land Protection Act 1994*. The effectiveness of this control for this subspecies has been evaluated as poor in highland areas with greater potential in lowland riparian areas. At this stage control is not keeping up with deer populations and will be very difficult in the absence of a top predator.

Table 104. Floodplain Violet protection requirements and recommendations for invasive vertebrate (ungulates)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none">• Assess the feasibility of fencing areas that adjoin private land to ensure cattle do not enter streams; and• Ongoing control of feral animals, particularly deer and pigs.

Invasive plant (non-woody weeds)

Competition from introduced grasses and forbs, exacerbated by elevated nutrient levels, is currently greatest at lower elevations. However, bog sites at higher elevations are also at significant risk. The level of threat could increase on the Murray River floodplain because of reduced flooding due to association with climate change. Given the subspecies is poorly known at higher elevations, it is likely that this threat applies to at least 50% of the population and possibly up to

more than 80%. It is likely that the subspecies has been displaced from many riparian sites in the eastern part of northern Victoria.

Current existing controls for this hazard include:

- The *Catchment and Land Protection Act 1994*. This control was evaluated as poor but with greater potential at higher elevation sites where selective control of the key problem species is more feasible.
- Targeted invasive species programs. The effectiveness of this control for this subspecies has been evaluated as poor as selective and effective control of ground-layer species such as introduced grasses is extremely difficult, especially over broader areas. Expertise is needed to selectively treat the relevant weed species without eliminating the associated ground flora, however resources are rarely available for more careful ecological rehabilitation work by skilled revegetators.

Table 105. Floodplain Violet protection requirements and recommendations for invasive plant (non-woody weeds)

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Identify priority sites for targeted weed control.
Potential management actions	<ul style="list-style-type: none"> • Training of weed spraying contractors to treat weeds without eliminating the associated ground flora.

4.21 Forest Geebung (*Persoonia silvatica*)

The Forest Geebung was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (95% of modelled habitat) and Gippsland (5% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.21.1 Risk Assessment

Table 106. Forest Geebung risk ratings in the East Gippsland RFA region:

	Drying climate; Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)
Consequence	Extreme	Moderate	Moderate
Likelihood	Almost Certain	Likely	Likely
Overall risk rating	High	Significant	Significant

Table 107. Forest Geebung risk ratings in the Gippsland RFA region:

	Drying climate; Increased fire frequency and intensity	Invasive vertebrate (deer)
Consequence	Extreme	Moderate
Likelihood	Almost Certain	Likely
Overall risk rating	High	Significant

4.21.2 Climate change; Fire

Drying climate and increased fire frequency and intensity

Climatic warming and drying increase the risk of extreme drought stress resulting in recruitment failure following forestry operations, regeneration burning, or planned burns. Climatic warming and drying also increases fire risk resulting in increasing frequency, intensity, and landscape scale of uncontrolled bushfires at intervals shorter than the tolerable fire interval for the species, which is inferred to be in the 50-80-year range or more. The species occurs in Cool Temperate Rainforest including most notably the state's most extensive surviving stands of mature Cool Temperate Mixed Forest, both FFG-Listed threatened communities, and Wet Forest or Montane Wet Forest, attaining full maturity in old-growth rainforest ecotones. Although the species can recover both vegetatively through resprouting and through germination from the soil-stored seedbank, mortality of adult individuals and recruitment failure of both resprouts and seed-based recruits depletes the available seedbank and increases the risk of local extinction. Both vegetative resprouts and seed-based recruits are exposed to the risk of targeted browsing by Sambar. This hazard extends across all the species' distribution.

Current existing controls for this hazard include:

- Planned burning and strategic bushfire management planning. These controls are considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 108. Forest Geebung protection requirements and recommendations for drying climate and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Target at-risk parts of the species' range to sample a variety of genes that might better support climate adaptation work on the species; • Target fire prevention and suppression activities to prevent high intensity bushfire impacting important populations; and • Avoid planned burning operations in or near important populations.

4.21.3 Forestry operations

Forestry operations

Forest Geebung may be threatened by forestry operations in parts of its range, including the disturbance and removal of understorey species and invasion by weeds. Forestry operations in high elevation native forests in high rainfall zones generally involve the seed-tree silvicultural system to maximise regeneration success. Such operations are likely to have a significant impact on understorey trees and shrubs, including mature stands of Forest Geebung. Although the species is capable of resprouting from surviving rootstocks, it also responds by germination of soil-stored seed. It is a common component of Wet Forest, Montane Wet Forest, and Cool Temperate Mixed Forest stands, particularly on the Errinundra Plateau.

It's possible that a partial loss of propagules occurs through the forestry regeneration process if seedlings or resprouts emerge following the initial harvesting disturbance, which are then subsequently impacted by post-harvest regeneration burns, however a secondary cohort may recruit following the regeneration burn. Both resprouting and newly germinated juveniles are at elevated risk of recruitment failure through extreme drought stress, targeted browsing by Sambar or Black-tailed Wallaby and, potentially, by intense competition by fire-adapted sclerophyll species and exotic weeds, most notably Forest Blackberry. Based on the 2015 net harvest area layer, 18% of the species' VBA records and 26% of its important populations are within merchantable areas. Using the revised operable layer, this is reduced to 5% of both VBA records and important populations.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for rainforest, old growth forest and waterways including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 60% of the species' modelled distribution and 69% of important populations are within the reserve system.

Table 109. Forest Geebung protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland and Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 6a).
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Conduct thorough surveys of all scheduled coupes across the known range of the species to identify all stands for protection and buffering; and • <i>Ex-situ</i> seed collection, as the species is currently present in the VCS by a single collection. Ideally, multiple localities are included in the collection, which each comprise larger stands of the species and have good seed set at the time of collection and include wide ranging sites to accommodate some genetic variation in the interest of climate adaptation.

4.21.4 Invasive species

Invasive vertebrate (deer)

Sambar have been increasing in population across the East Gippsland region in the last decade (Watter et al. 2020), infiltrating all districts and forest types, often observed congregating in damper habitats including Cool Temperate Rainforest, Cool Temperate Mixed Forest, Wet Forest, and Montane Wet Forest. Numerous plant taxa have been documented to be targeted by Sambar, either by browsing, antler rubbing, trampling, or wallowing. Red Deer (*Cervus elaphus*) are potentially expanding their range and are likely to overlap with forests that support Forest Geebung. Red Deer are likely to be similar in behaviour to Sambar, but possibly less abundant overall. While it is unclear how frequently Sambar are likely to target Forest Geebung trees for antler rubbing, Sambar have the capacity to completely ringbark numerous understorey shrubs and trees which, if maintained over successive seasons, risks the death of established adults. Sambar are also likely to target resprouting individuals and juvenile seed-based recruits for browsing following clear-fell timber harvesting, regeneration burning, scalping or bushfire. This hazard extends across all the species' distribution.

Current existing controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 110. Forest Geebung protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Monitor representative populations following clear-fell harvesting, regeneration burning, scalping or bushfire, as well as in healthy mature stands, to see evidence of antler rubbing or targeted browsing; • Target Sambar for control particularly after major decline events such as fire or extremely severe drought; • Include targeting of Red Deer in the Bendoc-Goongerah area; and • If significant clusters of plants can be identified that face critical threats, then this may justify targeted deer control or exclusion fencing, however fencing is generally not a practical option for this species due to high costs and difficult terrain.

4.22 Forest Phebalium (*Phebalium squamulosum* subsp. *squamulosum*)

The Forest Phebalium was listed as Endangered in Victoria under the FFG Act in May 2021. The subspecies has modelled habitat in the Central Highlands (52% of modelled habitat), East Gippsland (44% of modelled habitat) and Gippsland (4% of modelled habitat) RFA regions. While the CAM assessment focusses on the impacts of deer on this subspecies, the expert/s did not assess that hazard as part of this risk assessment. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.22.1 Risk Assessment

Table 111. Forest Phebalium risk ratings in East Gippsland and Gippsland RFA regions:

	Increased fire frequency and intensity	Forestry operations
Consequence	Moderate	Moderate
Likelihood	Possible	Likely
Overall risk rating	Medium	Significant

Table 112. Forest Phebalium risk ratings in Central Highlands RFA region:

	Increased fire frequency and intensity	Forestry operations
Consequence	Minor	Moderate
Likelihood	Possible	Likely
Overall risk rating	Medium	Significant

4.22.2 Fire

Increased fire frequency and intensity

Bushfire at a frequency more than the tolerable fire interval of the subspecies would be seen as detrimental to the survival of the populations impacted. This impacts the subspecies by not allowing it to reach its reproductive state of flowering and setting seed before fire, therefore impacting recruitment. Climate change can dry out the forest vegetation leading to higher fire frequency and intensity. This hazard extends across 70% of the subspecies' modelled habitat in the Gippsland and East Gippsland RFA regions, but across only 30% of the subspecies' modelled habitat in the Central Highlands RFA region due to the predominating wet and very damp forest in that region.

Current existing controls for this hazard include:

- Planned burning. This control may be effective in reducing the risk of severe bushfires in this subspecies' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this subspecies and its habitat from severe bushfires.
- Values checking and strategic bushfire management planning. Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor to satisfactory at mitigating risk to this subspecies. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 113. Forest Phebalium protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Ensure that important populations are mapped, recorded, and made available for fire management planning purposes; and • Investigate the biology of the subspecies to ascertain if it is an obligate seeder.

4.22.3 Forestry operations

Forestry operations

The subspecies is estimated to be severely fragmented and is estimated to have fewer than ten locations. It has a continuing decline in number of locations or subpopulations, based on the current and projected impact of the identified threats, including forestry operations. As forestry operations open the landscape via track and road establishment, this may facilitate incursions of invasive species including deer. Based on the 2015 net harvest area layer, 19% of the subspecies' modelled habitat and 15% of its important populations occur in merchantable areas. Using the revised operable layer, this is reduced to 7% of its modelled habitat and 9% of its important populations.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this subspecies in the Code, however the Code includes general measures that may provide indirect protection. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this subspecies.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as satisfactory as 52% of the subspecies' habitat distribution model and 73% of important populations are within the reserve system.

Table 114. Forest Phebalium protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the Central Highlands, Gippsland and East Gippsland RFA regions, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better). Conduct a site inspection and detailed planning in consultation with the Department to ensure the subspecies is adequately protected during timber harvesting operations (See Maps 6a and 6b).
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.23 Forest Sedge (*Carex alsophila*)

The Forest Sedge was listed as Endangered in Australia under the FFG Act in May 2021. The species has modelled habitat in the Central Highlands (98% of modelled habitat) and Gippsland (2% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.23.1 Risk Assessment

Table 115. Forest Sedge risk ratings in the Central Highlands RFA region:

	Drying climate	Forestry operations
Consequence	Moderate	Moderate
Likelihood	Possible	Possible
Overall risk rating	Medium	Medium

4.23.2 Climate change

Drying climate

The species is potentially susceptible to climatic drying as well as any disruption to the hydrology of wetlands and streams across 100% of its distribution. Minor drainage lines which support the species' habitat may become drier and more fire prone, potentially opening canopy over time and reducing habitat suitability. Changes to rainfall in the next 20 years may not change significantly enough to observe decline in the species from the drying of the climate alone, however the cumulative impacts of drying and increased fire possibly contribute to the altering of vegetation structure. There is also some uncertainty as to how vegetation along drainage lines and creeks will be impacted within 20 years due to predicted changes to climate. It is possible that more than one major fire event may occur in this period within the Central Highlands, and if so, some populations may be lost with the transitioning of wet vegetation types into drier communities.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation

Table 116. Forest Sedge protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Allocate watering to creeks containing populations where possible and monitor effect;• Undertake minor engineering to remove disused dams or other works to restore suitable hydrological regime;• Increase deer control in catchment areas, to improve resilience of the vegetation to climate change related impacts;• Propagate and establish new populations in drainage line vegetation where there are clear gains for ecological improvement; and• Identify sites based on likely security with watering and retention of water in lower gradient forest creeks/swamps.

4.23.3 Forestry operations

Forestry operations

Based on the 2015 net harvest area layer, the modelled habitat contains 23% of merchantable timber. Using the revised operable layer, this is reduced to 9%. The main impacts of forestry operations on the species include changes to the

quantity of runoff and potential sedimentation into drainage lines. Sediment input can slow down water flow and make a previously occupied site too swampy. The species occupies lower gradient gullies in areas that are not fast flowing, and if the hydrological conditions change, habitat loss or direct mortality may occur. Weed invasion can also be encouraged by changes to hydrology and sedimentation. This could subsequently encourage deer to wallow in newly created muddy areas.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for riparian habitat and waterways including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- Pre-harvest surveys. The effectiveness of this control for this species has been evaluated as good, provided surveyors can accurately identify the species and gather appropriate data.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 50% of the species' modelled distribution and 72% of important populations are within the reserve system.

Table 117. Forest Sedge protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.24 Gippsland Stringybark (*Eucalyptus mackintii*)

The Gippsland Stringybark was listed as Vulnerable in Australia under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (91% of modelled habitat), and Gippsland (9% of modelled habitat) RFA regions. While it is acknowledged that other hazards impact on this species, as per the CAM assessment, the expert/s only assessed forestry operations as part of this risk assessment. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.24.1 Risk Assessment

Table 118. Gippsland Stringybark risk ratings in the East Gippsland and Gippsland RFA regions:

Forestry operations	
Consequence	Moderate
Likelihood	Possible
Overall risk rating	Medium

4.24.2 Forestry operations

Forestry operations

The species occurs in mixed species forest subject to timber harvesting. When coupes are clearfell harvested, the regenerating forest often shifts to be dominated by Silvertop Ash (*Eucalyptus sieberi*), impacting Gippsland Stringybark recovery. Silvertop Ash is faster growing and therefore dominates regeneration, which may also occur due to regeneration burning and bushfire. Following harvesting, Gippsland Stringybark is highly dependent on the availability of seed in retained trees to regenerate. Once it is established it persists well with good growth rates, however it is vulnerable to disturbances that remove most of the individuals in a site as it then relies on a few individuals that may not have as much seed to compete with more prolific seeders. This may be an issue in seed tree retention or adaptive retention harvesting approaches. In terms of intensity of disturbance, adaptive retention harvesting is quite severe compared to fire, as very rarely does fire kill Gippsland Stringybark outright. In drier ridge type areas where it becomes the predominate species, harvesting does not typically occur. Where it is at most risk is in lowland coastal plains where it tends to occur as a minor species scattered throughout the forest, and generally in a lower proportion compared to other eucalypts. It is a moderately preferred harvesting timber as it is not particularly fast growing, however it has properties that make it suitable for construction and woodchips. Multiple disturbance scenarios, where timber harvesting occurs followed by fire, could exacerbate the issue of recruitment and lead to further declines. Based on the 2015 net harvest area layer, 26% of the species' modelled habitat contains merchantable timber. Using the revised operable layer, this is reduced to 9%.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as uncontrolled as there is no species-specific prescription and no requirement for retention.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 47% of the species' modelled distribution and 31% of important populations are within the reserve system.
- Adaptive Management Approaches. The effectiveness of this control for this species has been evaluated as good as several coupes close to Bruthen where the species was identified were put into harvesting retention areas. However, it is a challenging species to identify in the field as it is very similar to Stringybark.

Table 119. Gippsland Stringybark protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider the introduction of species-specific prescriptions in any future Code amendments; • Prioritise seed collection for the VCS from multiple sites from a wide geographic range; and • Re-seed the species in forestry coupes to reverse population decline.

4.25 Jungle Bristle-fern (*Abrodictyum caudatum*)

The Jungle Bristle-fern was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (54% of modelled habitat), Central Highlands (37% of modelled habitat) and Gippsland (10% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.25.1 Risk Assessment

Table 120. Jungle Bristle-fern risk ratings in the Central Highlands and East Gippsland RFA regions:

	Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)	Planned burning*
Consequence	Extreme	Moderate	Moderate	Moderate
Likelihood	Almost Certain	Likely	Likely	Possible
Overall risk rating	High	Significant	Significant	Medium

4.25.2 Fire

Increased fire frequency and intensity

Altered fire regimes under climate change are projected to continue to threaten this species and its habitat. Many locations have already been severely burnt as an early climate change signal with many sites burnt in the last 40 years (e.g., 1983 Ash Wednesday fire, 2009 Black Saturday fires and, most recently, the Black Summer fires of 2019-20). The threat incorporates drought stress and includes increasing fire risk, with each catastrophic fire event resulting from incremental impacts which accrue over decades. The species is likely to have been significantly depleted across its range because of the documented contraction and elimination of Cool and Warm Temperate Rainforest stands, which is the critical habitat of the species, in response to catastrophic bushfire.

The Jungle Bristle-fern is unusual amongst Victorian taxa of epiphytic ferns in being commonly associated with Rough Tree-fern (*Cyathea australis*) rather than Soft Tree-fern which is the favoured host of almost all other Victorian epiphytes. Since the Rough Tree-fern typically occupies drier, upslope and often ecotonal rainforest sites, Jungle Bristle-fern clones typically occur in sites at greater risk of fire ingress and exposure to desiccating winds and insolation than all other related filmy ferns and bristle ferns. Vegetative regeneration of established mature plants from rhizomes protected within the trunks of tree ferns post-fire are likely to be at elevated risk of antler rubbing by Sambar which tend to congregate in mesic habitats in gullies and on lower slopes, particularly following intense landscape-scale bushfires.

When a large fire hits a rainforest or rainforest margin with sufficient intensity to destroy the canopy, there is a high chance of sclerophyll invasion and stand replacement by eucalypt forest. Many examples of this have been seen where stands of rainforest have been impacted by severe fire events. Whilst the species has the capacity to resprout from established rhizomes immediately post-fire, its clones in sites which undergo succession to eucalypt forest are projected to undergo significant drying out of the tree fern trunk and dramatically increased insolation, both projected to result in the wilting and death of these clones. This hazard extends across all the species' populations.

Current existing controls for this hazard include:

- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 121. Jungle Bristle-fern protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Undertake targeted removal of eucalypts invading former rainforest following intense bushfire.

Planned burning

Traditionally, planned burns in the general vicinity of rainforest and other riparian vegetation have been reliant on differential moisture gradients to reduce the intensity and impact of fire on all fire-sensitive vegetation types in the riparian environment. Whilst this approach has often worked satisfactorily in the past, recent experience and climate change projections (CSIRO & Bureau of Meteorology 2020) demonstrate the increasing risk of even well-controlled planned burns entering rainforest and its buffers. This hazard extends across 10-25% of the species' populations with all fire in the ecotonal environment threatening to expose fire-sensitive plants to mortality and local extinction. Fire in the ecotonal environment, with the risk of fire ingress into the mature rainforest stand, risks the destruction of the closed canopy and invasion of sclerophyll taxa such as eucalypts and acacias. Although the species can recover vegetatively from established rhizomes protected within the densely interwoven rootlets which constitute the stem or caudex of tree ferns, immediately post-fire surviving clones of the Jungle Bristle fern and their tree fern hosts are likely to decline in health as the maturing eucalypts draw moisture out of the soil, open the understorey to light and drying winds and shed highly flammable leaf and small woody litter which increases the risk of intense future fire. Planned burning acts synergistically with increasing drought stress to increase the risk of mortality or crown death of fire-sensitive plants including, in extreme cases, tree fern hosts.

Current existing controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 122. Jungle Bristle-fern protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> Provide a generous exclusion zone in all planned burning corridors in the vicinity of all Warm Temperate Rainforest stands; and Continue to expand and improve on rainforest mapping for use in burn planning, aiming to update mapping considering rainforest loss through destruction of closed canopy and invasion by sclerophyll taxa.

4.25.3 Forestry operations

Forestry operations

This species generally occurs in association with rainforest. An analysis of VBA records showed that ~28% occurred within mapped rainforest or its buffers. In this situation, occurrences should be adequately protected from forestry operations due to the requirements of the Code. The risk to this species from forestry operations in the East Gippsland RFA region was re-assessed in light of new information about the exposure to forestry operations. The experts concluded that, where the species occurred on the margins or outside rainforest and/or its buffers, and especially where the rainforest habitat might have been burnt by bushfires or otherwise disturbed, protection could not be assumed. The experts emphasised the need for additional protections that targeted both the known occurrences and the rainforest

habitat where it had been disturbed and stressed the importance of greater survey effort to improve understanding of the distribution and abundance of this species.

The extent of this hazard is sporadic across the range of the species with 24% of modelled habitat in the East Gippsland RFA region and 16% of modelled habitat in the Central Highlands RFA region potentially available for harvesting, based on the 2015 net harvest area layer. Using the revised operable area layer this is reduced to 7% of the species' modelled habitat in the East Gippsland RFA region, 8% in the Central Highlands RFA region and 7% state-wide.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 63% of the species' modelled distribution and 86% of important populations are within the reserve system.

Table 123. Jungle Bristle-fern protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland and Gippsland RFA regions, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).</p> <p>Within the Central Highlands, East Gippsland and Gippsland RFA regions, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Maps 5a and 5b).</p> <p>Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments.

4.25.4 Invasive species

Invasive vertebrate (deer)

Sambar have been increasing in population across the East Gippsland region in the last decade (Watter et al. 2020), infiltrating all districts and forest types, often observed congregating in damper habitats including Warm Temperate Rainforest. Although it is unclear whether Sambar actively target the species' host tree fern species, they have been documented to impact lowland and coastal rainforest communities, targeting a wide range of obligate rainforest taxa. This hazard occurs across all the species' populations in the East Gippsland and Central Highlands RFA regions. While it is unclear how frequently Sambar are likely to target tree ferns for antler rubbing, they have the capacity to trample, browse and decimate understorey vegetation in rainforest and Riparian Forest which are the critical habitat of tree fern hosts on which the Jungle Bristle-fern depends, which can result in the demise of current populations and their local extinction. Sambar often target regenerating stands following bushfire, planned burns and regenerating timber harvesting

coupes, resulting in recruitment failure of seed recruits or resprouting individuals at their most vulnerable stage of development.

Current existing controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 124. Jungle Bristle-fern protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Monitor representative populations following timber harvesting, planned burning and bushfire, as well as in healthy mature stands, to see evidence of antler rubbing of the Rough Tree-fern which is the favoured host of the species; and • Target Sambar for control particularly after major decline events such as fire or extremely severe drought.

4.26 Lacey River Buttercup (*Ranunculus amplus*)

The Lacey River Buttercup was listed as Critically Endangered in Australia under the FFG Act in May 2021. The species has modelled habitat in the West (70% of modelled habitat), Gippsland (26% of modelled habitat), and Central Highlands (2% of modelled habitat) RFA regions, with 3% of modelled habitat in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.26.1 Risk Assessment

Table 125. Lacey River Buttercup risk ratings in the Gippsland RFA region:

	Altered rainfall patterns	Plantations	Loss of instream habitat	Reduced flooding and flow volumes	Invasive vertebrate (pigs)	Invasive plant (weeds)
Consequence	Major	Moderate	Major	Moderate	Major	Moderate
Likelihood	Likely	Likely	Possible	Possible	Likely	Almost Certain
Overall risk rating	High	Significant	Significant	Medium	High	High

Table 126. Lacey River Buttercup risk ratings in the West RFA region:

	Altered rainfall patterns	Plantations	Loss of instream habitat	Reduced flooding and flow volumes	Invasive vertebrate (pigs)	Invasive plant (weeds)
Consequence	Major	Moderate	Major	Moderate	Major	Moderate
Likelihood	Likely	Likely	Likely	Possible	Likely	Almost Certain
Overall risk rating	High	Significant	High	Medium	High	High

4.26.2 Climate change

Altered rainfall patterns

Potential climate change impacts to the species include reduced rainfall, increased evaporation, and extreme temperatures, which can reduce the species' population sizes and increase habitat loss. Continuing drying of wetlands, either through climate-change effects or water table draw down from plantations, could concentrate the destructive activities of invasive species in remaining wetlands.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 127. Lacey River Buttercup protection requirements and recommendations for altered rainfall patterns

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Establish or maintain secure populations and ensure that hazards are suitably controlled; • Ensure genetically diverse representative seed collections are held in the VCS; • Translocate plants to form populations in habitats that have a high likelihood of persistence in a projected future warmer, drier climate; and • Prioritise environmental watering of systems where important populations are identified.

4.26.3 Forestry operations

Plantations

Plantations adjacent to populations of the species can deplete local ground water aquifers and reduce runoff, leading to drying of wetlands. During harvesting, there can be significance damage to small wetlands if they are not protected from machinery. This can also lead to runoff and erosion into wetlands, reducing water quality. Plantations or regenerating native forests with relatively high growth rates can exacerbate drying of wetlands and other waterways through elevated transpiration rates and canopy interception of precipitation. Weeds more easily invade degraded habitats, and a reduction in wetland habitats can concentrate destructive activities of animals in remaining wetlands.

This hazard applies to 32% of post-1970 VBA locations within buffered plantation areas in the West RFA region and 22% in the Gippsland RFA region. Other occurrences are mostly on private land or within the CAR reserve system so are not exposed to the hazard.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as poor as there is no species-specific code prescription under the Code.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as only 17% of the species' modelled distribution and 15% of important populations are within the reserve system.

Table 128. Lacey River Buttercup protection requirements and recommendations for plantations.

Requirement	Recommendation
Interim protections	Not required for this hazard as it is a longer-term threat.
Priority management actions	<ul style="list-style-type: none"> • Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Work with plantation managers and scientists to assess the impacts of hydrological changes associated with plantation forestry; • Implement feasible mitigations where the impacts are assessed as significant; • Maintain <i>ex-situ</i> seed collections in the VCS as insurance against local population loss; and • Conduct targeted surveys to identify any new populations associated with plantations.

4.26.4 Habitat loss, degradation, and fragmentation

Loss of instream habitat

This hazard has the potential to impact all the species' populations. The continued drying of wetlands, in concert with climate-change effects and alteration of streamflow, will deplete habitat quality, alter hydrology, and reduce population size. Weeds more easily invade degraded habitats, and a reduction in wetland habitats can concentrate destructive activities of animals in remaining wetlands.

The risk for this hazard was assessed as High in the West RFA region and Significant in the Gippsland RFA region due to wetter conditions in the east of the state.

Current existing controls for this hazard include:

- Regional Waterway Strategies. The effectiveness of this control for this species has been evaluated as satisfactory under the assumption that wetlands are managed responsibly in accordance with RWSs and similar control programs.

Table 129. Lacey River Buttercup protection requirements and recommendations for loss of instream habitat

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none">• Establish and maintain secure populations and ensure that hazards are suitably controlled;• Ensure genetically diverse representative seed collections are held in the VCS; and• Conduct further surveys of mapped suitable habitat to identify any new populations.

Reduced flooding and flow volumes

Decreased frequency, amplitude and duration of flooding potentially impacts 20-30% of the species' habitat, as does river regulation and draining of swamps which can lead to reduced flow volumes. These can both lead to reduced population sizes, habitat loss and altered hydrology. Drying of habitat may lead to invasion by exotic and indigenous terrestrial taxa.

Current existing controls for this hazard include:

- Regional waterway strategies. The effectiveness of this control for this species has been evaluated as satisfactory because current flows appear to be sufficient for sustaining this species at known sites (e.g., Fitzroy River)

Table 130. Lacey River Buttercup protection requirements and recommendations for reduced flooding and flow volumes

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat and has a medium risk level.
Potential management actions	<ul style="list-style-type: none">• Implement all actions of regional waterway strategies; and ensure waterways that support the species receive adequate winter-spring flows.

4.26.5 Invasive species

Invasive vertebrate (pigs)

Rooting pigs can destroy the wetland habitat of this species and have the potential to impact 60-70% of its distribution, which is more pronounced in the West RFA region. Pigs can potentially rip out plants, turn over the soil layer and aid the invasion of weeds, and pig rooting can also degrade water quality.

Current existing controls for this hazard include:

- Local invasive species control programs. The effectiveness of this control has been evaluated as poor for this species as pigs are difficult to control and most control programs to date appear to have failed to eradicate them or significantly reduce numbers.

Table 131. Lacey River Buttercup protection requirements and recommendations for invasive vertebrate (pigs)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Monitor Lacey River Buttercup sites for pig activity; and • Implement pig control programs at sites where pigs threaten this species.

Invasive plant (weeds)

While the species grows in shallow water that many weed species cannot tolerate, the introduction of an aquatic weed could seriously degrade the species' habitat and has the potential to occur across all the species' distribution.

Current existing controls for this hazard include:

- Weed control programs. The effectiveness of this control has been evaluated as poor for this species because very few weed control programs are undertaken in the wetland communities that support the species.

Table 132. Lacey River Buttercup protection requirements and recommendations for invasive plant (weeds)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Monitor known sites for weed invasion; and • Conduct weed control programs at any known sites threatened by weeds.

4.27 Lake Mountain Grevillea (*Grevillea monslacana*)

The Lake Mountain Grevillea was listed as Critically Endangered in Australia under the FFG Act in May 2021. The species has modelled habitat in the Central Highlands (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.27.1 Risk Assessment

Table 133. Lake Mountain Grevillea risk ratings in the Central Highlands RFA region:

	Bushfire	Forestry operations	Plantations
Consequence	Minor	Minor	Negligible
Likelihood	Possible	Likely	Unlikely
Overall risk rating	Medium	Medium	Low

4.27.2 Fire

Bushfire

There are no records of vegetative reproduction by the species, and plants are killed outright by fire. Therefore, regular fire, including cool burns, could threaten long-term survival of populations if they can't reach a flowering and seeding age (Stajsic and Molyneux 2005). The 2009 bushfire burnt the Lake Mountain area at a generally high intensity, however there were likely pockets in high altitude wet forest that either didn't burn or were burnt at low to moderate intensity. It has been over ten years since the bushfires, and while it is possible that some plants have reached reproductive maturity, this would depend on ideal conditions. Some populations may not have reached this point, yet which leaves the species at risk from future fire events. Providing future fires are not more frequent than 10-15 years, populations have a fair chance of survival. This hazard extends across approximately 20% of the species' distribution.

Current existing controls for this hazard include:

- Planned burning. This control may be effective in reducing the risk of severe bushfires in this species' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this species and its habitat from severe bushfires.
- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 134. Lake Mountain Grevillea protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none">• Establish <i>ex-situ</i> propagation.

4.27.3 Forestry operations

Forestry operations

Current forestry operations and management practices in the wet forest parts of the species' distribution may also increase the risks and exacerbate the effects of bushfires (e.g., Furlaud et al. 2021). However, the strength of this relationship is contested within the scientific community (e.g., Keenan et al. 2021), and the extent of this effect may be less significant in the face of mega fires driven primarily by extreme heat and drought caused by human-induced climate-

change (e.g., Bowman et al. 2021). Based on the 2015 net harvest area layer, the modelled habitat contains 25% of merchantable timber. Using the revised operable layer, this is reduced to 9%.

Current controls for the hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however it may receive some protection from other general Code prescriptions. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 39% of the species' modelled distribution and 63% of important populations are within the reserve system.

Table 135. Lake Mountain Grevillea protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Conduct targeted surveys for the species to determine accuracy of VBA records; and • Species-specific code prescriptions should be considered in any future Code amendments.

Plantations

If the species is present in or near plantations, their harvesting may impact the species by direct mortality due to physical disturbance. The species is an obligate seeder, so if regeneration burning or bushfire occurs post-harvest, the plants may not have reached reproductive maturity and would become locally extinct. Approximately 15% of the species' habitat distribution model is within 200 m of plantations.

Current controls for the hazard include:

- Environmental Effects Statement with a preliminary comprehensive survey of the values of the area. This has been evaluated as satisfactory as a comprehensive survey should find the species if it is present.
- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however it may receive some protection from other general Code prescriptions. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.

Table 136. Lake Mountain Grevillea protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of low.
Priority management actions	Not required for this hazard based on the overall risk level of low.
Permanent protections	Not required for this hazard based on the overall risk level of low.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments.

4.28 Lax Twig-sedge (*Baumea laxa*)

The Lax Twig-sedge was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the Gippsland (31% of modelled habitat) and West (67% of modelled habitat) RFA regions and has 2% of modelled habitat in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.28.1 Risk Assessment

Table 137. Lax Twig-sedge risk ratings in the Gippsland RFA region:

	Drying climate	Agriculture
Consequence	Major	Moderate
Likelihood	Likely	Likely
Overall risk rating	High	Significant

Table 138. Lax Twig-sedge risk ratings in the West RFA region:

	Drying climate	Plantations	Agriculture
Consequence	Major	Moderate	Moderate
Likelihood	Likely	Possible	Likely
Overall risk rating	High	Medium	Significant

4.28.2 Climate change

Drying climate

Climate change threats include decreased rainfall, increased evaporation, extreme temperatures and increased frequency and intensity of fire. Climatic drying and warming has a non-reversible impact on the individuals of the species, with the potential over time to threaten most individuals in the geographic area through direct mortality and habitat degradation. The relevant wetland, wet heath and swamp scrub habitats are largely independent of controllable stream-flow inputs, so environmental watering is not a feasible mitigation.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 139. Lax Twig-sedge protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> <i>In-situ</i> propagation and maintenance of seed bank; and Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.28.3 Forestry operations

Plantations

Threats to the species include the drying and destruction of wetlands by forest plantation use of groundwater and canopy interception of precipitation, although the degree to which this happens due to elevated rates of evapo-transpiration has

not been determined for all areas or forest types. This hazard interacts with climate change, which potentially leads to increased risk of habitat desiccation. Some 26% of modelled habitat within the West RFA region is potentially exposed to plantations.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as poor because the history of management for protection of included or abutting remnant vegetation has varied across the extent of plantations. The potential for damage from issues such as spray drift and run-off from track networks may not yet be fully dealt with and the impact of increased water use by regenerating young trees may be exacerbated by reduced rainfall, particularly where remnant wet habitat is less well buffered.
- Victorian Planning Provisions and planning schemes. The effectiveness of this control for this species has been evaluated as poor in relation to the development of new plantations on private land. The control does not prevent incremental damage to wetland habitat abutting plantations (e.g., from desiccation or fertilizer/herbicide drift) if the plantations are established on already cleared land.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 31% of the species' modelled distribution and 80% of important populations are within the reserve system.

Table 140. Lax Twig-sedge protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Review strategies to minimise spray drift during plantation management, particularly during re-establishment; • Survey potential habitat within existing plantations and planned expansions; • Review Code requirements for protection of biodiversity values, including remnant habitat within or adjoining plantations, to ensure effectiveness; and • Expand and potentially revegetate buffers in any locations where this would improve the species' security.

4.28.4 Habitat loss, degradation, and fragmentation

Agriculture

Habitat loss, degradation and fragmentation arises from agriculture including clearing, fertilizer use, edge effects and livestock grazing. Much of the habitat has been fragmented by past land clearing and disturbance and while fragmentation may apply at some level to greater than 80% of the species' distribution, it is particularly relevant to private land sites and poorly buffered refugia on public land. The threat to residual private land populations will increase as agriculture becomes more industrial and climate change expands the potential to crop wetland habitats.

Current existing controls for this hazard include:

- Victorian Planning Provisions and planning schemes. The effectiveness of this control for this species has been evaluated as poor because it has limited capacity to prevent habitat loss and degradation associated with the conversion from grazing to cropping. The relevant habitat is treeless and often includes a substantial component of introduced species; it therefore might not be recognised as having any value for native flora conservation by land managers. The control also does not prevent incremental damage resulting from land-use practises such as grazing or fertilizer drift.
- Support programs such as Landcare. The effectiveness of this control for this species has been evaluated as poor as participation is voluntary. However, these programs are potentially highly effective where implemented, but are dependent on goodwill and local community support.

Table 141. Lax Twig-sedge protection requirements and recommendations for agriculture

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is an incremental hazard.
Potential management actions	<ul style="list-style-type: none">• Ensure compliance with existing regulatory measures; and• Conduct seasonally appropriate survey of sites.

4.29 Leafless Pink-bells (*Tetratheca subaphylla*)

The Leafless Pink-bells was listed as Vulnerable in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (85% of modelled habitat) and Gippsland (15% of modelled habitat) RFA regions. This species also occurs in the Central Highlands RFA region in the Upper Yarra catchment, but this has not been included in its habitat distribution model. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.29.1 Risk Assessment

Table 142. Leafless Pink-bells risk ratings in the Gippsland RFA region:

	Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)*	Phytophthora cinnamomi
Consequence	Major	Moderate	Major	Major
Likelihood	Possible	Possible	Possible	Possible
Overall risk rating	Significant	Medium	Significant	Significant

Table 143. Leafless Pink-bells risk ratings in the East Gippsland RFA region:

	Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)*	Phytophthora cinnamomi
Consequence	Major	Moderate	Major	Major
Likelihood	Possible	Likely	Possible	Possible
Overall risk rating	Significant	Significant	Significant	Significant

* The risk rating for this hazard also applies to the Central Highlands RFA region.

4.29.2 Fire

Increased fire frequency and intensity

The species is likely to be at increasing risk of adult mortality and recruitment failure in response to repeat fire events at intervals approaching the tolerable fire interval for the species. Increased fire frequency, as well as other disturbance, will increase the species' reliance on regeneration and recruitment, with potential recruitment failure related to increased occurrence of drought. This hazard extends across 60% of the species' distribution, with the Central Highlands populations potentially subject to less disturbance and therefore less likely to be significantly impacted in a 20-year timeframe.

Current existing controls for this hazard include:

- Landscape scale strategic fuel management. The effectiveness of this control for this species has been evaluated as satisfactory except under conflagration conditions. Fuel management has aimed and largely been successful in protecting high value forestry resources, which correlates with this species' habitat.

Table 144. Leafless Pink-bells protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Improved landscape scale strategic fuel management; and • <i>Ex-situ</i> seed banking.

4.29.3 Forestry operations

Forestry operations

Soil disturbance by heavy machinery may kill individual plants, but the mortality risk may be exacerbated by regeneration fires due to multiple intense stressors over a short period. Any post-fire recruitment of seedlings will be at risk of competition from other taxa and this combination of disturbances may confer a competitive advantage to a range of common and widespread indigenous species over Leafless Pink-bells. Forestry also interacts strongly with other climate change hazards (e.g., increased droughts) where the cumulative effect is to promote a suite of relatively resilient, usually common, and widespread species which populate and can dominate the habitat of Leafless Pink-bells following local disturbances. Disturbances related to forestry operations and climate change can also disrupt natural regeneration processes by preventing successful seedling recruitment and the replenishment of a local propagule bank. This may be a significant hazard given the species' fidelity to relatively common Ecological Vegetation Classes (EVCs) where sensitive and rare species may be at greater risk of local extinctions as more resilient species take over. Forestry operations could also have a greater impact on the species at sites that support *Phytophthora cinnamomi* which could be introduced through contaminated soil on heavy plant equipment and vehicles. Vehicle hygiene practices are therefore required during forestry operations to limit pathogen spread.

Based on the 2015 net harvest area layer, 17% of the species' modelled habitat in the Gippsland RFA region and 24% of its modelled habitat in the East Gippsland RFA region have the potential to be impacted by forestry operations. Using the revised operable layer this is reduced to 8% in the East Gippsland RFA region and 6% in the Gippsland RFA region.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as satisfactory in the Gippsland RFA region where it has species-specific code prescriptions, and poor in the East Gippsland RFA region where the prescriptions do not apply. It may, however, receive some protection from other general Code prescriptions.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 58% of the species' modelled distribution and 66% of important populations are within the reserve system.

Table 145. Leafless Pink-bells protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 6a).
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Commission FPSP surveys in the Gippsland RFA region and alert surveyors to this target species to ensure it receives adequate consideration during searches; • Conduct targeted surveys in the Gippsland RFA region where historic records are low accuracy (e.g., old voucher specimens); • Collect seed for the VCS from across the species' range, as no seed is currently held in the VCS for this species (A. Messina, RBGV pers. comm. 11/10/21); • Consider including appropriate prescriptions for this species in the East Gippsland RFA region as part of future Code amendments; • Monitor populations subject to disturbance to better understand the species' response; and • Complete research on the persistence of plants in harvested landscapes.

4.29.4 Invasive species

Invasive vertebrate (deer)

Direct browsing impacts on the species are rarely observed, however mortality from trampling and soil instability resulting from deer activity are likely to be widespread. Deer may spread and/or create suitable conditions for *Phytophthora cinnamomi* and exacerbate drought impacts. This hazard extends across 80% of the species' distribution.

Current existing controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 146. Leafless Pink-bells protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Coordinated longer term and strategic deer culling; • Assess the feasibility of exclusion fencing at key sites; and • Undertake <i>ex-situ</i> seed banking.

4.29.5 Population dynamics

Phytophthora cinnamomi

In New South Wales *P. cinnamomi* was found on the roots of Leafless Pink-bells (McDougall and Summereli 2001), and deaths of understorey species such as this species are common on infested sites, leading to a less diverse vegetation (Cahill et al. 2008; McDougall 2005). Populations in southern NSW seem to be in drier sites that may be more susceptible than in Victoria, however *P. cinnamomi* is widespread throughout Gippsland. While impacts on this species are yet to be documented in Victoria, they are plausible, with up to 70% of the population possibly exposed. Mortality within populations may be exacerbated by drought, and forestry activities may lead to localised introduction of *P. cinnamomi*, creating conditions conducive to disease outbreaks. Important factors that contribute to its spread at any site are local rainfall, drainage patterns and soil texture, and once it is introduced to a site it is almost impossible to control or eliminate.

Current existing controls for this hazard include:

- Hygiene protocols. The effectiveness of this control for this species has been evaluated as satisfactory when protocols are applied.

Table 147. Leafless Pink-bells protection requirements and recommendations for *Phytophthora cinnamomi*

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Potential management actions	<ul style="list-style-type: none"> • Improve signage and availability of awareness materials for recreational drivers going in and out of the region as they may not be aware of <i>P. cinnamomi</i> or hygiene protocols; and • Undertake <i>ex-situ</i> conservation and monitoring as per other hazards.

4.30 Long Pink-bells (*Tetratheca stenocarpa*)

The Long Pink-bells was listed as Endangered in Australia under the FFG Act in May 2021. The species has modelled habitat in the Central Highlands (97% of modelled habitat) RFA region, with 3% in non-RFA regions, however the model does not consider outlying occurrences in the West and North East RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.30.1 Risk Assessment

Table 148. Long Pink-bells risk ratings in the Central Highlands and North East RFA regions:

	Planned burning	Invasive vertebrate (deer)	Invasive plant (weeds)
Consequence	Moderate	Moderate	Minor
Likelihood	Possible	Likely	Likely
Overall risk rating	Medium	Significant	Medium

Table 149. Long Pink-bells risk ratings in the Central Highlands RFA region only:

	Drought	Forestry operations	Roading
Consequence	Major	Moderate	Moderate
Likelihood	Possible	Possible	Likely
Overall risk rating	Significant	Medium	Significant

4.30.2 Climate change

Drought

Threats to this species potentially include the impacts of climate change such as decreased rainfall and drought conditions, causing recruitment failure. Disturbance to habitat may occur from recreational land use in otherwise remote and more intact habitat that offers greater resilience to climate change. This hazard is likely to be associated with an increase in fire frequency and intensity, and while the species is a post-fire resprouter, frequent fire could impact the species through structural alteration of the vegetation and associated ecological simplification. Browsing pressure is also increased under drought conditions. This hazard extends across all the species' distribution.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 150. Long Pink-bells protection requirements and recommendations for drought

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Determine ecophysiological thresholds of recruitment and match to suitable land management actions; and Assess the impacts of recreational vehicles on this species and its habitat and manage accordingly.

4.30.3 Fire

Planned burning

Threats to this species potentially include altered fire regimes modifying the structure of vegetation in the species' habitat. Planned burning is carried out across the species' range, often at frequencies below its tolerable fire interval. Although the species readily reshoots after a single fire event, burns that are too frequent or too hot for persistence of populations and habitat and high intensity bushfires have the potential to cause habitat structure and composition changes which could result in the decline in population of this species. The creation of fire breaks and mechanical fuel treatments may also impact the species' populations and habitat.

Current existing controls for this hazard include:

- Planned activities and fuel management. The effectiveness of planned burning and fuel management as a risk mitigation for this species has been evaluated as poor to satisfactory, as it is not clear how impacts on Long Pink-bells are balanced with other priorities during burn planning. Public land within its distribution has a range of fire histories, which may provide sufficient habitat variability. Mechanical fuel treatments have the potential to destroy plants and impact on populations of Long Pink-bells.

Table 151. Long Pink-bells protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat and because of its overall medium risk level.
Potential management actions	<ul style="list-style-type: none">• Ensure the species' sites are not burnt outside of its tolerable fire interval;• Produce a protocol for assessment of threatened species prior to planned burns;• Where possible, retain islands of unburnt habitat within broader burn patches;• Survey land within planned burn areas to determine the extent of populations, add new distribution information to the VBA, and review management where a decline is observed;• Limit the creation of new temporary fire breaks through intact native vegetation for the purpose of conducting planned burns; and• Provide compulsory inductions for fire management personnel on how to avoid impacts to threatened species.

4.30.4 Forestry operations

Forestry operations

Threats to this species potentially include forestry activities in the wettest parts of its habitat, as well as in lowland forest. The species can be locally common in shorter heathy open forest, but its abundance declines in taller versions of the Lowland Forest EVC, and it is absent from Damp Forest. Current forestry operations and management practices may also increase the risks and exacerbate the effects of bushfires (e.g., Furlaud et al. 2021). However, the strength of this relationship is contested within the scientific community (e.g., Keenan et al. 2021), and the extent of this effect may be less significant in the face of mega fires driven primarily by extreme heat and drought caused by human-induced climate-change (e.g., Bowman et al. 2021). Forestry operations may also increase the risk from weed invasion and browsing by Sambar Deer. It could also lead to introduction of *Phytophthora cinnamomi* on machinery; therefore, vehicle hygiene practices are required during forestry operations to limit pathogen spread. Based on the 2015 net harvest area layer, the modelled habitat in the Central Highlands RFA region contains 9% merchantable timber. Using the revised operable layer, this is reduced to 5%.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however it may receive some protection from other general Code prescriptions. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.

- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 55% of the species' modelled distribution and 49% of important populations are within the reserve system.

Table 152. Long Pink-bells protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Undertake research on the species' ecological requirements and recruitment processes, as well as on its eco-physiology; • Species-specific code prescriptions should be considered in any future Code amendments; and • Improve information the location of important populations in State Forest.

4.30.5 Habitat

Roading

This species can occur along roadsides, which would make populations susceptible to the widening of tracks (Tolsma et al. 2012). Native vegetation removal on public land is managed in accordance with the Procedure for the removal, destruction or lopping of native vegetation on Crown land (DELWP 2018). Land managers can use the procedure for any proposal involving the clearing of native vegetation, which may include road work not otherwise exempt or any other reason relating to park use. Native vegetation clearing may add to the spread of pathogens and invasive species and increase access into areas of high-quality vegetation/habitat. This hazard extends across approximately 10% of the species' distribution.

Current existing controls for this hazard include:

- Native vegetation removal on public land. The effectiveness of this control for this species has been evaluated as poor as the efficiency of counterbalancing is not known. The method for determining gains for threatened species is likely ineffective as it is too simplistic and not targeted at specific habitat values.
- Support programs such as Landcare for landholders to protect and restore habitat, including remnant patches of native vegetation and isolated paddock trees. The effectiveness of this control for this species has been evaluated as satisfactory as most populations are likely on public land. The protection of the species in general would not rest on the success of programs such as Landcare, but associated controls would contribute in part.

Table 153. Long Pink-bells protection requirements and recommendations for roading

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Conduct targeted surveys prior to any vegetation clearing to determine the species' presence and to estimate the number of plants if present.
Potential management actions	<ul style="list-style-type: none"> • Review the Crown land counterbalancing procedure to better account for impacts to threatened species; and • If vegetation removal is unavoidable, establish other plants elsewhere as a direct counterbalancing measure.

4.30.6 Invasive species

Invasive vertebrate (deer)

Threats to this species potentially include browsing by deer which causes habitat loss and degradation and reduces population sizes. Deer are well established across most of the species' range, however the species is probably not heavily targeted and can re-shoot if browsed.

Current existing controls for this hazard include:

- Regional deer control strategy. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from.

Table 154. Long Pink-bells protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Monitor the impact of deer on the species;• Target deer control around the species' habitat; and• Assess the feasibility of fencing core populations if browsing is having a significantly negative impact.

Invasive plant (weeds)

Weed invasion has largely accompanied the incursion of residential development into the district with accompanying risks, including the dispersal of *Phytophthora cinnamomi* from residential gardens and earthworks, elevated nutrient levels, associated edge effects and reduction of native herbivores. The species prefers heathy to shrubby foothill forests that are not particularly prone to weed invasion, however the extent of incursions of garden escapes into bushland has increased in recent years. This hazard extends across around 30% of the species' distribution in and around private land.

Current existing controls for this hazard include:

- The *Catchment and Land Protection Act 1994*. The effectiveness of this control for this species has been evaluated as poor because while many of the relevant problem species (notably woody weeds and large geophytes) can be effectively and selectively controlled by skilled operators, the resources available for this work are very limited and there are very few controls on introductions of potentially invasive flora. The majority of weed spraying contractors operating on public land lack the expertise to selectively treat the relevant weed species without eliminating the associated ground flora.
- Targeted invasive species programs. The effectiveness of this control for this species has been evaluated as mostly poor, but likely to be satisfactory in selected priority sites. There is a limited availability of resources for more careful ecological rehabilitation work by skilled revegetators providing selective protection of remnant flora.

Table 155. Long Pink-bells protection requirements and recommendations for invasive plant (weeds)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Undertake public education about invasive plants;• Monitor invasions and review the actual resilience of the vegetation;• Provide adequate resources to address issues before they become uncontrollable;• Conduct weed control where required in the species' habitat; and• Establish and utilise on-ground work crews with sufficient ecological rehabilitation skills.

4.31 Mountain Bird-orchid (*Chiloglottis jeansii*)

The Mountain Bird-orchid was listed as Vulnerable in Australia under the FFG Act in May 2021. The species has VBA points in the Central Highlands (84% of VBA points) and Gippsland (16% of VBA points) RFA regions. While the CAM assessment focusses on the impacts of fire on this species, the expert/s did not assess that hazard as part of this risk assessment. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.31.1 Risk Assessment

Table 156. Mountain Bird-orchid risk ratings in the Central Highlands RFA region:

	Forestry operations	Invasive vertebrate (deer)
Consequence	Moderate	Minor
Likelihood	Likely	Possible
Overall risk rating	Significant	Medium

4.31.2 Forestry operations

Forestry operations

The association of the species with landscapes dominated by merchantable forest types suggests it may have suffered significant historic decline through early timber harvesting of the Melbourne water catchments, forestry operations in Mountain Ash forests in the last 70 years and the impact of repeated fire events since the late 1800s. The key impact of forestry operations is likely to be through the disruption of soils by machinery operating throughout timber harvesting coupes, particularly along snig tracks, on log landings and through preparation of fire control lines for regeneration burns. Road construction and maintenance to service forestry operations could also impact on populations. Based on the 2015 net harvest area layer, 15% of the species' VBA points are in merchantable areas. Using the revised operable layer, this is reduced to 9%.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for rainforest, old-growth forests and waterways including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 45% of the species' important populations and 57% of post-1970s VBA points are within the reserve system.

Table 157. Mountain Bird-orchid protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments; • Exclude patches of forest from harvesting where the species has been located in coupes; and • Conduct <i>ex-situ</i> propagation to establish populations in protected sites.

4.31.3 Invasive species

Invasive vertebrate (deer)

The species is also threatened by Sambar activity, particularly trampling and wallowing in damp habitats in riparian or gully vegetation, and deer are also vectors for weed propagules into the species' habitat. However, it is difficult to determine the exact effect of deer on the species' populations as the species has been observed in reasonable numbers where deer are also moderately abundant in the landscape. It is possible that the habitat range or niche of the species allows it to avoid areas of concentrated deer impacts. Sambar occur across approximately 80% of the species' modelled habitat.

Current existing controls for this hazard include:

- The Victorian Deer Control Strategy. The effectiveness of this control for this species has been evaluated as poor as it is difficult to determine the exact effect of deer on the species' populations, and because deer control programs occur variously across the Central Highlands.
- The Bushfire Biodiversity Response and Recovery program. The effectiveness of this control for this species has been evaluated as poor because such measures are not applied consistently enough over time to provide a sustained gain in the context of control for deer.

Table 158. Mountain Bird-orchid protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none">• Establish deer exclosure areas around some important populations and monitor vegetation growth;• Undertake targeted surveys in areas on the margins of reported range, including forests of West Gippsland; and• Update information in the VBA to gain a better understanding for planning.

4.32 Naked Sun-orchid (*Thelymitra circumsepta*)

The Naked Sun-orchid was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the West (41% of modelled habitat), East Gippsland (35% of modelled habitat), Gippsland (10% of modelled habitat) and Central Highlands (8% of modelled habitat) RFA regions and has 6% of modelled habitat in the non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.32.1 Risk Assessment

Table 159. Naked Sun-orchid risk ratings in the East Gippsland, Gippsland and West RFA regions:

	Drought	Bushfire	Planned burning	Plantations
Consequence	Minor	Major	Moderate	Major
Likelihood	Likely	Possible	Possible	Possible
Overall risk rating	Medium	Significant	Medium	Significant

Table 160. Naked Sun-orchid risk ratings in the Central Highlands and East Gippsland RFA regions only:

Forestry operations	
Consequence	Major
Likelihood	Unlikely
Overall risk rating	Medium

Table 161. Naked Sun-orchid risk ratings in the East Gippsland and Gippsland RFA regions only:

Invasive vertebrate (ungulates)	
Consequence	Major
Likelihood	Likely
Overall risk rating	High

4.32.2 Climate change

Drought

The species is threatened by reduced rainfall due to increased climatic drying, causing declining habitat conditions. If drought occurs, it can lead to direct mortality and loss of habitat. The occurrence of a very severe drought may also make the species' habitat more susceptible to a peat fire, however the likelihood of this occurring the next 20-years is probably likely small, and climate change is expected to impact over a longer timeframe. The interaction of fire and drought increase the impact of this hazard.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 162. Naked Sun-orchid protection requirements and recommendations for drought

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Include bushfire mitigations that aim to limit bushfire incursion into peat sites; and • Ensure species habitat is considered in incident management to avoid bushfire suppression negatively impacting the species where possible.

4.32.3 Fire

Bushfire

Despite the species being considered generally fire tolerant, under extreme fire conditions peaty soils have the potential to smoulder and kill underground plant structures of this species. This species is also at some risk from fire control strategies during an active fire, such as mechanical disturbance from control line construction. Post-fire, the impact of feral herbivores is exacerbated as herbivores are attracted to unburnt areas and disturb the soil. The species' recovery therefore depends on effective control of the impacts of feral herbivores, and prevention of major soil and vegetation disturbance from fire recovery activities. These risks apply to 100% of the species' habitat.

Current controls for this hazard include:

- Values checking and bushfire response: Documented habitat being identified early in incident management processes primarily to avoid disturbance from fire response activities. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 163. Naked Sun-orchid protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Improve mapping of known locations; and • Train key incident control centre personnel in the timely incorporation of detailed natural values.

Planned burning

The main risk of this hazard is forcing a particularly wet site to burn via planned burning in the wrong season (i.e., spring), which would burn off the active growth of these plants. For this species, every-year seed set is critical, so burning in the wrong season would limit its potential to recruit. As orchid seed is very short lived, limiting recruitment through planned burning may result in local extinction of this species, however if the burning is done at a time that would naturally burn (i.e., autumn) it is generally positive for the species. This hazard applies to 20-30% of habitat.

Current controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 164. Naked Sun-orchid protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> Improve values checking processes for this species' habitat, including on-ground survey and/or better modelling of habitat and consideration of modelling in the values checking process.

4.32.4 Forestry operations

Forestry operations

The species can be impacted by direct mortality and mechanical damage resulting from forestry operations. Mechanical disturbance can impact the species by causing swampy areas that the species prefers to dry out. Based on the 2015 net harvest area layer, around 5-10% of the species' important populations are in merchantable areas. Using the revised operable layer, this is reduced to 2%. The modelled habitat in the Central Highlands RFA region that overlaps with merchantable areas is likely to be an overestimate as there is only one known location in the Toorong River.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This control was evaluated as satisfactory in the Gippsland and East Gippsland RFA regions as the 200m radius seems appropriate to mitigate impacts to this species, however it is evaluated as poor in the Central Highlands RFA region where the code prescriptions do not extend; however, general Code requirements for waterways provide protection.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 36% of the species' modelled distribution and 56% of important populations are within the reserve system.

Table 165. Naked Sun-orchid protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	<ul style="list-style-type: none"> Comprehensively search likely habitat and map important populations; and Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> Conduct surveys during the appropriate season in potentially suitable habitat with a view to excluding forestry operations from areas supporting important populations; and Consider expanding Code prescription across the species' range to include the Central Highlands RFA region during any future Code amendments.

Plantations

This hazard impacts the species via direct mortality, hydrological change, and mechanical disturbance. Hydrological changes occurring outside the plantation extent can negatively impact the species, with stream-flow data from CMAs suggesting that actively growing young plantations reduce both overland flow and ground water recharge, which can reduce the species' preferred habitat of damp areas. Plantations potentially impact 10-15% of the species' distribution. Climatic drying exacerbates any hydrological changes.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This control was evaluated as satisfactory in the Gippsland and East Gippsland RFA regions as the 200m radius seems appropriate to mitigate impacts to this species, however it is evaluated as poor in the West RFA region where the code prescriptions do not extend; however, general Code requirements for waterways provide protection.

- Planning provisions. The effectiveness of this control for this species has been evaluated as poor to satisfactory as new plantations would not be likely to be approved on a known population and plantation managers are likely to observe approved boundaries. However, this assumes that the current understanding of distribution and abundance is comprehensive and accurate.

Table 166. Naked Sun-orchid protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	<ul style="list-style-type: none"> • Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Assess likely hydrological impacts of any proposed plantations in the vicinity of populations of this species.

4.32.5 Invasive species

Invasive vertebrate (ungulates)

Cattle, deer, and horses trample and cause direct damage to plants and habitat, impacting hydrology and damp areas. The two known sites in the Nunninong area are most at risk. This hazard has the potential to impact up to 60% of the species' distribution, and already has a significant impact over 15%.

There is a cumulative interaction with bushfire, with extensive bushfires concentrating deer and horses into the wetter, unburnt, areas of the landscape where this species occurs.

Current controls for this hazard are limited, but include:

- Post-fire feral herbivore control. While this has been conducted near the known occurrences of this species, it is not an ongoing process, so the risk of the hazard is therefore considered uncontrolled for this species.

Table 167. Naked Sun-orchid protection requirements and recommendations for invasive vertebrate (ungulates)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Targeted feral animal control in the vicinity of populations and/or exclusion fencing.

4.33 Native Hemp (*Androcalva rossii*)

The Native Hemp was listed as Critically Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.33.1 Risk Assessment

Table 168. Native Hemp risk ratings in the East Gippsland RFA region:

	Drought	Increased fire frequency and severity	Forestry operations	Invasive vertebrate (deer)
Consequence	Extreme	Major	Minor	Extreme
Likelihood	Possible	Possible	Unlikely	Possible
Overall risk rating	High	Significant	Low	High

4.33.2 Climate change

Drought

On its own, severe drought is not a major hazard. However, when this occurs in concert with a disturbance event, most likely bushfire, regeneration will be more susceptible to the impacts of drought, especially if it occurs within three to four years post-fire as it can wipe out all regeneration. This hazard applies to 100% of the distribution and results in direct mortality and recruitment failure.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 169. Native Hemp protection requirements and recommendations for drought

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Maintain <i>ex-situ</i> seed collection.

4.33.3 Fire

Increased fire frequency and severity

This species can be fire-killed; however, fire also promotes regeneration. This hazard occurs across 100% of its range but is variable as the population in Orbost would not be subject to the same extent due to its isolation from forest. The likely minimum tolerable fire interval for population maintenance for this species is 20 years, therefore increased fire frequency as predicted and sometimes seen due to climate change would suggest that this 20-year period may plausibly be exceeded across its range. Fire intensity is likely not an issue, however higher intensity fire at more regular intervals is the key risk to this species.

Current controls include:

- Planned Burning. The effectiveness of planned burning as a risk mitigation for this species has been evaluated as poor. The combination of planned burns and bushfires may exceed the tolerable fire interval for this species.

Table 170. Native Hemp protection requirements and recommendations for increased fire frequency and severity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Collect emergency seedbank stores; • Improve values checking for fire response planning so that it is protected in incident management processes (e.g., to protect from mechanical disturbance, back burning); and • Improve mapping and knowledge of the distribution of the species – the 2019-20 fires in East Gippsland may have prompted soil recruitment that we would otherwise not see.

4.33.4 Forestry operations

Forestry operations

Based on the 2015 net harvest area layer 28% of the species' modelled habitat and 5% of its VBA points are in merchantable areas. Using the revised operable area layer, this is reduced to 11% of the species' modelled habitat and 2% of its VBA points. Plants could be mechanically removed in harvesting or roading activities, however most of the occurrences of this species in areas available to forestry would be along stream sides and afforded protections under the Code. Sedimentation could occur and soil could be compromised through harvesting. Adjacent management practises such as coupe burns may also create unsuitable habitat.

Current controls include:

- The *Code of Practice for Timber Production 2014*. This control was evaluated as satisfactory as there are species-specific prescriptions for this species, and it is generally associated with streams which include additional buffered areas. These buffers probably mitigate fire and regeneration related impacts that may follow forestry operations as well as mechanical disturbance impacts.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 47% of the species' modelled distribution and 45% of important populations are within the reserve system.

Table 171. Native Hemp protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of low.
Priority management actions	Not required for this hazard based on the overall risk level of low.
Permanent protections	Not required for this hazard based on the overall risk level of low.
Potential management actions	<ul style="list-style-type: none"> • Improve mapping and knowledge of the distribution of the species – there is a current opportunity to do this as the 2019-20 fires in East Gippsland may have prompted soil recruitment that we would otherwise not see.

4.33.5 Invasive species

Invasive vertebrate (deer)

Browsing by feral deer occurs across 100% of the species' extent and can lead to direct mortality and recruitment failure. Following a disturbance event such as bushfire, regeneration of the species is highly susceptible to browsing by deer.

Currently, the species is threatened by a combination of clearing for agriculture, proximity to roads, public access, browsing by Sambar Deer (particularly at recruitment stages), imposed anthropogenic fire regimes, and climatic

warming and drying, which synergistically increase the risk of recruitment failure in response to repeat fire events and extreme drought stress. Populations that are exposed to higher levels of frequent disturbance may become extinct, leading to a substantial reduction in the species.

Current controls include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar Deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 172. Native Hemp protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none">• Undertake targeted deer control following a disturbance event.

4.34 Oval Fork-fern (*Tmesipteris ovata*)

The Oval Fork-fern was listed as Endangered in Victoria under the FFG Act in May 2021. The species has VBA points in the East Gippsland (68% of VBA points), Central Highlands (23% of VBA points) and Gippsland (9% of VBA points) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.34.1 Risk Assessment

Table 173. Oval Fork-fern risk ratings in the Central Highlands, and Gippsland RFA regions:

	Drought	Increased fire frequency and intensity	Forestry operations; Rooding	Habitat clearing	Invasive vertebrate (deer)	Myrtle Wilt*
Consequence	Extreme	Extreme	Moderate	Minor	Moderate	Moderate
Likelihood	Almost Certain	Almost Certain	Possible	Unlikely	Possible	Possible
Overall risk rating	High	High	Medium	Low	Medium	Medium

Table 174. Oval Fork-fern risk ratings in the East Gippsland RFA region only:

	Drought	Increased fire frequency and intensity	Forestry operations; Rooding	Habitat clearing	Invasive vertebrate (deer)	Myrtle Wilt*
Consequence	Extreme	Extreme	Moderate	Minor	Moderate	Negligible
Likelihood	Almost Certain	Almost Certain	Likely	Unlikely	Possible	Rare
Overall risk rating	High	High	Significant	Low	Medium	Low

4.34.2 Climate change; Fire

Drought and increased fire frequency and intensity

Drought and increased fire frequency and intensity have been combined here due to the close relationship between the two hazards. The primary current and future threat to the species is climate change-driven severe droughts and the associated predicted increase in the frequency and intensity of bushfires. Recent frequent bushfires are likely to have directly killed plants and opened rainforest remnants to desiccation and invasion by non-rainforest taxa. The high risk of future fires suggest that the species may become close to extinction in the next 100 years. This hazard extends across all the species' distribution now that rainforest gullies are likely no longer protected from fire due to increased drying, and it is believed to have most of its Victorian sites occurring within the boundary of the 2019-20 bushfires.

Current controls for this hazard include:

- The *Climate Change Act 2017* and associated mitigation strategies. These controls are not effective in managing the risk to this species at the scale relevant to its conservation.
- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 175. Oval Fork-fern protection requirements and recommendations for drought and increase fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for these hazards as they are longer-term threats.
Potential management actions	<ul style="list-style-type: none"> • Assess the populations in East Gippsland to discover how much has been lost; • Investigate potential for cooler burns around gullies to try and reduce intensity of bigger fires; and • The VCS is being developed to accommodate spore collection for ferns, so ensure this species is included in early collections.

4.34.3 Forestry operations

Forestry operations and roading

This species generally occurs in association with rainforest. An analysis of VBA records showed that ~43% occurred within mapped rainforest or its buffers. In this situation, occurrences should be adequately protected from forestry operations due to the requirements of the Code. The risk to this species from forestry operations in the East Gippsland RFA region was re-assessed in light of new information about the exposure to forestry operations. The experts concluded that, where the species occurred on the margins or outside rainforest and/or its buffers, and especially where the rainforest habitat might have been burnt by bushfires or otherwise disturbed, protection could not be assumed. The experts emphasised the need for additional protections that targeted both the known occurrences and the rainforest habitat where it had been disturbed and stressed the importance of greater survey effort to improve understanding of the distribution and abundance of this species.

In addition to edge effects, permanent roads create conditions suitable for weed establishment, especially for blackberries, and harvesting and roading in habitat could also lead to Myrtle Wilt. Based on the 2015 net harvest area layer, approximately 10-20% of the population could be exposed to the hazard, including in the Central Highlands, Strzelecki Ranges and East Gippsland. Using the revised operable area layer, this reduces to 9% of the species' VBA points, including 16% in the Central Highlands RFA region and 8% in the East Gippsland RFA region.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 61% of the species' important populations and 69% of post-1970 VBA points are within the reserve system.

Table 176. Oval Fork-fern protection requirements and recommendations for Forestry operations and roading

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland and Gippsland RFA regions, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).</p> <p>Within the Central Highlands, East Gippsland and Gippsland RFA regions, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Maps 5a and 5b).</p> <p>Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Conduct FPSP surveys at all coupes that could potentially support the species; and • The VCS is being developed to accommodate spore collection for ferns, so ensure this species is included in early collections.

4.34.4 Habitat loss, degradation, and fragmentation

Habitat clearing

Most habitat is in National parks or reserves with only a small proportion of records on private land. There is minimal incentive for landowners to clear this kind of habitat as it is not suitable for agricultural or building purposes. Clearing opens habitat to drying and therefore more frequent/intense fires and opens it up for weed invasion and Myrtle Wilt. This hazard extends across less than 5% of the species' habitat.

Current controls for this hazard include:

- Native vegetation regulations. The effectiveness of this control for this species has been evaluated as satisfactory because even though it hasn't been directly demonstrated, there hasn't really been pressure to clear this kind of habitat, so it appears to be effective.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 61% of the species' important populations and 69% of post-1970 VBA points are within the reserve system.

Table 177. Oval Fork-fern protection requirements and recommendations for habitat clearing

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of low.
Potential management actions	<ul style="list-style-type: none"> • Ensure compliance of native vegetation removal regulations; • Provide information on the species and incentives for landowners to protect habitat; and • Monitor populations.

4.34.5 Invasive species

Invasive vertebrate (deer)

The species is threatened by rutting and wallowing by deer, particularly Sambar, which target rainforest and other riparian communities, and while browsing is not likely, it is possible. Antler rubbing could be more of an issue, however they appear to prefer tree stumps of a certain diameter and harder timber rather than tree-ferns where this species grows. Regardless, deer are still likely to degrade the species' habitat over time. After bushfires deer numbers can increase in regenerating forests, which can also happen after timber harvesting but not at the same landscape scale. This hazard extends across all the species' distribution.

Current controls for this hazard include:

- Targeted deer control. The effectiveness of this control for this species has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 178. Oval Fork-fern protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none">• Assess the feasibility of fencing in areas in the short term where there are numerous deer and are impacting smaller populations/single plants; and• Undertake targeted deer control in the vicinity of Oval Fork-fern populations.

4.34.6 Population dynamics

Myrtle Wilt

This hazard depends on Myrtle Beech extent across the species' habitat. It does not occur in East Gippsland which has approximately half of the species' populations, so overall around 30% of the species is potentially at threat from Myrtle wilt. Any disturbance to a patch of Myrtle Beech makes it more susceptible to Myrtle Wilt and dying back of myrtles could change the whole ecology of the forest with more light, heat and wind coming through.

Extensive camera trap use for Leadbeater's Possum (*Gymnobelideus leadbeateri*) in the Central Highlands RFA region require arborists to climb trees to install cameras. The FPSP generally require that any arborist climbing a Myrtle Beech, which is a common species targeted for camera traps as it occupies good habitat for Leadbeater's Possum, to remove spikes from arborist boots to limit potential spread of pathogens. This may be a standard operational requirement with the FPSP, but it is unclear if it is required by other organisations. This hazard interacts with forest operations as damage to Myrtle Beech trees through mechanical disturbances is one of the main ways Myrtle Wilt might be exacerbated in core forest areas in the Central Highlands RFA region.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as satisfactory when Myrtle Beech occurs in rainforest if the rainforest buffers are consistently applied to limit disturbance. In cases where rainforest is disturbed the control would be evaluated as poor, as well as when Myrtle Beech occurs outside rainforest, such as in small groves across hillslopes in high rainfall montane habitat associated with Montane Riparian Thicket and patchy seepage zones, noting that wetlands and Montane Riparian Thicket are protected from harvesting under the Code.

Table 179. Oval Fork-fern protection requirements and recommendations for Myrtle Wilt

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Conduct post harvesting monitoring to determine any impact on the species; and • Apply extra care where Myrtle Beech occurs next to the upslope side of any riparian buffer (on land subject to forestry operations) considering potential to transmit disease to the downslope rainforest patches.

4.35 Pale Hickory-wattle (*Acacia sporadica*)

The Pale Hickory-wattle was listed as Critically Endangered in Australia under the FFG Act in May 2021. The species has modelled habitat in the North East (80% modelled habitat), Central Highlands (12% modelled habitat) and Gippsland (1% modelled habitat) RFA regions, with 5% of modelled habitat in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.35.1 Risk Assessment

Table 180. Pale Hickory-wattle risk ratings in the North East RFA region:

	Plantations	Physical or chemical damage	Invasive vertebrate (deer)
Consequence	Moderate	Moderate	Moderate
Likelihood	Likely	Likely	Likely
Overall risk rating	Significant	Significant	Significant

4.35.2 Forestry operations

Plantations

This hazard applies to approximately 20% of the species' distribution and may result in direct mortality and habitat degradation. Occurrences of the species in plantation areas are not subject to harvesting or new log landings, nor are occurrences of the species in adjacent State Forest subject to harvesting. Impacts of forestry operations on the species largely occur through inadvertent destruction of subpopulations and longer-term invasion and competition with pine wildlings. Current forestry operations and management practices may also increase the risks and exacerbate the effects of bushfires (e.g., Furlaud et al. 2021). However, the strength of this relationship is contested within the scientific community (e.g., Keenan et al. 2021), and the extent of this effect may be less significant in the face of mega fires driven primarily by extreme heat and drought caused by human-induced climate-change (e.g., Bowman et al. 2021).

Current controls for this hazard include:

- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 44% of the species' modelled distribution and 52% of important populations are within the reserve system.

Table 181. Pale Hickory-wattle protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	<ul style="list-style-type: none"> • Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Liaise with plantation managers to maintain appropriate protection measures for this species.

4.35.3 Habitat loss, degradation, and fragmentation

Physical or chemical damage

If stands of the species under power transmission lines are managed for fire prevention, either via mechanical means or herbicides, it is likely to be lethal to individual clones other than those for which there is seed production, with slashing less likely to be lethal. This hazard applies to 30% of the species' populations and arises from either vegetation management under power transmission lines (applies to Carboor population), or deer (applies to all populations).

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 182. Pale Hickory-wattle protection requirements and recommendations for physical or chemical damage

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Exclude aerial or ground-based use of broad-leaf or non-selective herbicides where the species occurs; • Woody taxa perceived as problems (e.g., Silver Wattle (<i>Acacia dealbata</i>), <i>Eucalyptus</i> spp.) should be controlled through hand cut and paste of herbicide; • Install appropriate signage so staff and contractors understand the need for these actions; and • Ensure that broad genetic representation exists in <i>ex-situ</i> conservation collections (VCS, live plants at the RBGV and Euroa Arboretum).

4.35.4 Invasive species

Invasive vertebrate (deer)

Deer have the potential to cause considerable damage or death to above-ground parts through browsing or rubbing. Drying of vegetation in general and increased burning may render resprouting taxa more attractive to deer as their rapid post-fire regrowth occurs in an environment where little other vegetation else may be available. This hazard applies to 10% of the species' habitat.

Current controls include:

- Victorian Deer Control Strategy. The effectiveness of this control for this species has been evaluated as poor because there have been increased observations of damage to vegetation by uncontained deer numbers.

Table 183. Pale Hickory-wattle protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Continue the monitoring of all stands to assess what level of threat deer pose. If considered significant, establish targeted, intensive deer management in those areas; and • Ensure that broad genetic representation exists in <i>ex-situ</i> conservation collections (VCS, RBGV, Euroa Arboretum).

4.36 Purple Coopernookia (*Coopernookia barbata*)

The Purple Coopernookia was listed as Vulnerable in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.36.1 Risk Assessment

Table 184. Purple Coopernookia risk ratings in the East Gippsland RFA region:

	Drying climate	Bushfire	Forestry operations	Invasive vertebrate (deer)
Consequence	Major	Major	Minor	Major
Likelihood	Likely	Possible	Rare	Possible
Overall risk rating	High	Significant	Low	Significant

4.36.2 Climate change

Drying climate

The species is threatened across its distribution in the long-term by climatic drying and warming, risking elevated mortality and changes in vegetation structure. Any impacts are likely to be exacerbated by altered fire regimes, increasing the risk of repeat fire and recruitment failure. Drought, hot weather and repeat fires have the potential to damage or destroy recovering plants and/or seedlings. A drying climate is likely to interact with all other hazards, with potential negative effects on existing plants due to mortality caused by extreme weather (e.g., prolonged drought killing existing plants and other hazards reducing likely recruitment) or recruitment (e.g., timber harvesting, grazing, or fire followed by extreme weather impacting recruitment by seedlings).

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 185. Purple Coopernookia protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Undertake additional <i>ex-situ</i> conservation collections (e.g., seed storage of populations not yet stored in the VCS).

4.36.3 Fire

Bushfire

The bushfires of 2019-20 are believed to have impacted around 76% of the species' modelled habitat, with some 96% of the habitat affected by fire since 2000. The overall impacts of the fire are yet to be determined. Drought, hot weather and repeat fires have the potential to damage or destroy recovering plants and/or seedlings, and the species' recovery depends on the effective control of the impacts of herbivores, notably Sambar, and by preventing soil disturbance following fire recovery.

The species is likely to respond well to fire through post-fire recruitment as it has a reasonable short time to becoming reproductive, possibly only 2 or 3 years, therefore some level of recruitment might be expected provided fire frequency is > 5 years. However, cumulative impacts with other threats make this a significant risk. It seems unlikely that populations will burn again before 2023, however, if this were to happen it would be likely to have very negative outcomes for this species. Fires followed by extreme weather or grazing, and timber harvesting followed by repeat fires, may lead to recruitment failure.

Current controls for this hazard include:

- Bushfire management phases of planning, prevention, preparedness, fuel management, response, recovery, and monitoring. The effectiveness of this control in managing risk to this species has been evaluated as poor, because despite these controls, the impacts of bushfire on this species have increased over the past 20 years.

Table 186. Purple Coopernookia protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Undertake additional <i>ex-situ</i> conservation collections (e.g., seed storage of populations not yet stored in the VCS).

4.36.4 Forestry operations

Forestry operations

The species occurs in relatively intact habitat, although it is likely that some areas have been subject to historic forestry operations. Forestry operations are likely to interact with all other hazards, with potential negative effects on recruitment and habitat loss from timber harvesting being followed by other hazards such as grazing by feral animals, extreme weather or bushfire removing seedlings. Based on the 2015 net harvest area layer 20% of the species' modelled habitat is in merchantable areas. Using the revised operable area layer, this is reduced to 6%.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species, although the level of risk is low.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor to satisfactory as 62% of the species' modelled distribution and 48% of important populations are within the reserve system.

Table 187. Purple Coopernookia protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of low.
Priority management actions	Not required for this hazard based on the overall risk level of low.
Permanent protections	Not required for this hazard based on the overall risk level of low.
Potential management actions	No management actions have been recommended for this hazard.

4.36.5 Invasive species

Invasive vertebrate (deer)

The species is likely to be threatened by feral herbivores, notably Sambar. Browsing by deer is likely to reduce seed set due to flowers and fruits along with foliage being eaten. Drought, hot weather and repeat fires have the potential to damage or destroy recovering plants and/or seedlings, and the species' recovery depends on the effective control of the impacts of herbivores and by preventing soil disturbance following fire recovery. Following the 2009 bushfires there was a very large expansion of deer numbers, and as the bushfires of 2019-20 are believed to have impacted around 76% of the species' modelled habitat, deer populations are likely to increase/re-establish in areas of East Gippsland. This hazard extends across all the species' distribution.

Current controls for this hazard include:

- Victorian deer control strategy. The effectiveness of this control for this species has been evaluated as poor, because while this strategy is a good start to controlling this hazard, deer remain abundant throughout the state and occur in often very remote areas. They also are very quick at re-establishing in areas following control.
- Biodiversity Response Planning. The effectiveness of this control for this species has been evaluated as poor because part of this control includes deer control, and while this is likely to have a short-term impact on deer numbers in a localised area, they are likely to re-establish at the completion of these projects.
- The Bushfire Biodiversity Response and Recovery program. The effectiveness of this control for this species has been evaluated as poor because although the program has seen reduction in deer numbers in areas effected by bushfire, it is restricted to these areas, and deer populations in adjacent forest are still large.

Table 188. Purple Coopernookia protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Continuation and expansion of current deer controls is required to reduce deer populations.
Potential management actions	<ul style="list-style-type: none"> • Assess the feasibility of fencing of significant populations; and • Undertake <i>ex-situ</i> conservation storage of populations not yet in seed banks.

4.37 Rough-barked Apple (*Angophora floribunda*)

The Rough-barked Apple was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. While it is acknowledged that other hazards impact on this species as per the CAM assessment, the expert/s only assessed forestry operations as part of this risk assessment.

4.37.1 Risk Assessment

Table 189. Rough-barked Apple risk ratings in the East Gippsland RFA region:

Forestry operations	
Consequence	Minor
Likelihood	Unlikely
Overall risk rating	Low

4.37.2 Forestry operations

Forestry operations

The overlap between merchantable forest and the species' distribution is small (2-3%) and on the margin of its distribution. Where forestry operations do impact the species, selective harvesting rather than clearfell harvesting occurs. The species is not very merchantable and where it dominates the forest it is unlikely to be harvested. Mature trees would be retained in a coupe and so would be at a competitive advantage to other taxa that regrow from seedlings. However, the species has been recorded from coupes included in recent Timber Release Plans, which border Croajingolong National Park north of Mallacoota, east of the Princes Highway near the state border. At these sites the species is common in mixed forest and includes numerous large old canopy trees along riparian areas and on lower to mid slopes, but also in some cases much further upslope closer to likely harvest zones. It is possible that the species would gain protection based on the forestry controls in place for Black Sheoak (*Allocasuarina littoralis*) which is key habitat for Glossy Black Cockatoos (*Calyptorhynchus lathami*), however most of this species was burnt in the 2019-20 bushfires. Direct impacts of harvesting at these sites include direct mortality and reduced recruitment as it may be outcompeted when regenerating from seedlings. Future decline may occur due to the impacts of future fire regimes, competitive interactions with other taxa, and the localised impacts of forest and fire management operations.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general protections for rainforest and other protections (e.g., Glossy Black Cockatoo habitat) including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 63% of the species' modelled distribution and 67% of important populations are within the reserve system.

Table 190. Rough-barked Apple protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of low.
Priority management actions	Not required for this hazard based on the overall risk level of low.
Permanent protections	Not required for this hazard based on the overall risk level of low.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments.

4.38 Sandfly Zieria (*Zieria smithii*)

The Sandfly Zieria was listed as Endangered in Victoria under the FFG Act in May 2021. The species has VBA points in the East Gippsland (53% of VBA points) and Gippsland (46% of VBA points) RFA regions, with 1% in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.38.1 Risk Assessment

Table 191. Sandfly Zieria risk ratings in the East Gippsland RFA region:

	Increased fire frequency and intensity	Forestry operations
Consequence	Extreme	Moderate
Likelihood	Rare	Likely
Overall risk rating	Significant	Significant

Table 192. Sandfly Zieria risk ratings in the Gippsland RFA region:

	Increased fire frequency and intensity	Forestry operations
Consequence	Extreme	Moderate
Likelihood	Rare	Possible
Overall risk rating	Significant	Medium

4.38.2 Fire

Increased fire frequency and intensity

The species is threatened in all regions by an increased fire frequency, intensity, and landscape scale, combined with climatic warming and drying which synergistically increase the risk of recruitment failure due to extreme drought stress and repeat fires at intervals below or approaching the tolerable fire interval for the species. The species is likely to be at particular risk of adult mortality and recruitment failure, noting that it often occupies shallow to skeletal soils on dry rocky ground or on open rocky outcrops (VicFlora 2020). This hazard interacts with targeted browsing and trampling by deer through the exposure of seedlings to mortality and habitat degradation. It also interacts with forestry where current forestry operations and management practices may also increase the risks and exacerbate the effects of bushfires (e.g., Furlaud et al. 2021). However, the strength of this relationship is contested within the scientific community (e.g., Keenan et al. 2021), and the extent of this effect may be less significant in the face of mega fires driven primarily by extreme heat and drought caused by human-induced climate-change (e.g. Bowman et al. 2021). The 2019-20 bushfires give a clear indication of the potential for a significant event to occur that would have extreme consequences (at least in terms of severity and duration), given that 70% of important populations across both the East Gippsland and Gippsland RFA regions have been burnt by bushfire since 2000. This hazard has the potential to impact all the species' populations in Victoria.

Current controls for this hazard include:

- Planned burning. This control may be partially effective depending on the location of planned burns and the time elapsed since the operation. Strategic fuel breaks and associated backburning may, however, provide valuable protection for this species and its habitat from severe bushfires in some cases.
- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

- Bushfire suppression. The risk to this species is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on this species.

Table 193. Sandfly Zieria protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Potential management actions	<ul style="list-style-type: none"> • Collect seed for the VCS from across the species' range; • Establish a dedicated Seed Production Area set up to be climate proof and include location/s where the bushfire threat can be mitigated (e.g., outside the major areas of forested land susceptible to major bushfires), possibly on private land; and • Nominate Sandfly Zieria as an at-risk species within Victoria's Climate Change Adaptation Action Plan for the Natural Environment System.

4.38.3 Forestry operations

Forestry operations

Forestry operations can impact this species through disturbance by machinery during harvesting followed by regeneration burning. Salvage harvesting will have a disproportionate impact on populations due to the risk of local extinction if the propagule bank is exhausted. Forestry operation impacts are exacerbated by any stochastic disturbance events that disrupt recruitment processes. The species' patchy occurrence and lack of a prescription put it at greater overall risk since the 2019-20 bushfires. The extent of forestry operations impacts is not likely to be widespread (i.e., not all habitat exposed to harvesting), but the severity and duration of forestry impacts would be significant unless protections are in place. Large sub-populations have been detected during FPSP surveys at two sites in unburnt mixed forest at Stockdale State Forest in the Gippsland RFA region. These plants are protected but demonstrate that more populations occur in areas available for harvesting and could be lost if unprotected. Despite the patchiness of sub-populations in the landscape, these are at risk of population decline from forestry operations in the East Gippsland RFA region because there are currently no prescriptions that apply if the species is observed/recorded within a coupe proposed for timber harvesting. It is also therefore not a target for FPSP searches, and the detection probabilities for this species may not be considered when selecting coupes for survey.

Based on the 2015 net harvest area layer 15% of the species' important populations and 13% of its VBA points in the East Gippsland RFA region and 3% of important populations and 17% of VBA points in the Gippsland RFA region are in merchantable areas. Using the revised operable area layer this reduces to 7% of important populations and 9% of VBA points in the East Gippsland RFA region and 2% of important populations and 15% of VBA points in the Gippsland RFA region.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species has been evaluated as satisfactory in the Gippsland RFA region where it has species-specific code prescriptions, and poor in the East Gippsland RFA region where those prescriptions do not extend. It may, however, receive some protection from other general Code prescriptions.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 54% of the species' important populations and 51% of post-1970 VBA points are within the reserve system.

Table 194. Sandfly Zieria protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 6a).
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Document any observations of Sandfly Zieria at recently harvested sites given post-harvest threatened species monitoring; • Monitor to ensure plants successfully re-establish, and for other potential threats (e.g., deer browsing); • Consider including appropriate prescriptions for this species in the East Gippsland RFA region as part of future Code amendments; • Use detection probabilities to identify suitable FPSP survey sites in East Gippsland RFA region; • Develop the species' HDM to gain a better understanding of potential occurrence on forest available land; • Collect seed from plants recorded from unburnt forests in State Forest to safeguard in the VCS; and • Provide post-harvest monitoring protocols to assess the recruitment of plants in timber harvesting coupes and provide threat abatement to other disturbances where required e.g., deer management.

4.39 Satinwood (*Nematolepsis squamea* subsp. *squamea*)

The Satinwood was listed as Vulnerable in Victoria under the FFG Act in May 2021. The subspecies has modelled habitat in the West (100% of modelled habitat) RFA region, however there are also some records in the East Gippsland RFA region which have not been accounted for in the model and have been included in this assessment. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.39.1 Risk Assessment

Table 195. Satinwood risk ratings in the West RFA region:

	Increased fire frequency and intensity	Fuel management roading	Forestry operations	Plantations	Invasive vertebrate (deer)
Consequence	Major	Minor	Minor	Minor	Major
Likelihood	Possible	Likely	Unlikely	Possible	Possible
Overall risk rating	Significant	Medium	Low	Medium	Significant

Table 196. Satinwood risk ratings in the East Gippsland RFA region:

	Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)
Consequence	Major	Moderate	Major
Likelihood	Likely	Likely	Possible
Overall risk rating	High	Significant	Significant

4.39.2 Fire

Increased fire frequency and intensity

A long-term threat to the subspecies is the potential impact of altered fire regimes, repeat fire events at intervals close to the tolerable fire interval for the subspecies and recruitment failure in response to climatic drying and warming. The subspecies may also be subject to low levels of incremental loss to activities such as road widening and bushfire fuel management practises. Too frequent and intense fire is likely to provide a competitive advantage for eucalypt and acacia taxa to replace or become canopy dominants in the subspecies' habitat, with a higher cover of eucalypts possibly leading to a more fire prone vegetation. This threat extends across 90% of the subspecies' distribution.

Current controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures in managing the risk to this subspecies has been evaluated as satisfactory.
- Bushfire suppression. The risk to this subspecies is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on this subspecies.

Table 197. Satinwood protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Plant a selection of areas within the Great Otway National Park with Satinwood, where the landscape context is better suited to retaining non-eucalypt dominance. Mix planting with Blackwood (<i>Acacia melanoxylon</i>) and understorey broad leaf shrubs. This measure may require lopping of some eucalypts to allow other taxa to establish; • Offer incentive for farms adjoining Great Otway NP to plant Satinwood in gullies or windbreaks where suitable; and • Establish <i>ex-situ</i> propagation.

Fuel management roading

The subspecies may be subject to low levels of incremental loss to activities such as road widening for bushfire fuel management, which has impacts to tree protection zones as well as direct removal. This impacts approximately 10% of the subspecies' habitat.

Current controls for this hazard include:

- Risk controls across the bushfire management phases of planning, prevention, preparedness, fuel management, response, recovery, and monitoring. The effectiveness of this control for this subspecies has been evaluated as satisfactory as maintenance of roading for fire management may be as much as a mitigation measure as it is an impact to the subspecies, given the generally low exposure.

Table 198. Satinwood protection requirements and recommendations for fuel management roading

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Use counterbalancing measures in the crown land procedure, whether required to or not for actions needed for fuel reduction. This may include establishing equivalent number of plants lost elsewhere; • Retain some individuals on roadsides within fuel management zones, where this can be done while achieving fuel load targets; and • Develop clear protocol for clearing for this purpose. Ensure non-compliance is followed up for contractors when clearing occurs outside of permitted clearing.

4.39.3 Forestry operations

Forestry operations

The subspecies is thought to be a fire-sensitive obligate seed regenerator which recruits episodically post-fire at pre-settlement intervals of (45-) 80-120 (-500) years depending on local habitat conditions. If timber harvesting occurs in areas where there are records for this subspecies, it may be the case that post harvesting, the regeneration could be exposed to either slash burning and/or bushfire prior to reaching reproductive maturity. The subspecies does not have a current Code prescription and occupies a restricted range in East Gippsland; therefore, it is likely to be affected by timber harvesting in that region. While there is some uncertainty about the subspecies' response to timber harvesting, a precautionary interim approach is required post bushfire. This hazard has the potential to impact less than 5% of the subspecies' populations in the West RFA region, however may impact where alterations are made to roads and tracks. It has the potential to impact less than 20% of the population in the East Gippsland RFA region.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this subspecies in the Code, however the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this subspecies.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as poor as 51% of the subspecies' modelled distribution and 60% of important populations are within the reserve system.

Table 199. Satinwood protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better). Conduct a site inspection and detailed planning in consultation with the Department to ensure the subspecies is adequately protected during timber harvesting operations (See Map 6a). <p>Interim protections not required in the West RFA region based on the overall risk level of low.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term in the East Gippsland RFA region.
Potential management actions	<ul style="list-style-type: none"> • Species-specific code prescriptions should be considered in any future Code amendments; • Ensure alterations to roads and tracks are only made where absolutely necessary in the vicinity of known populations; and • Place a buffer zone over verified populations, or plan timber harvesting coupe as normal at one of the verified sites and assess the response of the subspecies.

Plantations

While native forest timber harvesting on public land has been phased out in the Otway Ranges since 2008, harvesting on private land and in plantations continues in parts of its range. Pine plantations could potentially facilitate encroachment by invasive subspecies. This hazard has the potential to impact 28% of the subspecies' modelled habitat in the West RFA region.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as poor because, although there are general protections for waterways and rainforest, this subspecies does not occur in these habitats.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as poor as 51% of the subspecies' modelled distribution and 60% of important populations are within the reserve system.
- Vegetation Clearance Controls. The effectiveness of this control for this subspecies has been evaluated as satisfactory as controls are generally consistently applied, however the effectiveness has not been demonstrated.

Table 200. Satinwood protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Increase weed control; • Increase pest animal control; and • Check on buffer zones width in plantations and assess if adequate for important populations. If not, then submit case to plantation managers to increase the width of buffer zones.

4.39.4 Invasive species

Invasive vertebrate (deer)

The isolated stand on the slope of Mt Buck, north of Orbost in East Gippsland, may be threatened by the increasing density of Sambar throughout the region, and this threat may also apply to the Boggy Creek Gorge stand if it is also considered to be indigenous. Possible deer browsing and rubbing could cause a significant decrease in extent of populations, and when combined with climate change and probable increased exposure to higher intensity bushfire, could lead to an even higher impact of deer in refugia habitat. This hazard impacts approximately 80% of the subspecies' habitat.

Current controls for this hazard include:

- Aerial and ground shooting program. This has been evaluated as poor as shooting will only have a very minor effect in reducing the deer populations.

Table 201. Satinwood protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	May be required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Asses the feasibility of fencing off important populations; • Establish <i>ex-situ</i> propagation to safeguard wild populations; and • Conduct field assessments on a small number of sites to investigate if deer cause similar damage as they do to Shiny Nematolepis (<i>Nematolepis wilsonii</i>), as this will indicate whether urgent action is required.

4.40 Selma Saddle Grevillea (*Grevillea miqueliana* subsp. *cincta*)

The Selma Saddle Grevillea was listed as Critically Endangered in Australia under the FFG Act in May 2021. The subspecies has modelled habitat in the Central Highlands (34% of modelled habitat), Gippsland (27% of modelled habitat) and North East (39% of modelled habitat) RFA regions, however all known records are in the Gippsland RFA region, so this will be the only region assessed. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.40.1 Risk Assessment

Table 202. Selma Saddle Grevillea risk ratings in the Gippsland RFA region:

	Increase fire intensity and frequency	Forestry operations
Consequence	Extreme	Moderate
Likelihood	Likely	Likely
Overall risk rating	High	Significant

4.40.2 Fire

Increased fire frequency and intensity

The subspecies is threatened by climatic and physical threats such as climate change resulting in increased frequency and intensity of fire, unseasonal planned fire (especially in winter) and impacts of fire control activities. The cumulative effect of climate warming combined with lack of pollinators will highly likely reduce number of plants within populations. As all populations of this subspecies have been exposed to bushfire since 2000 it is critical to protect the cohort of vegetative plants at least until they reach reproductive maturity and have formed seed to replenish the soil-stored seed supply.

Current control measures for this hazard are not effective in managing the risk to this subspecies at the scale relevant to its conservation.

Table 203. Selma Saddle Grevillea protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard based as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">Establish <i>ex-situ</i> propagation of the subspecies to safeguard against another bushfire eliminating populations prior to becoming reproductively mature; andConsider options to conserve this subspecies under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.40.3 Forestry operations

Forestry operations

Forestry operations is an anthropogenic threat to the subspecies, which based on the 2015 net harvest area layer extends across 20% of the subspecies' modelled habitat. Using the revised operable area layer, this is reduced to 5%. It is part of a suite of threats that is likely to result in a decline of area of occupancy, extent of occurrence, and quality of habitat. Forestry operations may produce regeneration which is more fire prone and, combined with increased fire frequency and intensity, is likely to cause a considerably higher risk of bushfire adversely affecting populations.

Current control measures for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this subspecies has been evaluated as satisfactory in the Gippsland RFA region where it has species-specific code prescriptions.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as poor as 59% of the subspecies' modelled distribution and 48% of important populations in the Gippsland RFA region are within the reserve system.

Table 204. Selma Saddle Grevillea protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Establish <i>ex-situ</i> propagation of the subspecies.

4.41 Slender Fork-fern (*Tmesipteris elongata*)

The Slender fork-fern was listed as Critically Endangered in Victoria under the FFG Act in May 2021. The species has VBA points in the Gippsland (63% of VBA points), West (33% of VBA points), and Central Highlands (4% of VBA points) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.41.1 Risk Assessment

Table 205. Slender Fork-fern risk ratings in the Central Highlands and Gippsland RFA regions:

	Increased fire frequency and intensity	Forestry operations; roading	Invasive vertebrate (deer)
Consequence	Moderate	Moderate	Major
Likelihood	Likely	Possible	Likely
Overall risk rating	Significant	Medium	High

Table 206. Slender Fork-fern risk ratings in the West RFA region:

	Increased fire frequency and intensity	Forestry operations; roading	Invasive vertebrate (deer)
Consequence	Moderate	Negligible	Major
Likelihood	Likely	Possible	Likely
Overall risk rating	Significant	Low	High

4.41.2 Fire

Increased fire frequency and intensity

The species is reliant on Cool Temperate Rainforest habitat which is threatened primarily by severe bushfires; stands may be eliminated by a single severe bushfire or progressively reduced by a series of bushfires. Increased fire severity and frequency is now the greatest threat to the species and its rainforest habitat, neither of which are dependent on fire for recruitment nor maintenance. The threat of bushfire applies to 60% of the species' range and can lead to direct mortality.

Current existing controls for this hazard include:

- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 207. Slender Fork-fern protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.41.3 Forestry operations

Forestry operations and roading

Forestry operations, including timber harvesting and road construction in or adjacent to its habitat in parts of its range, may pose a threat in the short-term due to edge effects including increased light and wind penetration, elevated temperatures, and reduced humidity. In addition to edge effects, roads create conditions suitable for weed establishment, especially for blackberries. Forestry operations can lead to habitat loss and weed invasion across approximately 10% of the species' distribution, while roading may be a minor hazard across less than 5% of habitat. In the West RFA region timber harvesting was ceased in the Otway Ranges in 2008, therefore the above hazards are no longer considered relevant, however roading may still be a minor hazard. The associated physical disturbance from re-routeing roads and/or tracks leads to direct mortality.

Current existing controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however the Code includes general protections for waterways, old growth and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as good as 81% of the species' important populations and 87% of post-1970 VBA points are within the reserve system.
- Values checking. The effectiveness of this control for this species has been evaluated as satisfactory as it is standard practise for regional staff to consult detailed mapping of known populations, to avoid them in any roading works.

Table 208. Slender Fork-fern protection requirements and recommendations for forestry operations and roading

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk levels of low and medium.
Priority management actions	Not required for this hazard based on the overall risk levels of low and medium.
Permanent protections	Additional permanent protections may be required in the longer-term except in the West RFA region where the overall risk level is low.
Potential management actions	<ul style="list-style-type: none"> • Establish <i>ex-situ</i> propagation in collaboration with RBGV; and • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.41.4 Invasive species

Invasive vertebrate (deer)

The species is threatened by rutting, wallowing, antler rubbing and targeted browsing by deer, particularly Sambar, which target rainforest and other riparian communities. Deer occur in 80% of the species' habitat. With possible severe bushfire impacting on populations, the browsing and rubbing by deer would have a large detrimental effect on the regeneration of tree ferns, which are the species' main hosts.

Current existing controls for this hazard include:

- Aerial and ground shooting program. The effectiveness of this control for this species has been evaluated as poor because shooting programs only achieve minor reductions in deer numbers

Table 209. Slender Fork-fern protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Potential management actions	<ul style="list-style-type: none"> • Investigate options to control for feral deer populations; and • Assess the feasibility of fencing of important populations.

4.42 Small Autumn Greenhood (*Pterostylis reflexa*)

The Small Autumn Greenhood was listed as Vulnerable in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.42.1 Risk Assessment

Table 210. Small Autumn Greenhood risk ratings in the East Gippsland RFA region:

	Drying climate	Forestry operations
Consequence	Major	Minor
Likelihood	Likely	Possible
Overall risk rating	High	Medium

4.42.2 Climate change

Drying climate

All the species' subpopulations and habitat may be at risk from disturbance from changed fire regimes (especially planned burning) and increasingly dry conditions from declining rainfall across the distribution of the species leading to direct mortality.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 211. Small Autumn Greenhood protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.42.3 Forestry operations

Forestry operations

Based on the 2015 net harvest area layer, 43% of the species' modelled habitat is potentially available to forestry operations, which can cause direct mortality. Using the revised operable area layer, this is reduced to 13%. It has very small subpopulations that are highly susceptible to stochastic events causing major decline or local extinction within a very short time frame. Forestry operations, when combined with a drying climate, may cause a cumulative impact leading to a reduced number of plants.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however the Code includes general measures that may offer it some protection. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 39% of the species' modelled distribution and 47% of important populations are within the reserve system.

Table 212. Small Autumn Greenhood protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Establish <i>ex-situ</i> propagation as a safeguard in case populations experience a significant decline; and • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.43 Small Fork-fern (*Tmesipteris parva*)

The Small Fork-fern was listed as Endangered in Victoria under the FFG Act in May 2021. The species has VBA points in the East Gippsland (56% of VBA points), Central Highlands (28% of VBA points) and Gippsland (16% of VBA points) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.43.1 Risk Assessment

Table 213. Small Fork-fern risk ratings in the Central Highlands RFA region:

	Drought	Increased fire frequency and intensity	Forestry operations; roading	Invasive vertebrate (deer)	Myrtle Wilt
Consequence	Extreme	Major	Moderate	Moderate	Moderate
Likelihood	Almost Certain	Likely	Likely	Possible	Possible
Overall risk rating	High	High	Significant	Medium	Medium

Table 214. Small Fork-fern risk ratings in the East Gippsland RFA region:

	Drought	Increased fire frequency and intensity	Forestry operations; roading	Invasive vertebrate (deer)
Consequence	Extreme	Major	Moderate	Moderate
Likelihood	Almost Certain	Likely	Likely	Possible
Overall risk rating	High	High	Significant	Medium

Table 215. Small Fork-fern risk ratings in the Gippsland RFA region:

	Drought	Increased fire frequency and intensity	Forestry operations; roading	Invasive vertebrate (deer)	Myrtle Wilt
Consequence	Extreme	Major	Moderate	Moderate	Moderate
Likelihood	Almost Certain	Likely	Possible	Possible	Possible
Overall risk rating	High	High	Medium	Medium	Medium

4.43.2 Climate change; Fire

Drought and increased fire frequency and intensity

The primary current and future threat to the species is climate change-driven severe droughts and the associated predicted increase in the frequency and intensity of bushfires. In the past bushfires would skip over the wetter gullies, but now bushfires are impacting those gullies. Frequent bushfires are likely to directly kill plants and open rainforest remnants to desiccation and invasion by non-rainforest taxa. The high risk of future bushfires suggest that the species may become close to extinction in the next 100 years. Observations from parts of the Black Saturday fire extent around Kinglake indicate that some stands of tree ferns were killed and are now decaying stumps, so are not suitable as habitat for this species. There is potential for high intensity fires to remove micro-habitat for the species elsewhere, as well as causing changes to vegetation structure that will cause loss of populations. Drought is also going to alter forest ecology leading to weed invasion. This hazard extends across all the species' distribution.

Current controls for this hazard include:

- Climate change policies. Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.
- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 216. Small Fork-fern protection requirements and recommendations for drought and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as these are longer-term threats.
Potential management actions	<ul style="list-style-type: none"> • Assess the populations in East Gippsland to find out how much has been lost in the 2019-20 bushfires; • Ensure buffering rainforest is in place to improve resilience overall; • <i>Ex-situ</i> population establishment to increase chance of reintroduction, although growing this species would likely to be difficult; and • Determine suitability of low intensity burns in non-riparian vegetation adjacent to populations and around gullies. Implement if deemed effective at reducing fire risk without loss of other ecological values.

4.43.3 Forestry operations

Forestry operations and roading

This species generally occurs in association with rainforest. An analysis of VBA records showed that ~47% occurred within mapped rainforest or its buffers. In this situation, occurrences should be adequately protected from forestry operations due to the requirements of the Code. The risk to this species from forestry operations in the East Gippsland RFA region was re-assessed in light of new information about the exposure to forestry operations. The experts concluded that, where the species occurred on the margins or outside rainforest and/or its buffers, and especially where the rainforest habitat might have been burnt by bushfires or otherwise disturbed, protection could not be assumed. The experts emphasised the need for additional protections that targeted both the known occurrences and the rainforest habitat where it had been disturbed and stressed the importance of greater survey effort to improve understanding of the distribution and abundance of this species.

Forestry operations, including timber harvesting and road construction in or adjacent to its habitat in parts of its range, may also pose a threat in the short-term due to edge effects including increased light and wind penetration, elevated temperatures, and reduced humidity. In addition to edge effects, permanent roads create conditions suitable for weed establishment, especially for blackberries.

Based on the 2015 net harvest area layer approximately 10% of post-1970 VBA points could be exposed to forestry operations, including in the Central Highlands, Strzelecki Ranges and East Gippsland. Using the revised operable area layer, this reduces to 7%. For roading there would have to be a coincidence between where the road goes and where the population of the species occurs, which are both rare in the landscape.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however the Code includes general protections for rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 71% of the species' important populations and 75% of post-1970 VBA points are within the reserve system.
- Impact assessments for roading. This has been evaluated as satisfactory based on the outcome of impact assessment when they are undertaken. Whilst there is scope for exemptions for some works (minor roadworks

etc.), there are usually surveys for new projects. For bigger maintenance projects, it may not be satisfactory due to exemptions.

Table 217. Small Fork-fern protection requirements and recommendations for forestry operations and roading

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland and Gippsland RFA regions, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).</p> <p>Within the Central Highlands, East Gippsland and Gippsland RFA regions, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Maps 5a ad 5b).</p> <p>Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider establishing species-specific code prescriptions in any future Code amendments; • Targeted surveys on all road construction, upgrade, and maintenance operations; and • Evaluate translocation of species if road cannot be realigned.

4.43.4 Invasive species

Invasive vertebrate (deer)

The species is also threatened by rutting, wallowing, antler rubbing and targeted browsing by deer, particularly Sambar which target rainforest and other riparian communities, which can result in the reduction of understorey cover and direct damage to tree fern trunks. Damage to vegetation by deer may increase susceptibility of habitat to fire due to changes in composition and cover of understorey vegetation. Browsing is not likely but is possible, and deer appear to prefer tree stumps of a certain diameter and harder timber rather than tree-ferns where this species grows, so there would be limited rubbing on its hosts. However, they are still likely to degrade the habitat over time. After bushfires deer numbers can increase and seem to thrive in regenerating forests, which is similar for timber harvesting areas but at a smaller scale. This hazard extends across all the species' distribution.

Current controls for this hazard include:

- The Victorian Deer Control Strategy. This has been evaluated as poor to satisfactory as it is difficult to establish cause and effect for deer control on the responses of various biodiversity values. There are ongoing deer control programs in various parts of the Central Highlands, but it may not be succeeding at reducing deer numbers.

Table 218. Small Fork-fern protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Priority management actions	<ul style="list-style-type: none"> • Fencing in areas in the short term where there are numerous deer and are impacting smaller populations or single plants of the species, and in areas where deer control is difficult or ineffective; • Increase targeted deer control in the vicinity of threatened plant populations; • Monitor the species' sites with remote cameras to estimate deer density; and • Establish translocation procedure and identify recipient sites to establish new populations for increased dispersal capacity.

4.43.5 Population dynamics

Myrtle Wilt

This hazard depends on the Myrtle Beech extent across this species' habitat. There is approximately 30% of the species' distribution potentially at threat from Myrtle Wilt, but none of this is in East Gippsland which has ~50% of the populations. Any disturbance to a patch of Myrtle Beech, even just one tree being knocked into a gully, can increase susceptibility to Myrtle Wilt. Dying back of myrtles can change the whole ecology of the forest, including an increase of light coming through.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as satisfactory.

Table 219. Small Fork-fern protection requirements and recommendations for Myrtle Wilt

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	No potential management actions have been recommended for this hazard.

4.44 Small-leaf Star-hair (*Astrotricha parvifolia* subsp. 1)

The Small-leaf Star-hair was listed as Critically Endangered in Australia under the FFG Act in May 2021. The subspecies has modelled habitat in the Gippsland (96% of modelled habitat) and Central Highlands (4% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.44.1 Risk Assessment

Table 220. Small-leaf Star-hair risk ratings in the Gippsland RFA region:

	Drought	Planned burning	Plantations
Consequence	Major	Major	Moderate
Likelihood	Unlikely	Possible	Likely
Overall risk rating	Medium	Significant	Significant

4.44.2 Climate change

Drought

Drought is a concern to the subspecies when it interacts with bushfire, and can cause direct mortality, recruitment failure and habitat loss and degradation. The occurrence of a very severe drought may make the subspecies' habitat more susceptible to a peat fire, however the likelihood of this occurring in the next 20-years is probably small, and climate change is expected to impact over a longer timeframe.

This hazard has been evaluated as uncontrolled.

Table 221. Small-leaf Star-hair protection requirements and recommendations for drought

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium and because it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Mitigations recommended are linked to bushfire mitigations with the aim to limit bushfire incursion into peat sites and/or avoid bushfire suppression negatively impacting the subspecies; and Ensure the subspecies' habitat is considered in incident management.

4.44.3 Fire

Planned burning

If swampy patches where this plant occurs are subjected to an appropriate fire consistent with its tolerable fire interval or a soil disturbance event, the subspecies will germinate. However, it may not adequately recruit and replenish the soil seedbank if the site is drier where planned burning does occur, and very frequent fire is a threat to adequate seed set and replenishment of soil seedbanks for this subspecies. The habitat can be somewhat peaty, and a peat fire could also seriously damage the habitat and the soil seedbank of this subspecies. This hazard could impact up to 100% of the subspecies' distribution as it is within very fire prone habitat (dense, wet heathy woodland), and can cause recruitment failure and direct mortality of this subspecies. Planned burning interacts with climate change and drought, because if a dry period follows a fire, this may compromise recruitment of this subspecies.

Current controls for this hazard include:

- Values Checking, regionally established mitigation protocols. This has been evaluated as satisfactory as they appear to be applied consistently.
- RGB seedbank collection. This has been evaluated as satisfactory, however unknown germination requirements of the subspecies limit the confidence in this control.

Table 222. Small-leaf Star-hair protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard if the current arrangements are maintained.
Potential management actions	<ul style="list-style-type: none"> Undertake research into germination requirements of the subspecies.

4.44.4 Forestry operations

Plantations

Some of the known populations of this subspecies occur in Radiata Pine (*Pinus radiata*) plantations on sandy soils, and other locations occur in swampy sites in the vicinity to plantations. Some 29% of important populations and 60% of modelled habitat are subject to plantations, which may impact the subspecies through hydrological changes. The swampy habitat of the subspecies is likely to be drier now because of actively growing plantations immediately adjacent, and there is potential for mechanical during plantation management. However, the sites are well documented and plantation managers generally have good prescriptions in place. Conversely, the subspecies needs a degree of soil disturbance to recruit and is present primarily in the soil seedbank for much of its lifecycle. If swampy patches where this plant occurs are subjected to an appropriate fire or soil disturbance event, the subspecies will germinate, however it may not adequately recruit and replenish the soil seedbank if the site is drier through the growing plantations. Plantation managers tend to exclude fire from plantations which would limit recruitment of the subspecies, but if fire occurs at a frequency consistent with its tolerable fire interval, it is likely to benefit the subspecies.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This control was evaluated as poor because there is no species-specific prescription in the Code, and as the subspecies occurs in heathy swamps, waterway protections in the Code do not benefit it.
- The CAR reserve system. The effectiveness of this control for this subspecies has been evaluated as poor as 24% of the subspecies' modelled distribution and 51% of important populations are within the reserve system.
- Local plantation management guidelines. This control was rated as good as both the Catchment Management Authorities and DELWP have developed prescriptions in partnership with the plantation managers to protect and manage the subspecies, which are consistently applied by the relevant land managers.

Table 223. Small-leaf Star-hair protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	<ul style="list-style-type: none"> Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> <i>Ex-situ</i> seedbanking of the subspecies.

4.45 Snowdrop Wood-sorrel (*Oxalis magellanica*)

The Snowdrop Wood-sorrel was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the Central Highlands (45% of modelled habitat), West (40% of modelled habitat), East Gippsland (13% of modelled habitat) and Gippsland (2% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.45.1 Risk Assessment

Table 224. Snowdrop Wood-sorrel risk ratings in the Central Highlands and East Gippsland RFA regions

	Altered rainfall patterns	Forestry operations
Consequence	Extreme	Minor
Likelihood	Likely	Likely
Overall risk rating	High	Medium

4.45.2 Climate change

Altered rainfall patterns

The most serious threat to the species is decreased rainfall due to climate change across its entire distribution. Longer term decline seems likely due to the impacts of climate change, and potentially habitat degradation due to increased fire frequency and intensity. The effect of altered rainfall patterns is likely to be increased by forestry operations as this opens the forest structure to desiccation, although this impact might be mitigated using modified harvesting and forest regeneration practises.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 225. Snowdrop Wood-sorrel protection requirements and recommendations for altered rainfall patterns

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">Establish <i>ex-situ</i> propagation to safeguard populations from becoming extinct.

4.45.3 Forestry operations

Forestry operations

The species' response to timber harvesting and regeneration practises is not documented. However, changes to the vegetation structure and composition due to past forestry operations in the habitat, together with the likely increase in the frequency and intensity of bushfires, may lead to habitat degradation. In the shorter term, forestry operations could impact the tree and shrub layer, opening the forest structure to drying. Based on the 2015 net harvest area layer, 26% of the species' modelled habitat and 10% of VBA points in the Central Highlands RFA region, and 22% of modelled habitat and 3% of VBA point in the East Gippsland RFA region are in merchantable forest. Using the revised operable area layer this reduces to 12% of the species' modelled habitat and 9% of VBA points in the Central Highlands RFA region, and 7% of modelled habitat with no VBA points in the East Gippsland RFA region.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This control has been evaluated as poor as there is no species-specific code prescription for the species across most of its range; however, general prescriptions for the protection and buffering of rainforests also provide protection from forestry operations.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 56% of the species' modelled distribution and 82% of important populations are within the reserve system.
- Modified harvesting and forest regeneration practises. These have been evaluated as satisfactory as they have been implemented in native forest and are designed to further mitigate the potential threat from forestry operations to threatened species and their habitats, however their effectiveness has not been demonstrated.

Table 226. Snowdrop Wood-sorrel protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing species-specific code prescriptions that cover all the species' distribution in any future Code amendments.

4.46 Soft Skullcap (*Scutellaria mollis*)

The Soft Skullcap was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.46.1 Risk Assessment

Table 227. Soft Skullcap risk ratings in the East Gippsland RFA region:

	Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)
Consequence	Moderate	Moderate	Major
Likelihood	Possible	Unlikely	Likely
Overall risk rating	Medium	Medium	High

4.46.2 Fire

Increased fire frequency and intensity

An increase in the frequency and intensity of fire is likely to alter species composition and structural aspects of the habitat, as well as threaten the survival of Warm Temperate Rainforest where this species occurs. Fire may also facilitate deer access and can cause increased competition in the ground strata which may be detrimental to this species. This hazard extends across 80% of the species' populations.

Current controls for this hazard include:

- Planned burning. This control may be effective in reducing the risk of severe bushfires in this species' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 228. Soft Skullcap protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium and because it is a longer-term threat.
Potential management actions	No potential management actions have been recommended for this hazard.

4.46.3 Forestry operations

Forestry operations

This hazard includes direct impacts from machinery activity damaging plants and habitat, and indirect impacts from erosion or downstream deposition, as well as weed introduction and promotion. The species prefers opening of rainforest; it can survive within rainforest but has also been observed regenerating readily post-fire where the rainforest canopy had been consumed. This hazard extends across less than 5% of the species' important populations and known occurrences.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as satisfactory because although there is no species-specific prescription for the species in the Code, other more general prescriptions such as protection and buffering of rainforests, old growth forests and waterways provide protection from forestry operations and are generally applied appropriately.

- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 61% of the species' modelled distribution and 70% of important populations are within the reserve system.

Table 229. Soft Skullcap protection requirements and recommendations for Forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.46.4 Invasive species

Invasive vertebrate (deer)

The greatest current threat to the species is likely to be the degradation by Sambar of Warm Temperate Rainforest and its ecotones with Riparian Forest and sheltered gullies within Damp, Wet or Lowland Forest. Sambar have a documented capacity to denude the understorey of such forests by targeted browsing of trees, shrubs and vines, and concentrated trampling, wallowing, and rutting in damp sites, eliminating stands of herbaceous vegetation on the forest floor. Sambar have undergone a population increase across East Gippsland (Watter et al. 2020), and their projected impact on gully vegetation poses a threat to the long-term persistence of the species. Current deer activity is projected to eliminate the remaining occurrences within the next few decades. This hazard extends across 95% of the species' populations.

Current controls for this hazard include:

- Exclusion Fences. This has been evaluated as good for the few examples of exclusion fences occurring, but it is limited in its extent.
- Targeted deer control. This has been evaluated as poor as it is limited in extent.

Table 230. Soft Skullcap protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Potential management actions	<ul style="list-style-type: none"> • Expand deer control programs and targeted deer culling within important populations areas that are bushfire impacted.

4.47 Spicy Everlasting (*Ozothamnus argophyllus*)

The Spicy Everlasting was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (99% of modelled habitat) and Gippsland (1% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.47.1 Risk Assessment

Table 231. Spicy Everlasting risk ratings in East Gippsland and Gippsland RFA regions:

	Drying climate	Forestry operations
Consequence	Moderate	Moderate
Likelihood	Possible	Possible
Overall risk rating	Medium	Medium

4.47.2 Climate change

Drying climate

The species is threatened in the long-term by climatic drying and warming resulting in changes in vegetation structure, such as increasing tree and shrub density and potential changes in soil microflora, particularly of mycorrhizal fungi. These impacts are likely to be exacerbated by imposed fire regimes, increasing the risk of repeat fire and recruitment failure. This hazard extends across 70% of the species' modelled habitat.

Current control measures for this hazard are not effective in managing the risk to this species at the scale relevant to its conservation.

Table 232. Spicy Everlasting protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Establish <i>ex-situ</i> propagation;• Ensure important populations are appropriately recorded and available for values checking purposes; and• Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.47.3 Forestry operations

Forestry operations

Based on the 2015 net harvest area layer, 15% of the species' modelled habitat and 11% of its important populations are in merchantable areas. Using the revised operable area layer, the species' modelled habitat is reduced to 5% in merchantable areas and its important populations stay the same at 11%. The combination of disturbance associated with timber harvesting and any subsequent fires may result in disruptions to regeneration of this species and therefore population declines.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This control has been evaluated as poor as the species does not have species-specific code prescriptions in the East Gippsland FMA where most of its modelled habitat occurs.

- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 66% of the species' modelled distribution and 68% of important populations are within the reserve system.

Table 233. Spicy Everlasting protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Ensure important populations are appropriately recorded and available for coupe planning purposes; and • Consider reviewing and extending species-specific code prescription to East Gippsland as part of any future Code amendments.

4.48 Sticky Wattle (*Acacia howittii*)

The Sticky Wattle was listed as Vulnerable in Australia under the FFG Act in May 2021. The species occurs in the Gippsland (76% of modelled habitat), Central Highlands (7% of modelled habitat), North East (4% of modelled habitat) and West (1% of modelled habitat) RFA regions, with 12% of modelled habitat in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.48.1 Risk Assessment

Table 234. Sticky Wattle risk ratings in the Gippsland RFA region:

	Increased fire frequency and intensity	Plantations	Invasive vertebrate (deer)	Native browsers and grazers
Consequence	Major	Major	Moderate	Moderate
Likelihood	Rare	Likely	Likely	Likely
Overall risk rating	Medium	High	Significant	Significant

4.48.2 Fire

Increased fire frequency and intensity

The species may be threatened by climatic drying and increased fire risk across 100% of its range. This hazard may act synergistically to increase the exposure of recruiting stands to the risk of recruitment failure in response to extreme drought stress or targeted browsing pressure and, therefore, of seedbank depletion. Young recruits can flower and set seed within 5-7 years of germination, therefore the risk of repeat fire events at intervals approaching the tolerable fire interval for the species is low, since few habitats accumulate sufficient fuel levels to support intense fire within the tolerable fire interval. In the longer term, however, this risk is projected to increase.

This hazard interacts with all other hazards that expose populations and small, isolated, or disjunct remnant stands to disturbance including grazing/browsing threats, seed-bank exhaustion and other climate change pressures that drive plant mortality, including drought and drying effects.

Current controls for this hazard include:

- The *Climate Change Act 2017* and associated mitigation strategies. These controls are strategic in nature and are not considered to be effective in managing the risk to this species at the scale relevant to its conservation.
- Victorian Conservation Seedbank. This control has been evaluated as poor because Sticky Wattle is only present in the VCS by a single collection.

Table 235. Sticky Wattle protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Maintain seed collection representative of the species range.

4.48.3 Forestry operations

Plantations

The establishment and harvesting of plantations of Radiata Pine and Shining Gum potentially impacts 72% of the species' VBA points and 49% of important populations in the Gippsland RFA region. This species grows along roadsides and in the plantation estate which potentially leads to direct mortality, habitat loss and loss of seedbank. Use of

herbicides as part of plantation management may impact this species. In South Gippsland, where incremental habitat loss and degradation associated with agriculture and plantation management is a continuing threat, decline may be potentially compensated by seedbank recruitment in areas no longer managed as plantations.

The impacts of plantations are likely to interact with climate change and herbivore threats, such as wallabies browsing regeneration which puts pressure on populations in plantations when harvesting or other disturbances such as bushfire occur. In the event of a significant landscape-scale bushfire event, pre- or post- harvesting, the outcome for individual stands of Sticky Wattle will depend significantly on successful recruitment and seedbank replenishment.

Current controls include:

- The *Code of Practice for Timber Production 2014*. This control was rated as poor to satisfactory because waterway buffers may protect parts of the private land population, however the species-specific code prescription application of SMZ's in plantations would inhibit plantation management and is therefore unrealistic.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 44% of the species' modelled distribution and 38% of important populations are within the reserve system.

Table 236. Sticky Wattle protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard as this is a longer-term threat.
Priority management actions	<ul style="list-style-type: none"> • Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Survey when the species is flowering (October) to identify stands outside of plantations themselves but vulnerable to roadside management; • Include on local council registers of significant roadside vegetation or other regulatory mechanisms to ensure protection; • Within plantations, consider establishing zones around mature plants with the intention to leave a network/patchwork of mature stands that can recruit and replenish the seedbank; and • Research to identify if sub-populations on private land in South Gippsland are being compensated by seedbank recruitment in areas no longer managed as plantations.

4.48.4 Invasive species

Invasive vertebrate (deer)

Feral deer, particularly Sambar, threaten all moist forest taxa. Because the Sticky Wattle occurs in moist forests, deer therefore have the possibility of impacting 100% of its populations. Deer use areas with fresh regrowth post-disturbance, such as fire or harvesting, which can lead to reduced or failed recruitment, browsing impacts and direct mortality. Compared to other browsers like the Black-tailed Wallaby, deer have a greater impact per animal. This hazard interacts with bushfire, planned burning, and burns following harvesting, as these mechanisms generate mass germination post fire which attract deer.

Current controls include:

- Targeted deer control. This control has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from
- Deer deterrents (urine pots, sensor light). This control has been evaluated as poor because trials on the Bogong High Plains show they are only effective for a short-time period as deer become acclimatised. This control may be useful for a small area or site with high concentrations of extremely threatened species.

Table 237. Sticky Wattle protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Investigate feasible options to manage impacts of deer on important populations; and • Include important populations of this species in assets to be targeted during regional deer control programs.

Native browsers and grazers

Post-harvest regeneration from seed is targeted by the Black-tailed Wallaby which prefer viscid wattles. Black-tailed Wallaby browsing damage occurs in both plantation and native forestry operations and following fire, with the possibility of impacting 100% of the species' populations. This hazard can lead to reduced or failed recruitment, browsing impacts and direct mortality.

Current controls for this hazard include:

- Control of wallabies for post-timber harvesting regeneration. This control has been evaluated as poor; it is not used at a scale likely to be effective and has raised animal welfare concerns.

Table 238. Sticky Wattle protection requirements and recommendations for native browsers and grazers

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Investigate feasible options to manage impacts of Swamp Wallabies on important populations.

4.49 Tall Plume-grass (*Dichelachne robusta*)

The Tall Plume-grass was listed as Vulnerable in Victoria under the FFG Act in May 2021. The species has VBA points in the East Gippsland (100% of VBA points) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.49.1 Risk Assessment

Table 239. Tall Plume-grass risk ratings in East Gippsland RFA region:

	Drought	Forestry operations	Native browsers and grazers
Consequence	Moderate	Moderate	Major
Likelihood	Possible	Possible	Unlikely
Overall risk rating	Medium	Medium	Medium

4.49.2 Climate change

Drought

The species is likely to be moderately drought tolerant once established, however recruitment may be severely impacted by drought. Only 75% of the locations are likely impacted, because one site is in a damper area and could be buffered in the 20-year time frame. Fire, mechanical disturbance and/or grazing may increase the species' reliance on recruitment and therefore increase susceptibility to drought impacts. This hazard may lead to direct mortality or reduced recruitment.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 240. Tall Plume-grass protection requirements and recommendations for drought

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium, and because it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Maintain seed collection representative of the species range; and• Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.49.3 Forestry operations

Forestry operations

Based on the 2015 net harvest area layer, 43% of the species' VBA points are in merchantable areas. Using the revised operable area layer, this is reduced to 19%. Due to the rarity of the species, it is particularly vulnerable to stochastic events, such as mechanical damage from forest roading and harvesting operations.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as uncontrolled as there is no species-specific code prescription, and other general Code prescriptions are unlikely to provide indirect protection.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 100% of the species' important populations and 56% of post-1970 VBA points are within the reserve system. However, the species is very poorly known, so more records may occur outside of the protected area network.

Table 241. Tall Plume-grass protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Undertake surveys and detailed mapping of populations; and • Consider introducing a species-specific code prescription as part of any future Code amendments.

4.49.4 Invasive species

Native browsers and grazers

Very small populations are susceptible to severe impacts from a single grazing event from macropods or wombats. The growth form may be susceptible to grazers pulling the whole plant out of the ground leading to direct mortality. Grazing impacts may increase susceptibility to drought impacts, which could lead to seedbank depletion, exhaustion, and local extinction. This hazard applies to the species' entire distribution.

This hazard has been evaluated as uncontrolled.

Table 242. Tall Plume-grass protection requirements and recommendations for native browsers and grazers

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Evaluate feasibility of exclusion fencing for important populations.

4.50 Tasmanian Wax-flower (*Philotheca virgata*)

The Tasmanian Wax-flower was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.50.1 Risk Assessment

Table 243. Tasmanian Wax-flower risk ratings in East Gippsland:

	Drought; increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)	Phytophthora cinnamomi
Consequence	Major	Major	Major	Major
Likelihood	Almost certain	Unlikely	Likely	Unlikely
Overall risk rating	High	Medium	Significant	Medium

4.50.2 Climate change; Fire

Drought and increased fire frequency and intensity

This is a species of relatively moist, sheltered sites and as such, is likely to be particularly susceptible to a drier climate and consequent increased fire frequency. The species may be at long-term risk of recruitment failure in response to repeat fire events at intervals approaching the tolerable fire interval for the species. If *Phytophthora* is present in the species' habitat, its virulence and impact on the shrub is very likely to be much more severe in a climate-changed environment (Green 2016).

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 244. Tasmanian Wax-flower protection requirements and recommendations for drought and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for these hazards as they are longer-term threats.
Potential management actions	<ul style="list-style-type: none"> Collect seed for the VCS from across the species' range as insurance against catastrophic loss; Ensure that important populations are mapped, recorded, and made available for fire management planning purposes; and Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.50.3 Forestry operations

Forestry operations

The topography of the species' site suggests that timber harvesting activity is unlikely to be within an area to cause damage to the plant, however there is a possibility of damage by felling timber and from post-timber harvesting regeneration burns. Interaction with climate warming and drying as well as increased exposure from a reduction in the surrounding forest is likely to accelerate the drying of the site, rendering it unsuitable for occupation by the species. Based on the 2015 net harvest area layer 27% of the species' modelled habitat is in merchantable areas, however this is likely to be a significant overestimate, and this hazard is more likely to impact around 5% of the species' population.

Using the revised operable area layer, less than 5% of the species' modelled habitat is in merchantable areas. Populations of the species are small and geographically very restricted to three known sites, only one which is not in a National Park.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as satisfactory if there is strict adherence to guidelines. The known population not in Coopracambra National Park (The Three Sisters) is the only population likely to be affected by RFA activities. The site is steep and rocky, and according to the Code has (or will have) at least a 200 m buffer from timber harvesting activities. Thus, provisions of the Code should amply protect the population during timber harvesting. But care must be exercised, should post-timber harvesting burns be done on any nearby felled coupes, that fire is kept well clear of the species' stand.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 53% of the species' modelled distribution and 84% of important populations are within the reserve system.

Table 245. Tasmanian Wax-flower protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Pre-timber harvesting surveys to ensure the site is secure, including ground truthing prior to any timber harvesting activities to ensure site was well clear of any potential damage; • <i>Ex-situ</i> conservation measures such as seed in the VCS (ideally from all known populations) and/or living collections of genetic diverse individuals from each population; • Attempt translocations of young plants to a safe, matched site away from current threats; • Conduct targeted searches of areas modelled as likely habitat; and • Refine modelling to include only known accurately plotted sites to attempt to locate currently unknown populations.

4.50.4 Invasive species

Invasive vertebrate (deer)

Observations of related, structurally similar species suggests that the species is likely to be threatened by targeted browsing of Sambar, causing direct mortality and limiting recruitment. There is also likely to be increased destruction from antler rubbing by Sambar – potentially a more severe hazard than direct browsing. The related shrub, Shiny Nematolepis, is targeted by Sambar for antler rubbing, resulting in ringbarking and death to an estimated 20% of the entire population of some 400 individuals known around 2010 (Neville Walsh pers. obs.). This effect is not restricted to smaller plants of 'browsable' size, but rather is more severe on adult shrubs/trees. There is the potential for deer to introduce/spread likely pathogen *Phytophthora cinnamomi*.

Current controls for this hazard include:

- The Victorian Deer Control Strategy. This has been evaluated as poor as damage by Sambar continues to increase despite the Strategy. Being a member of the Rutaceae, risks to the Tasmanian Wax-flower are likely to be elevated relative to other species of similar stature. Other Rutaceous species known to be targeted by Sambar include Yellow-wood and Shiny Nematolepis, both threatened species in Victoria (Bilney 2013; Murphy et al. 2008)

Table 246. Tasmanian Wax-flower protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Potential management actions	<ul style="list-style-type: none"> • Deer control such as fencing, shooting, and baiting. Fencing is an extreme response and probably difficult to implement given site conditions, but can be used if damage is evident and significant; • <i>Ex-situ</i> conservation measures such as seed in the VCS (ideally from all known populations) and/or living collections of genetic diverse individuals from each population; • Attempt translocation of young plants to a safe, matched site away from current threats; • Conduct targeted searches to sites modelled as likely habitat; and • Refine modelling to include only known accurately plotted sites to attempt to locate currently unknown populations.

4.50.5 Population dynamics

Phytophthora cinnamomi

Phytophthora cinnamomi can cause root rot in the root systems of host species, resulting in direct mortality as well as damage to root systems. The species is known to be hosts to *P. cinnamomi* in Tasmania, and if *Phytophthora* (either *P. cinnamomi* or other species yet to be determined) is shown to be present in the habitat of the Tasmanian Wax-flower, its virulence and impact on the shrub is very likely to be much more severe in a climate-changed environment (Green 2016). Other closely related members of the Rutaceae (e.g., *Phebalium* spp.) have been shown to be highly susceptible to *Phytophthora* infection (Wan et al. 2019). This hazard has the potential to extend across 5% of the species' population. While susceptibility is high, the likelihood of spread of the pathogen to occupied sites is uncertain, although deer are potential vectors of the soil-borne spores. As long as sites remain relatively unstressed by drought, even if *Phytophthora* is present, mortality may not be inevitable.

Current controls for this hazard include:

- No specific control measures are in place, but disease management occurs in some Parks and Reserves. This has been evaluated as poor because as far as is known there are no provisions to limit the spread of *P. cinnamomi* in habitat areas for the species. The spread of *P. cinnamomi* from infected sites into parks and reserves, including roadsides, is under the control of a state or local government authority and is a listed Threatening Process under Victoria's Flora and Fauna Guarantee Act 1988.

Table 247. Tasmanian Wax-flower protection requirements and recommendations for *Phytophthora cinnamomi*

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • <i>Ex-situ</i> conservation measures such as seed in VCS (ideally from all known populations) and/or living collections of genetic diverse individuals from each population; • Attempt translocation of young plants to a safe, matched site away from current threats; • Conduct targeted searches to sites modelled as likely habitat and refine modelling to include only known accurately plotted sites to attempt to locate currently unknown populations; and • Ensure drainage from tracks is away from stands of the species; and close attention to vehicle hygiene procedures (thorough washing of tyres etc. prior to entering subject areas).

4.51 Tree Geebung (*Persoonia arborea*)

The Tree Geebung was listed as Endangered in Australia under the FFG Act in May 2021. The species has modelled habitat in the Central Highlands (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.51.1 Risk Assessment

Table 248. Tree Geebung risk ratings in the Central Highlands RFA region:

	Increased fire frequency and intensity	Forestry operations	Invasive invertebrate	Invasive vertebrate (deer)	Invasive vertebrate (rodents)
Consequence	Extreme	Moderate	Moderate	Major	Minor
Likelihood	Possible	Possible	Rare	Possible	Possible
Overall risk rating	High	Medium	Low	Significant	Medium

4.51.2 Fire

Increased fire frequency and intensity

Future decline of the species is based on a continuing decline in numbers and habitat, based on current and projected elevated bushfire frequencies below the tolerable fire interval for the species because of climate change. Frequent disturbance that removes older specimens may lead to a diminished soil seed bank and subsequent longer-term decline in abundance. The scale of the 2019-20 bushfires indicate that an event is possible despite no historic precedent. Climatic change and fire events can also favour the growth of some invasive weeds. Current forestry operations and management practices in the wet forest parts of the species' distribution may also increase the risks and exacerbate the effects of bushfires (e.g. Furlaud et al. 2021). However, the strength of this relationship is contested within the scientific community (e.g. Keenan et al. 2021), and the extent of this effect may be less significant in the face of mega fires driven primarily by extreme heat and drought caused by human-induced climate-change (e.g. Bowman et al. 2021). Whilst bushfires pose an immediate risk, it may take another 30-50 years before climate change causes very serious impacts to this species.

Current controls for this risk include:

- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.
- Bushfire suppression. The risk to this species is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on this species.
- Insurance collections. This has been evaluated as poor as this species is represented in the VCS only by a single collection from Mt. Donna Buang Road.

Table 249. Tree Geebung protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as the risk is longer-term.
Potential management actions	<ul style="list-style-type: none"> • Collect seed for the VCS from across the species' range as insurance against catastrophic loss; and • Ensure that important populations are mapped, recorded, and made available for fire management planning purposes.

4.51.3 Forestry operations

Forestry operations, salvage harvesting and roading

Disturbance from timber harvesting and associated roading and forest regeneration practises is likely to occur in parts of its range, with approximately 24% of the species' modelled distribution in merchantable areas based on the 2015 net harvest area layer. Using the revised operable area layer, this is reduced to 9%.

While it is understood that VicForests has adopted alternative harvesting practices, clear-fell forestry operations are thought to eliminate most of the mature resident plants within a harvested coupe. Anecdotal information indicates that regeneration following timber harvesting is variable, although prolific germination has been observed in some circumstances; the reasons for this are not known. Spatial analysis of likely habitat for Tree Geebung on all land tenures indicates that 44% occurs within the CAR reserve system, including parks, reserves, and special protection zones in State Forest. Further areas are excluded from harvesting as species-specific protections for the species are included in the Code. In recent years, modified harvesting and forest regeneration practises have been implemented in native forest that are designed to further mitigate the potential threat from forestry operations to threatened species and their habitats.

Salvage harvesting following bushfire may interrupt the post-fire recovery of this species, although seedling recruitment can be prolific following disturbance, so any impacts might be relatively modest. Forestry operations including road construction may play a role in the establishment and spread of weeds.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as poor because while mature individuals are generally protected from harvesting, they may be killed during the subsequent regeneration burning operations.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor to satisfactory as 54% of the species' modelled distribution and 52% of important populations are within the reserve system.

Table 250. Tree Geebung protection requirements and recommendations for forestry operations, salvage harvesting and roading.

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	<ul style="list-style-type: none"> • Investigate feasible options to improve survival of mature individuals throughout the harvesting and regeneration operations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Clarify current Code prescription; and • Ensure adequate pre-harvest surveys and monitoring of survival of mature individuals.

4.51.4 Invasive species

Invasive invertebrate

Larvae of micro-wasps have been observed to eat the developing embryos, with up to 80% of seed possibly being destroyed in this manner. Climate change could increase the magnitude of this threat significantly. The risk assessment considers that a major shift in conditions that favour an invasive invertebrate that predated Tree Geebung seed would have a significant impact on the species' long-term persistence, but not on short-term survivorship of individual plants. No plant losses are expected to result from the impact, and there would be available time to research and deploy some form of invertebrate management program possibly including biological control. The risk would escalate however, if a large-scale disturbance event destroyed existing mature plants and therefore exposed the population to much higher extinction risk, but this risk would be at a longer timeframe than 20-years. Invertebrate outbreaks that have decimated native species have been documented in recent years, usually in relation to eucalypts (Hoffman et al. 2019), and some local outbreaks of leaf-eating insects are known of anecdotally (on River Red-gum (*Eucalyptus camaldulensis*) in Melbourne's outer northern suburbs) that are assumed to be associated with climate change, but possibly act synergistically with other disturbances such as altered hydrology. This hazard possibly extends across all the species' distribution.

Current controls for this hazard include:

- The Victorian Conservation Seedbank. This has been evaluated as poor as the Tree Geebung is present in the VCS by only a single collection from Mt. Donna Buang Road.

Table 251. Tree Geebung protection requirements and recommendations for invasive invertebrates

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level.
Potential management actions	<ul style="list-style-type: none">• Evaluate likely severity of insect attack on this species; and• If significant, identify and evaluate feasible options to mitigate impacts.

Invasive vertebrate (deer)

Field observations indicate that Sambar may pose a threat to this species due to de-barking because of antler rubbing, and some plants show signs of browsing, probably by deer, although the overall impact is relatively low (Tolsma et al. 2012). Bilney (2013) demonstrates the level of impact Sambar can have on preferred target plants, which may interact with timber harvesting and bushfire where these expose Tree Geebung saplings to browsing and antler rubbing disturbances. The attention given to Tree Geebung by Sambar should not be downplayed for its significance at the local scale, where cumulative impacts of the disturbance may result in tree decline or regeneration failure. Unmanaged deer populations pose the greatest threat as the level of impact deer have on Tree Geebung is likely to reflect population densities. Sambar are present in relatively high numbers across the species' range.

Current controls for this hazard include:

- The Victorian Deer Control Strategy. This has been evaluated as poor as deer are very difficult to control at landscape-scales and the current efforts in the Central Highlands and West Gippsland region do not appear to be reducing the populations by any significant amount.

Table 252. Tree Geebung protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Include important Tree Geebung populations as assets to be protected when designing and implementing deer control programs; and• Monitor the impact of deer at Tree Geebung sites.

Invasive vertebrate (rodents)

Tree Geebung may be threatened by herbivory by rodents, probably by the Bush Rat (*Rattus fuscipes*), which are known to feed on the seed. It is possible that all Tree Geebung populations are potentially at risk from this threat although its severity is not clearly established.

This hazard has been evaluated as uncontrolled.

Table 253. Tree Geebung protection requirements and recommendations for invasive vertebrate (rodents)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none">• Evaluate likely severity of rodent herbivory on this species; and• If significant, identify and evaluate feasible options to mitigate impacts

4.52 Tullach Ard Grevillea (*Grevillea polychroma*)

The Tullach Ard Grevillea was listed as Endangered in Australia under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (62% of modelled habitat) and Gippsland (38% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.52.1 Risk Assessment

Table 254. Tullach Ard Grevillea risk ratings in the East Gippsland RFA region:

	Bushfire	Forestry operations
Consequence	Extreme	Major
Likelihood	Rare	Possible
Overall risk rating	Significant	Significant

Table 255. Tullach Ard Grevillea risk ratings in the Gippsland RFA region:

	Bushfire	Forestry operations
Consequence	Extreme	Major
Likelihood	Rare	Unlikely
Overall risk rating	Significant	Medium

4.52.2 Fire

Bushfire

Bushfires are likely to result in significant population changes, cause plant death of mature individuals and trigger a germination/recruitment pulse. 93% of modelled habitat and post-1970 VBA records and 97% of important populations of the species have been affected by bushfires since 2000. Habitat loss may occur from bushfires if the fire regime results in colonisation or dominance by other taxa at the site (likely to be indigenous species), or if the frequency of fire eliminates Tullach Ard Grevillea by preventing successful recruitment and replenishment of the propagule bank. Strong interactions with other hazards are likely, including climate change, deer browsing/trampling and forestry operations due to the pressure these have on natural recruitment processes that may result in local extinction of sub-populations. Temperate extremes and altered weather and temperature patterns could have strong effects on seedling and mature plant mortality/survivorship, pollinator populations, flowering, and seed-set, and invertebrate populations (e.g., Grevillea Leaf Skeletoniser or other currently present invertebrate taxa that become more significant threats over time). The 2019-20 bushfires give a clear indication of the potential for a significant event to occur that would have extreme consequences.

Current controls for this hazard include:

- Bushfire suppression. This has been evaluated as uncontrolled. The species occurs in remote areas that are difficult to access. It is not clear that protection of this species is considered in emergency planning arrangements for bushfires that reach these areas.
- Victorian Conservation Seedbank. This has been evaluated as uncontrolled as Tullach Ard Grevillea is not present in the VCS. The species' Victorian genetic diversity must be conserved to mitigate the risk of further disturbances that could degrade or eliminate discrete sub-populations. Protecting genetic diversity will be critical to maximising its evolutionary potential (Sgro et al. 2011).

Table 256. Tullach Ard Grevillea protection requirements and recommendations for bushfire

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Potential management actions	<ul style="list-style-type: none"> • Conduct research into the fire ecology and population structure of the species across the population; • Identify any site-specific opportunities to enhance bushfire management at important populations where fire has recently occurred; and • Collect seed for the VCS from across the species' range.

4.52.3 Forestry operations

Forestry operations

The species is impacted by forestry operations due to vegetation and soil disturbance by heavy machinery during harvesting and the subsequent impact of regeneration. Given the species is likely to be an obligate seeder, the magnitude of impacts sustained through forestry operations are likely to increase when stochastic disturbance events occur that disrupt episodic recruitment processes. These disturbances disrupt natural regeneration processes by preventing successful seedling recruitment and the replenishment of a local propagule bank (even if this is a naturally short-lived propagule bank). Forestry operations also interact strongly with climate change hazards where they act to promote a suite of relatively resilient (usually common) species to colonise and dominate the habitat of Tullach Ard Grevillea following local disturbances. Other hazards that are likely to interact with forestry operations include deer browsing and trampling given the riparian habitat of the species and tendency for deer to frequent the habitat, disease such as *Phytophthora* spread via soil borne on forestry machinery (however vehicle hygiene practices are required during forestry operations to limit pathogen spread), and roading where roads are constructed across waterways that support the species. Forestry operations could cause a major reduction in population size and the species may be threatened with extinction at a discrete sub-population within the East Gippsland RFA region, although it is likely that impacts will not affect all of the sub-population assuming there are plants located in riparian habitats and that waterway buffers are applied under the Code. Despite the species' rarity, it is at risk of population decline from forestry operations in the East Gippsland RFA region because there are currently no prescriptions that apply if it is observed/recorded within a coupe proposed for timber harvesting. It is also therefore not a target for FPSP searches, and the detection probabilities for this species may not be considered when selecting coupes for survey.

Based on the 2015 net harvest area layer, approximately 14% of the species' modelled habitat in the East Gippsland and Gippsland RFA regions is in merchantable areas. Using the revised operable area layer, this is reduced to 5%. It is possible that forestry impacts coincide with areas affected by 2019-20 bushfire, where the impacts would be extreme.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as uncontrolled in the East Gippsland RFA region as there are currently no species specific prescriptions that apply. They have been evaluated as poor in the Gippsland RFA region as the species has only been recorded once from FPSP surveys and no information is available on whether the SMZ was applied or if the coupe was ever harvested, so this control has not been demonstrated to be effective. Detections of target flora taxa within the RFA region where a prescription applies does not guarantee that all plants will be buffered from timber harvesting disturbances.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 66% of the species' modelled distribution and 63% of important populations are within the reserve system.

Table 257. Tullach Ard Grevillea protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 6a). <p>This hazard does not require interim protections in the Gippsland RFA region based on the overall medium risk level.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription for East Gippsland as part of any future Code amendments; • Improve information the location of important populations in State Forest; • Monitor population size and health of individuals, and assess threats; and • Investigate the species' response to disturbance.

4.53 Upright Pomaderris (*Pomaderris virgata*)

The Upright Pomaderris was listed as Critically Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.53.1 Risk Assessment

Table 258. Upright Pomaderris risk ratings in the East Gippsland RFA region:

	Drying climate; Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)	Small/restricted population (flora)
Consequence	Major	Moderate	Major	Extreme
Likelihood	Likely	Possible	Likely	Almost Certain
Overall risk rating	High	Medium	High	High

4.53.2 Climate change; Fire

Drying climate and increased fire frequency and intensity.

Climatic warming and drying are projected to result in an increasing risk of bushfire frequency, intensity, and landscape scale. This will expose all stands of the species to the rigours of seed-based recruitment, namely recruitment failure, due to intense drought or targeted herbivory by Sambar or Black-tailed Wallaby, seedbank depletion and exhaustion and the risk of local extinction. Field observation over many decades suggests that most *Pomaderris* species have a fickle response to fire with most adults killed outright, a few with weak resprouting and a highly variable seed-based recruitment success. This suggests that the genus is operating in an environment already close to the threshold of tolerance of current fire regimes and recruitment strategies. Upright Pomaderris is a species whose response to fire is neither predictable nor reliable and may help explain the very patchy and equally unpredictable distribution of this and many similar taxa. This hazard extends across all populations of the species.

Current controls for this hazard include:

- Planned burning. This control may be effective in reducing the risk of severe bushfires in this species' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 259. Upright Pomaderris protection requirements and recommendations for drying climate and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as this is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Collect seed for the VCS from across the species' range as insurance against catastrophic loss; and Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.53.3 Forestry operations

Forestry operations

This hazard relates specifically to native forest harvesting which frequently operates in forest types in which this species has been recorded, with approximately 29% of the species' modelled habitat in merchantable areas according to the 2015 net harvest area layer. However, experts noted that due to the patchy distribution of the species, the HDM likely overestimates potential habitat, and using the revised operable area layer merchantable area is reduced to 11%.

Forestry operations, including timber harvesting, regeneration burning or scalping and road construction and maintenance, are likely to result in adult mortality and reliance on recruitment from the soil-stored seedbank for population maintenance. Whenever these operations include regeneration burning, the risks of recruitment failure due to targeted browsing by native or exotic herbivores, extreme drought events or, potentially, intense competition from aggressive primary native colonisers is increased. Field observation over many decades suggests that most *Pomaderris* species have a fickle response to fire with most adults killed outright, a few with weak resprouting and a highly variable seed-based recruitment success. This suggests that the genus is operating in an environment already close to the threshold of tolerance of current fire regimes and recruitment strategies.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as poor. Because the species has a patchy distribution, it is not always likely to be targeted in pre-harvest surveys.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 55% of the species' modelled distribution and 88% of important populations are within the reserve system.

Table 260. Upright *Pomaderris* protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Improve information the location of important populations in State Forest; • Monitor population size and health of individuals, and assess threats; and • Investigate this species' response to disturbance.

4.53.4 Invasive species

Invasive vertebrate (deer)

Sambar have been increasing in population density and penetration across the region (Watter et al. 2020) with increasing evidence of targeted browsing of a diversity of *Pomaderris* species. This growing list includes species in unexpectedly dry, rocky, elevated sites where Sambar had not previously been noted as active. Browsing has been observed of both mature adult plants and juvenile recruits for a variety of *Pomaderris* taxa. If browsing is sustained over successive seasons the likelihood of adult mortality is substantially increased, exposing recruiting subpopulations to recruitment failure and local extinction. Prolonged or repeated browsing is also likely to reduce flowering and seedset. Small and isolated subpopulations are at particular risk of recruitment failure through targeted browsing by Sambar or Black-tailed Wallaby following intense bushfire, planned burning, post-timber harvesting regeneration or extreme drought events. Like many other *Pomaderris* species, with the notable exception of Hazel *Pomaderris* (*Pomaderris aspera*), Upright *Pomaderris* typically occurs in very small, isolated stands with little or no likelihood of recolonisation in the event of local extinction. The only plausible vectors of seed are ants (myrmecochory) which operate at the metre scale. This hazard extends across all the species' populations.

Current controls for this hazard include:

- Targeted deer control. This control has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.
- Deer deterrents such as urine pots and sensor lights. These have been evaluated as poor as they have been trialled on the Bogong high-plateaus and found not to be particularly effective and operate only effectively for a short-time period as the Deer become accustomed to the control. They are useful for small areas with high concentrations of extremely threatened species, however there is a poor likelihood of success for this species.

Table 261. Upright Pomaderris protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is an ongoing hazard operating stochastically.
Potential management actions	<ul style="list-style-type: none"> • Monitor recruiting populations in the first two years following timber harvesting, planned burning and bushfire (these are the three events that will trigger recruitment) to see evidence of browsing by Sambar; and • Given the localised nature of the species, fencing or tree-guarding a proportion of the recruits may be feasible and effective.

4.53.5 Population dynamics

Small/restricted population (flora)

The species is currently only known in Victoria in several dry upslope sites in remote forest between Goongerah and Bonang West north-east of Orbost. Whilst the forest habitat is not uncommon in the district, the likelihood that other occurrences occur elsewhere in the district cannot be predicted. All forest in the general vicinity of the known occurrences is state forest, with 11% of the species' modelled habitat potentially available to timber harvesting. These occurrences are threatened by forestry operations acting synergistically with the impact of Sambar and climatic warming and drying.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as poor, as it is limited by the very small number of known site records for a species which has the potential to occur sporadically across much of the region.

Table 262. Upright Pomaderris protection requirements and recommendations for small/restricted population (flora)

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Potential management actions	<ul style="list-style-type: none"> • Collect seed for the VCS from across the species' range as insurance against catastrophic loss; and • Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.54 Veined Pomaderris (*Pomaderris costata*)

The Veined Pomaderris was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.54.1 Risk Assessment

Table 263. Veined Pomaderris risk ratings in the East Gippsland RFA region:

	Drying climate; Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)
Consequence	Major	Moderate	Major
Likelihood	Likely	Possible	Likely
Overall risk rating	High	Medium	High

4.54.2 Climate change; Fire

Drying climate and increased fire frequency and intensity

Climatic warming and drying are projected to result in an increasing risk of bushfire frequency, intensity and landscape scale which expose all stands of *Pomaderris* species to the rigours of seed-based recruitment, namely recruitment failure due to intense drought or targeted herbivory by Sambar or Black-tailed Wallaby, seedbank depletion and exhaustion and the risk of local extinction. This hazard extends across all populations of the species. Field observation over many decades suggests that most *Pomaderris* species have a fickle response to fire with most adults killed outright, a few with weak resprouting and a highly variable seed-based recruitment success. This suggests that the genus is operating in an environment already close to the threshold of tolerance of current fire regimes and recruitment strategies. Veined Pomaderris is a species whose response to fire is neither predictable nor reliable and may help explain the very patchy and equally unpredictable distribution of this and many similar taxa.

Current controls for this hazard include:

- Planned burning. This control may be effective in reducing the risk of severe bushfires in this species' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this species and its habitat from severe bushfires.
- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.
- Bushfire suppression. The risk to this species is not effectively controlled; the scale and intensity of recent bushfires means that, despite the frameworks and available resources, emergency response does not always mitigate impacts on this species.

Table 264. Veined Pomaderris protection requirements and recommendations for drying climate and increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as this is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Ensure that important populations are mapped, recorded, and made available for fire management planning purposes; and • Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.54.3 Forestry operations

Forestry operations

This hazard relates specifically to native forest harvesting which frequently operates in forest types in which this species has been recorded, with approximately 19% of the species' modelled habitat in merchantable areas according to the 2015 net harvest area layer. Using the revised operable area layer, this reduces to 6%. Forestry operations, including timber harvesting, regeneration burning or scalping and road construction and maintenance, are likely to result in adult mortality and reliance on recruitment from the soil-stored seedbank for population maintenance. Whenever these operations include regeneration burning, the risks of recruitment failure due to targeted browsing by native or exotic herbivores, extreme drought events or, potentially, intense competition from aggressive primary native colonisers is increased. Field observation over many decades suggests that most *Pomaderris* species have a fickle response to fire with most adults killed outright, a few with weak resprouting and a highly variable seed-based recruitment success. This suggests that the genus is operating in an environment already close to the threshold of tolerance of current fire regimes and recruitment strategies. The Veined Pomaderris is an example of a species whose response to fire is neither predictable nor reliable and may help explain the very patchy and equally unpredictable distribution of this and many similar species.

- The *Code of Practice for Timber Production 2014*. There is no species-specific prescription for this species in the Code, however it may receive some protection from other general Code prescriptions. The lack of a specific prescription leads to the effectiveness of the Code being assessed as poor for this species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 66% of the species' modelled distribution and 86% of important populations are within the reserve system.

Table 265. Veined Pomaderris protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Consider introducing a species-specific code prescription as part of any future Code amendments; • Improve information the location of important populations in State Forest; and • Pre-timber harvesting surveys which should be conducted across the region for all FFG listed threatened species, particularly those with patchy and unpredictable distributions such as the Veined Pomaderris.

4.54.4 Invasive species

Invasive vertebrate (deer)

Sambar have been increasing in population density and penetration across the region (Watter et al. 2020) with increasing evidence of targeted browsing of a diversity of *Pomaderris* species. This growing list includes species in unexpectedly dry, rocky, elevated sites where Sambar had not previously been noted as active. Browsing has been observed of both mature adult plants and juvenile recruits for a variety of *Pomaderris* species. If browsing is sustained over successive seasons the likelihood of adult mortality is substantially increased, exposing recruiting subpopulations to recruitment failure and local extinction. Prolonged or repeated browsing is also likely to reduce flowering and seedset. Small and isolated subpopulations are at particular risk of recruitment failure through targeted browsing by Sambar or Black-tailed Wallaby following intense bushfire, planned burning, post-timber harvesting regeneration or extreme drought events. Like many other *Pomaderris* species, with the notable exception of Hazel Pomaderris, Veined Pomaderris typically occurs in very small, isolated stands with little or no likelihood of recolonisation in the event of local extinction. The only plausible vectors of seed are ants (myrmecochory) which operate at the metre scale. This hazard extends across all the species' populations.

Current controls for this hazard include:

- Targeted deer control. This control has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.
- Deer deterrents such as urine pots and sensor lights. These have been evaluated as poor as they have been trialled on the Bogong high-plains and found not to be particularly effective and operate only effectively for a short-time period as the Deer become accustomed to the control. They are useful for small areas with high concentrations of extremely threatened species, however there is a poor likelihood of success for this species.

Table 266. Veined Pomaderris protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is an ongoing hazard operating stochastically.
Potential management actions	<ul style="list-style-type: none"> • Monitoring of recruiting populations in the first two years following timber harvesting, planned burning and bushfire (these are the three events that will trigger recruitment) to see evidence of browsing by Sambar.

4.55 Velvety Geebung (*Persoonia subvelutina*)

The Velvety Geebung was listed as Endangered in Victoria under the FFG Act in May 2021. The species has VBA points in the North East (90% of VBA points) and Gippsland (10% of VBA points) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.55.1 Risk Assessment

Table 267. Velvety Geebung risk ratings in the Gippsland and North East RFA regions:

	Increased fire frequency and intensity	Forestry operations	Invasive plant (weeds)	Invasive vertebrate (deer)
Consequence	Moderate	Minor	Minor	Minor
Likelihood	Likely	Possible	Likely	Likely
Overall risk rating	Significant	Medium	Medium	Medium

4.55.2 Fire

Increased fire frequency and intensity

The main concern with this hazard is if there are multiple fires rather than one off events, which would breach the species' tolerable fire interval. This could result in direct mortality and recruitment failure as the species will not get appropriate soil seed stores to enable regeneration. Drought stress and a drying climate can increase the likelihood of the hazard, with the post-fire regeneration vulnerable to deer and blackberry. During a normal bushfire cycle where the tolerable fire interval is not breached, the species is usually able to respond and regenerate. This hazard has the potential to impact 100% of the species' population.

Current controls for this hazard include:

- Strategic fuel breaks. This control has been evaluated as satisfactory.
- Strategic Bushfire Management plans. This control has been evaluated as satisfactory.
- Direct attack/fire suppression. This control has been evaluated as satisfactory, noting that there are limits to the effectiveness of planned burning in the type of environment that the species occurs in.

Table 268. Velvety Geebung protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Collect seed for the VCS from across the species' range.
Potential management actions	<ul style="list-style-type: none"> • Ensure that important populations are mapped, recorded, and made available for fire management planning purposes; and • Evaluate response to low-intensity fires within its habitat to manage fuel loads and stimulate regeneration.

4.55.3 Forestry operations

Forestry operations

Velvety Geebung is likely to be affected by forestry operations in parts of its range, including through mechanical disturbance and regeneration burning, with approximately 26% of its VBA points in merchantable areas according to the 2015 net harvest area layer. Using the revised operable area layer, this reduces to 13%. Where plants are not detected and appropriately buffered as per the Code, direct mortality and habitat degradation could occur due to crushing. All the hazards assessed are interrelated and one can lead to an increase in the other.

Regeneration burns are unlikely to happen too frequently over the next 10 years, and there is some evidence in former log landings of the species sprouting up within them, so they are potentially resilient to disturbance, however this would depend on the potential of bushfire impacts or other disturbance following forestry operations. There would likely be an intent to preclude harvesting and fire impacts to at least parts of the coupes, such as in gullies and stream areas where the species is more likely to occur. However, regeneration burns may impact plants if they are high intensity fires, unless the plants are retained in reasonably buffered areas where fire is excluded.

Current controls for this hazard include:

- Pre-Harvest surveys. This has been evaluated as satisfactory.
- The *Code of Practice for Timber Production 2014*. This has been evaluated as satisfactory when correctly applied. The species is likely to be more abundant than current VBA records indicate, so forestry can still have a notable impact if coupes aren't surveyed and prescriptions followed.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 85% of the species' important populations and 56% of post-1970 VBA points are within the reserve system.

Table 269. Velvety Geebung protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Monitor the efficacy of harvesting operations to limit physical disturbance to the species and its response to various burn regimes.

4.55.4 Invasive species

Invasive vertebrate (deer)

Deer can rub and ringbark trees, killing mature plants, and suppress recruitment through selectively browsing on seedlings and eating drupes, and has the possibility of impacting 100% of the species' populations. Deer are also a vector for the spread of weeds such as blackberry that outcompete the species.

Current controls for this hazard include:

- Deer control. This has been evaluated as poor due to aerial shooting being restricted to the national park and not extending into the state forest area. There is incidental activity by recreational deer hunters but not enough to suppress deer populations, and access into the area is difficult.

Table 270. Velvety Geebung protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Expand aerial deer control into the State Forest; and • Conduct targeted ground-based deer culling at important populations during the rut to protect older trees, and post-fire for small plants/recruitment.

Invasive plant (weeds)

Blackberry is the main weed that impacts on this species and has the potential to impact around 10 to 15% of the species' populations. However, this depends on disturbance history and the amount of roading in the environment. Blackberry invasion can outcompete the species and can result in habitat loss and degradation. Post-timber harvesting

may increase the amount of blackberry in the area, with areas with a history of harvesting a lot weedier due to the roading network, disturbance of soil, and log landing.

This hazard has been evaluated as uncontrolled as there is nothing feasible available at the landscape scale.

Table 271. Velvety Geebung protection requirements and recommendations for invasive plant (weeds)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Consider the introduction of the Cane Leaf Beetle as a biological control for blackberry; and • Ensure that adequate weed control is conducted following disturbance, including bushfire response, roading, fuel management and forestry operations.

4.56 Violet Bladderwort (*Utricularia violacea*)

The Violet Bladderwort was listed as Endangered in Victoria under the FFG Act in May 2021. The species has VBA points in the West (91% of VBA points) RFA region, with 9% of VBA points occurring in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.56.1 Risk Assessment

Table 272. Violet Bladderwort risk ratings in the West RFA region:

	Drying climate	Plantations	Agriculture	Draining of water	Infrastructure maintenance
Consequence	Major	Moderate	Moderate	Moderate	Moderate
Likelihood	Likely	Likely	Likely	Possible	Possible
Overall risk rating	High	Significant	Significant	Medium	Medium

4.56.2 Climate Change

Drying climate

The species is threatened in the longer term by climatic drying which is projected to reduce the reliability of winter rainfall events, reducing the extent and quality of available habitat, and increasing the risk of seedbank depletion, recruitment failure and local extinction. There is a potential interaction with inappropriate fire regimes at some sites, including through planned burning, because if fires are too hot and soils too dry, this could lead to combustion of organic component in soil, loss of seedbank and potentially the alteration of wetland hydrology due to combustion of peat. Reduced rainfall may also make wet habitats more accessible to draining and agricultural conversion. This hazard extends across 100% of the species' habitat.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 273. Violet Bladderwort protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Establish <i>ex-situ</i> propagation as a safeguard; • <i>In-situ</i> propagation and maintenance of seed bank; • Establish new populations in suitable protected habitat; • The purchase of property by state government to protect populations of this species; and • Ensure landowners are aware of the location of populations and encourage maintenance of drainage patterns.

4.56.3 Forestry operations

Plantations

Many sites are threatened with continuing habitat degradation from large-scale plantation establishment, which interacts with climate change, potentially leading to increased risk of desiccation of habitat. The potential for damage from issues such as spray drift and run-off from track networks may not yet be fully dealt with and the impact of increased water use by regenerating young trees may be exacerbated by reduced rainfall, particularly where remnant wet habitat is less well

buffered. This hazard extends across 17% of the species' post 1970 VBA points and 20% of its important populations and combines records within plantations as well as part of private land.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as poor because while it is assessed in at least some regions, the history of management for protection of included or abutting remnant vegetation has varied across the extent of plantations.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 64% of the species' modelled distribution and important populations are within the reserve system.
- Victorian Planning Provisions and planning schemes. This has been evaluated as poor as this control is considered in relation to the development of new plantations on private land. The existing controls may or may not prevent clearing and lack the requirement of like for like, allowing the progressive loss of threatened habitats. The control does not prevent incremental damage to wetland habitat abutting plantations (e.g., from desiccation or fertilizer/herbicide drift) if the plantations are established on already cleared land.

Table 274. Violet Bladderwort protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard as the risk is longer-term.
Priority management actions	<ul style="list-style-type: none"> • Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Review of strategies to minimise spray drift during plantation management (notably at re-establishment); • Survey potential habitat within existing plantations and planned expansions, with policy for new plantations to ensure remnant habitat is sufficiently buffered; and • Consider increasing buffering for important populations in plantations.

4.56.4 Habitat loss, degradation, and fragmentation

Agriculture

Many sites are threatened with continuing habitat degradation through agricultural intensification, which should be considered as comprising a range of components, notably clearing, fertilizer use and livestock grazing. This hazard is likely to interact with climatic drying to potentially cause local extinction and extends across 20% of the species' habitat. This estimate is based on the proportion of records on private land and habitat modelling, as a best estimator in the absence of more detailed ground survey. The threat will be distributed across the extent of private land and increasing as agriculture becomes more industrial and climate change expands the potential to crop wetland habitats.

Current controls for this hazard include:

- Awareness of landowners of location of populations, which has been evaluated as satisfactory.
- Victorian Planning Provisions and planning schemes. This has been evaluated as poor as it does little to prevent clearing and lack the requirement of like for like, allowing the progressive loss of threatened habitats. In this case it is uncertain how much of the remaining habitat is considered desirable for clearing for agriculture, and consequently an assessment of satisfactory for the control rating may be relevant in the versions of the habitat for this species with less fertile soils. However, the control does not prevent incremental damage resulting from land-use practises such as grazing or fertilizer drift.
- Support programs such as Landcare. This has been evaluated as poor as participation is voluntary. It could potentially be highly effective where implemented, but very much dependant on goodwill and local community support.

Table 275. Violet Bladderwort protection requirements and recommendations for agriculture

Requirement	Recommendation
Priority management actions	Not required for this hazard because in the absence of industrial-scale farming enterprises, the potential threats may be likely to impact in a more incremental manner. However, more detailed understanding of regional trends in agricultural practises is required.
Potential management actions	<ul style="list-style-type: none"> • Investigate potential to enhance permanent protections through covenant schemes in areas supporting populations; • Enforcement of existing legislation; • Adequate seasonally appropriate survey of sites potentially subject to altered land-management; and • Communications and implementation of planning controls where changes in land use may impinge of potential habitat (or wetlands in general).

Draining of water; infrastructure maintenance

Many sites are threatened with continuing habitat degradation through wetland drainage and infrastructure maintenance, which are likely to interact with climatic drying to potentially cause local extinction. This hazard extends across 20% of the species' habitat.

Current controls for this hazard include:

- Awareness of landowners of location of populations, which has been evaluated as satisfactory.

Table 276. Violet Bladderwort protection requirements and recommendations for draining of water and infrastructure maintenance

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Assess populations to determine the level of threat by this hazard; and • Investigate options to improve protection of important populations of this species.

4.57 Wallaby-bush (*Beyeria lasiocarpa*)

The Wallaby-bush was listed as Vulnerable in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (63% of modelled habitat) and Gippsland (37% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.57.1 Risk Assessment

Table 277. Wallaby-bush risk ratings in the East Gippsland and Gippsland RFA regions:

	Increased fire frequency and intensity	Forestry operations and regeneration burning
Consequence	Major	Moderate
Likelihood	Likely	Likely
Overall risk rating	High	Significant

4.57.2 Fire

Increased fire frequency and intensity

Bushfire at a frequency below the species' minimum tolerable fire interval would be seen as detrimental to the survival of the populations impacted, as they would not get to reproductive states of flowering and setting seed before a fire comes through, impacting recruitment. Droughts and more regular rainfall deficits make forest vegetation prone to higher fire frequency and intensity. Frequent fires may interact with flooding on riparian sites with riverine shrubberies possibly exposed to erosion issues during post-fire conditions, especially in response to major drought-breaking rains. This hazard extends across 90% of the species' population.

Current controls for this hazard include:

- Planned burning. This control may be effective in reducing the risk of severe bushfires in this species' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 278. Wallaby-bush protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Potential management actions	<ul style="list-style-type: none">Collect seed for the VCS from across the species' range as insurance against catastrophic loss; andEnsure that important populations are mapped, recorded, and made available for fire management planning purposes.

4.57.3 Forestry operations

Forestry operations and regeneration burning

Forestry operations can cause physical disturbance to the species, resulting in direct mortality of individual plants where there is no SMZ in place. This has the potential to reduce the occurrences of viable populations. The species has been recorded in coupe surveys however is not a target for the FPSP due to the absence of a Code prescription. While it is known to be associated with streams or rocky habitat, it has been observed in other habitat types, therefore the lack of Code prescription puts it at risk in the short term. Regeneration burning post-harvesting, when possibly combined with bushfire, may lead to the minimum tolerable fire interval being exceeded. The species is highly likely to only regenerate from seed fall or soil-stored seed, so exposure to follow up fire may render the species locally extinct, as it would not

have reached reproductive maturity. This is particularly the case post 2019-20 bushfires, where salvage harvesting may be occurring. The tolerable fire interval may be exceeded due to multiple disturbance events in quick succession - a significant risk that may reduce genetic diversity of value to the species' long-term conservation.

Based on the 2015 net harvest area layer, around 13% of the species' modelled habitat and 9% of its important populations are available for timber harvesting. Using the revised operable area layer this is reduced to 6% of the species' modelled habitat and 7% of important populations.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as satisfactory in the Gippsland RFA region, but as the prescriptions do not apply in the East Gippsland RFA region, it is evaluated as uncontrolled in East Gippsland. There is also limited monitoring to assess the effectiveness of an SMZ over verified populations.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 58% of the species' modelled distribution and 74% of important populations are within the reserve system.

Table 279. Wallaby-bush protection requirements and recommendations for forestry operations and regeneration burning

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Management Zone(s) over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better) with the following conditions:</p> <ul style="list-style-type: none"> • The managing authority is required to apply a management area of 200 m radius over individual or collections of post-1970 VBA records (records with an accuracy of 100 m or better). Conduct a site inspection and detailed planning in consultation with the Department to ensure the species is adequately protected during timber harvesting operations (See Map 6a).
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Monitor effectiveness of SMZs over verified populations in the Gippsland RFA region; • Research the species' response to timber harvesting disturbance to assess population change and recruitment processes; and • Establish <i>ex-situ</i> seed collections in the VCS.

4.58 Wavy Swamp Wallaby-grass (*Amphibromus sinuatus*)

The Wavy Swamp Wallaby-grass was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the West (84% of modelled habitat), Gippsland (14% of modelled habitat), and Central Highlands (1% of modelled habitat) RFA regions, with 2% occurring in non-RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.58.1 Risk Assessment

Table 280. Wavy Swamp Wallaby-grass risk ratings in the Gippsland, East Gippsland and West RFA regions:

	Drying climate	Plantations	Agriculture	Invasive plant (weeds)
Consequence	Major	Moderate	Moderate	Moderate
Likelihood	Likely	Possible	Likely	Likely
Overall risk rating	High	Medium	Significant	Significant

Table 281. Wavy Swamp Wallaby-grass risk ratings in the West RFA region only:

	Loss of wetlands	Invasive vertebrate (pigs)
Consequence	Minor	Major
Likelihood	Possible	Likely
Overall risk rating	Medium	Significant

4.58.2 Climate change

Drying climate

Climate change is a threat to the species, including rainfall and wetland recharge, higher temperatures and therefore, higher evaporation rates. Climate change may increase the capacity of some introduced plant species to competitively occupy the habitat and increase the likelihood of attempted agricultural intensification, such as ploughing, cropping, within the habitat. Continuing drying of wetlands, either through climate-change effects or water table draw down from plantations, could concentrate destructive activities of feral animals such as pigs in remaining wetlands. Consequent effects of the hazard on wetlands, particularly those not linked to large, permanent watercourses (as is generally the case for the species' habitat) are likely to be considerable. This hazard extends across all the species' modelled habitat.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 282. Wavy Swamp Wallaby-grass protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Maintain or enhance wetland hydrology to maintain habitat quality.

4.58.3 Forestry operations

Plantations

The species may be threatened by changes to wetland hydrology linked to plantation forestry. Plantations can deplete local ground water aquifers and reduce runoff, leading to drying of wetlands. During harvesting, there can be significant damage to small wetlands if they are not protected from machinery. Increase in water-use by plantations, especially in the younger stages, may increase the impact of a drying climate, which can also lead to runoff and erosion into wetlands, reducing water quality. Continuing drying of wetlands through climate-change effects or water table draw down from plantations, could concentrate destructive activities of feral animals in remaining wetlands. Establishment of plantations in low-lying areas that would once have supported non-harvestable woodland vegetation has rendered any populations that have persisted in these environments susceptible. The change in overall nature of the environment surrounding the wetlands i.e., establishment of plantation monoculture forest where previously quite different vegetation likely existed, will have led to a change in physical and biotic functioning of the wetland such as natural herbivore types and abundance and is unlikely to be beneficial to the species. Plantation operations can also increase weed invasion. Approximately 30% of the species' VBA points are likely to be impacted by plantations in the West RFA region, approximately 13% in the East Gippsland RFA region, and approximately 21% of the species' modelled habitat is likely to be impacted state-wide. However, there is uncertainty how much of the soils, which are often heavy clays, in land surrounding the habitat of this species would be suitable for plantations, therefore the estimate of the potential extent of the hazard is consequently somewhat conjectural and may be a substantial over-estimate of the potential area over which plantations may be impacting the species. Modelling misses small wetlands that could support this species, so on-ground assessment or a simple analysis of aerial photography may be required to detect wetland habitat within coupes.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as satisfactory in the West and Gippsland RFA regions, assuming that wetlands management is appropriately covered by the Code and adhered to by management authorities. However, the establishment of plantations is likely to result, in many areas, in draw-down of the water table, and reduce habitat extent and quality the species. It has been evaluated as poor overall because while it is assessed in at least some regions, the history of management for protection of included or abutting remnant vegetation has varied across the extent of plantations. The potential for damage from issues such as spray drift and run-off from track networks may not yet be fully dealt with, and the impact of increased water use by regenerating young trees may be exacerbated by reduced rainfall, particularly where remnant wet habitat is less well buffered.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as poor as 8% of the species' modelled distribution and 27% of important populations are within the reserve system.
- Victorian Planning Provisions and planning schemes. This has been evaluated as poor, as it is considered in relation to development of new plantations on private land. While the habitat of this species is unsuitable for plantations, the control does not prevent incremental damage to wetland habitat abutting plantations (e.g., from desiccation or fertilizer/herbicide drift) if the plantations are established on already cleared land.

Table 283. Wavy Swamp Wallaby-grass protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard based on the overall risk level of medium.
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Conduct surveys at all plantations that could potentially support wetlands within the modelled distribution of the species; • Increase buffer area around wetlands to reduce impact of draw-down of water table from plantation trees; • Add water to wetlands to maintain habitat quality; • Survey potential habitat within areas proposed for plantations and avoid plantation establishment in areas where known or potential habitat exists; and • Review strategies to minimise spray drift during plantation management, notably at re-establishment.

4.58.4 Habitat loss, degradation, and fragmentation

Agriculture

Threats to the species include the loss of wetlands by draining, cropping, and development, stock grazing and physical damage to wetland habitats. The species is to some extent resilient to the effects of grazing by sheep due to its aquatic to semi-aquatic habitat and the preference of sheep to avoid wet area, however pugging and grazing by cattle has the potential for greater impact on populations of this plant, including reduced water quality and aiding weed invasion. This hazard extends across 5-10% of the species' habitat, as most records are not in private land subject to grazing.

Mechanisms to protect the relevant habitat on private land are very limited, as are resources and the required specialist skills for management of populations of public land.

Current controls for this hazard include:

- CMA streamside frontage programs. This has been evaluated as poor because although these programs can assist with protection and rehabilitation of streams, this is not the core habitat for the species which prefers floodplain wetlands.
- CMA Wetland Tender program. This has been evaluated as poor because whilst this program helped to restrict access to some wetlands and could potentially be very effective, it was only applied to a very small number of sites.
- EPBC Act (listed community Seasonal Herbaceous Wetlands). This has been evaluated as poor as there are limitations on capacity for enforcement and community support within agricultural areas, and a lack of protection for relevant wetland catchments. Potential habitat comprises of small, dispersed wetlands, primarily on private land.
- Victorian Planning Provisions and planning schemes. These has been evaluated as poor as they appear to do little to prevent conversion of land-use to cropping and does not prevent incremental damage resulting from land-use practises such as grazing or fertilizer drift.
- Support programs such as Landcare and Community grants. This has been evaluated as poor overall, however in some areas are satisfactory. This is based on participation being voluntary and potentially highly effective where implemented, but very much dependant on goodwill and local community support.

Table 284. Wavy Swamp Wallaby-grass protection requirements and recommendations for agriculture

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Surveys to locate extant populations and identify strategic refugia; • Ongoing community education related to Seasonal Herbaceous Wetlands; • Providing funding to private landowners who support high quality wetlands in the species' modelled range to fence off access to livestock; and • Inventory of potentially suitable habitat and support for community liaison by CMA and DELWP staff.

Loss of wetlands

Threats to the species include the loss of wetlands by draining, cropping, development, stock grazing and physical damage to wetland habitats. This hazard applies to the West RFA region and extends across 5-10% of the species' populations.

Current controls for this hazard include:

- Native Vegetation Regulations (Victorian Planning Provisions)
- Environmental Impact Assessments (EPBC Act) – listing of the Seasonally Herbaceous Wetlands of the Lowland Temperate Plains ecological community.

These have both been evaluated as satisfactory as only a small percentage of wetlands have been cleared or drained in recent years. However, this is probably more related to the fact that most wetlands on the more arable lands were drained historically.

Table 285. Wavy Swamp Wallaby-grass protection requirements and recommendations for loss of wetlands

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Ensure compliance with regulatory protections; • Provide incentives and support to landholders to protect important populations; and • Include measures to maintain and enhance hydrological regimes in relevant strategies.

4.58.5 Invasive species

Invasive vertebrate (pigs)

The species may be threatened by habitat damage by feral pigs, which extends across 50-60% of the species' habitat in the West RFA region. Pigs can potentially rip out plants, turn over the soil layer and aid the invasion of weeds which can degrade water quality.

Current controls for this hazard include:

- Local feral control programs. These have been evaluated as poor as pigs are difficult to control and most control programs to date appear to have failed to eradicate them or significantly reduce numbers.

Table 286. Wavy Swamp Wallaby-grass protection requirements and recommendations for invasive vertebrate (pigs)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Control pigs at sites where the species is present; and • Monitor the impact of pigs at those sites.

Invasive plant (weeds)

The species may be threatened by changes to wetland hydrology linked to weed invasion by herbaceous and woody weeds (e.g., Water Couch (*Paspalum distichum*), Toowoomba Canary-grass (*Phalaris aquatica*), Reed Canary-grass (*Phalaris arundinacea*), Grey Sallow (*Salix cinerea*), and Coastal Wattle (*Acacia longifolia* subsp. *sophorae*)). The species is impacted by competition from inundation-tolerant introduced grasses and forbs, exacerbated by elevated nutrient levels, fragmentation of native vegetation, and land-use practises including draining of wetlands. However, in the absence of elevated nutrients and disturbed hydrology, much of the relevant habitat for this species is relatively resilient to weed invasion because of the inundation regime. Climate change can increase the capacity of introduced plant species to competitively occupy the habitat and increase the likelihood of attempted agricultural intensification (e.g., drainage, ploughing, cropping) within the habitat. Establishment of plantations in the vicinity of wetlands may also contribute to desiccation of the habitat. Change in water content of wetlands supporting the species through climate change and/or water table draw-down from proximity to plantations is likely to tip competitive advantage to less specialised aquatic/semi-aquatic weedy taxa. This hazard extends across all the species' habitat, with most of the species restricted to wetlands on plains in the West RFA region, with small numbers of collections from wet sites in montane tableland areas of East Gippsland, and wetlands on the Gippsland Plains and Phillip Island.

Current controls for this hazard include:

- The *Catchment and Land Protection Act 1994*. This has been evaluated as poor as the selective and effective control of semi-aquatic introduced grasses such as Water Couch is difficult, and consequently outside of the scope and resources of most weed control programs. Weeds other than high-visibility ones are poorly managed, and those that are likely to affect populations of the species are more subtle in appearance, thus less likely to attract management actions.
- Targeted invasive species programs. These have been evaluated as poor because selective and effective weed spraying in wetland habitats is difficult and time consuming, especially over broader areas, requiring strategic timing over wetting and drying cycles, and is consequently outside of the scope and resources of most weed control programs. Resources are rarely available for more careful ecological rehabilitation work by skilled revegetators, which requires high-level plant identification skills, and may involve the use of spray-hoods or wiping of weeds, hand removal of plants and selective protection of remnant flora. Very few weed control programs are undertaken in wetland communities that support the species.

Table 287. Wavy Swamp Wallaby-grass protection requirements and recommendations for invasive plant (weeds)

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> • Ongoing support programs for protection and active management of habitat; • Inspection of significant populations to assess level of weed threat and carry out necessary and appropriate weed control; and • Implement available tools to avoid drainage or infilling of wetlands.

4.59 White Supplejack (*Ripogonum album*)

The White Supplejack was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.59.1 Risk Assessment

Table 288. White Supplejack risk ratings in the East Gippsland RFA region:

	Increased fire frequency and intensity	Planned burning	Forestry operations	Invasive vertebrate (deer)	Invasive plant (weeds)
Consequence	Extreme	Moderate	Moderate	Moderate	Moderate
Likelihood	Almost Certain	Possible	Likely	Likely	Possible
Overall risk rating	High	Medium	Significant	Significant	Medium

4.59.2 Fire

Increased fire frequency and intensity

The species is likely to have been significantly depleted because of the documented contraction and elimination of Warm Temperate Rainforest stands across its range in response to catastrophic bushfire. Climate change leads to massive increased fire risk, and recruiting stands are exposed post-fire to the hazards of drought-induced mortality, recruitment failure and targeted browsing. Habitat loss is a longer-term impact whereby the vegetation that regenerates after each fire event fails to recover the structural characteristics of mature rainforest, which is the critical habitat for the species.

The species is described as shortly rhizomatous and has the capacity to resprout from rootstocks where fire intensity is less than extreme, however the resprouts are particularly susceptible to targeted browsing, particularly by Sambar. Sambar won't kill off all the adult plants, but they will target lush recruiting plants where they are juveniles. When a large fire hits a rainforest or rainforest margin with sufficient intensity to destroy the canopy there is a high chance of sclerophyll invasion (typically eucalypts) and stand replacement by eucalypt forest. At the time of fire, most *Ripogonum* canopies are likely to be fire killed, and many examples of this have been seen where stands of rainforest have been impacted by severe fire events. This hazard extends across all White Supplejack populations.

Current controls for this hazard include:

- Planned burning. This control is considered ineffective in this case as the species' habitat is generally not suitable for planned burning. Strategic fuel breaks and associated backburning may however provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 289. White Supplejack protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Ensure that important populations are mapped, recorded, and made available for fire management planning purposes; and Collect seed for the VCS from across the species' range as insurance against catastrophic loss.

Planned burning

Traditionally, planned burns in the general vicinity of rainforest and other riparian vegetation have been reliant on differential moisture gradients to reduce the intensity and impact of fire on all fire-sensitive vegetation types in the riparian environment. Whilst this approach has often worked satisfactorily in the past, recent experience and climate change projections (CSIRO & Bureau of Meteorology 2020) demonstrate the increasing risk of even well-controlled planned burns entering rainforest and its buffers.

All fire in the ecotonal environment threatens to expose fire-sensitive plants to mortality and local extinction, and at greatest risk are elevated epiphytes such as filmy ferns and fork ferns which can be killed even by exposure to sun and wind. The precise impact on the species is unclear since the plant is observed both in intense shade and in the protection of small canopy gaps both within the rainforest stand and sometimes extending into the surrounding ecotone. In the long term, many of these plants are transgressive, rarely achieving sufficient maturity to flower and set seed. In 50 years of field observation, the species has been only very rarely observed in flower or fruit, a phenomenon typical of many rainforest plants across the globe, many of which exhibit mast flowering of the most mature individuals synchronously at rare and unpredictable intervals. Fire in the ecotonal environment, with the risk of fire ingress into the mature rainforest stand, risks mortality or at least crown death of these rare mature individuals, as well as the far greater proportion of sterile and transgressive individuals. This hazard extends across 10-25% of the species' distribution.

Current controls for this hazard include:

- Values checking and strategic bushfire management planning. The effectiveness of these measures has been evaluated as poor at mitigating risk to this species. Values checking relies on existing site records and modelled distribution, and for some taxa site records are not comprehensive. Habitat modelling may also exaggerate actual distributions, particularly for poorly-known taxa.

Table 290. White Supplejack protection requirements and recommendations for planned burning

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">• Review and where possible improve measures to protect Warm Temperate Rainforest during fire management operations; and• Ensure that important populations are mapped, recorded, and made available for fire management planning purposes.

4.59.3 Forestry operations

Forestry operations

This species generally occurs in association with rainforest. An analysis of VBA records showed that ~63% occurred within mapped rainforest or its buffers. In this situation, occurrences should be adequately protected from forestry operations due to the requirements of the Code. The risk to this species from forestry operations in the East Gippsland RFA region was re-assessed in light of new information about the exposure to forestry operations. The experts concluded that, where the species occurred on the margins or outside rainforest and/or its buffers, and especially where the rainforest habitat might have been burnt by bushfires or otherwise disturbed, protection could not be assumed. The experts emphasised the need for additional protections that targeted both the known occurrences and the rainforest habitat where it had been disturbed and stressed the importance of greater survey effort to improve understanding of the distribution and abundance of this species.

The extent of this hazard is sporadic across the range of the species with 5% of post-1970 VBA points and 25% of the species' habitat distribution model potentially available for timber harvesting, based on the 2015 net harvest area layer. Using the revised operable area layer, this reduces to 9% of the species' modelled habitat and 3% of VBA points. The habitat distribution model overestimates the species' range but has important omissions of known records.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. The effectiveness of this control for this species was rated as poor. Concerns regarding the accurate field identification of rainforest following disturbance warrants a more reliable approach to its protection. There is no species-specific prescription for this species in the Code, however

the Code includes general protections for waterways and rainforest including a prohibition on harvesting, the application of buffers and design standards for roads, crossings, and coupe infrastructure.

- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 54% of the species' modelled distribution and 76% of important populations are within the reserve system.

Table 291. White Supplejack protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	<p>Within the East Gippsland RFA region, the Secretary will establish Special Protection Zone(s) to protect Warm Temperate Rainforest and Cool Temperate Rainforest communities including relevant buffers based on the Department's corporate spatial dataset RAINFOR where the rainforest extent has been impacted by high severity fire in the last 10 years (since 2012) (DELWP 2019-20 Fire Severity: Crown Burn and High Crown Scorch). This is to provide protection for the habitat of unrecorded populations of this species where it has been recently disturbed (See Map 4).</p> <p>Within the Central Highlands, East Gippsland and Gippsland RFA regions, the Secretary will establish Special Management Zone(s) of 200 m radius around post-1970 VBA records of this species with 100 m or better accuracy and any new records (See Maps 5a and 5b).</p> <p>Note that permanent protections have been recommended for two Warm Temperate Rainforest communities in East Gippsland (Warm Temperate Rainforest - East Gippsland Alluvial Terraces and Warm Temperate Rainforest - Far East Gippsland). This measure may also provide additional protection and may overlap with areas identified above.</p>
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Management actions	<ul style="list-style-type: none"> • Improve protection for rainforest habitat of this species; • Improve important populations and HDM mapping to incorporate outlying records, particularly in the Lower Snowy and Jones Creek; and • Improve training to better identify application of the prescriptions in the field, with oversight to compliance and regulation groups.

4.59.4 Invasive species

Invasive vertebrate (deer)

Sambar have been increasing in population across the East Gippsland region in the last decade (Watter et al. 2020), infiltrating all districts and forest types, often observed congregating in damper habitats including Warm Temperate Rainforest. Although it is unclear whether Sambar actively target the species, they have been documented to impact lowland and coastal rainforest communities, targeting a wide range of tree and shrub species, such as the Listed Threatened canopy tree Yellow-wood, which has similar foliage texture to the White Supplejack. Many taxa are impacted by Sambar either by browsing, antler rubbing, trampling or wallowing, and for many of these targeted browsing of juveniles or resprouts has eliminated all recruits or transgressive individuals which will inevitably result in the demise of current populations and their local extinction. The species shares with *Eupomatia* the almost unique architecture among Victorian woody plants of being both an upright self-supporting plant with semi-scandent branches often supported by surrounding vegetation as well as a cane-like vine supported by canopy trees and shrubs. These scandent branches are particularly susceptible to being dragged down by Sambar even if they are not intentionally targeted for browsing. Sambar often target regenerating stands following bushfire, planned burns and regenerating timber harvesting coupes, resulting in recruitment failure of seed recruits or resprouting individuals at their most vulnerable stage of development. This hazard extends across the whole of the species' distribution.

Current controls for this hazard include:

- Targeted deer control. This control has been evaluated as poor because targeted culling is patchy, expensive, and challenging to target in remote forest areas. Sambar deer occur across a large area so there is a reservoir of other areas to recolonise from. It is important to note, however, that recent deer control programs carried out throughout East Gippsland show significant advances in ground-based shooting by using thermal imaging, after-dark hunting and in some cases the use of silencers. Targeted control programs should not be considered inappropriate if program funding is sustainable and the target flora species for protection face significant threat from deer activity.

Table 292. White Supplejack protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Monitor representative populations following timber harvesting, planned burning and bushfire, as well as in healthy mature stands, to see evidence of browsing; and • Target Sambar for control particularly after major decline events such as fire or extremely severe drought as there will be a lot more damage following fire or drought.

Invasive plant (weeds)

Some stands of the species, such as those on the Lower Snowy, Cabbage Tree Creek and Bemm River, each of which has extensive upstream areas of freehold farmland which act as reservoirs of invasive exotic plants, are threatened by weed invasion, notably by Blue Periwinkle (*Vinca major*), Wandering Jew (*Tradescantia fluminensis*) and Cape Ivy (*Delairea odorata*), each of which is capable of totally dominating the understorey of otherwise intact rainforest. Highly invasive transformer weeds can compete with native plants, particularly during early stages of both vegetative and seed-based recovery following bushfire, escaped planned burns and timber harvesting operations. Established individuals of the species are unlikely to be seriously threatened by ground cover weeds, although aggressive climbers such as Cape Ivy may compete with mature adult White Supplejack since both can scale the understorey into the canopy. This hazard impacts approximately half of the species' stands.

Current controls for this hazard include:

- Targeted control of highly aggressive invasive exotic weeds. There has been some targeted weed management on the Lower Snowy and some weed control delivered post-fire as part of the BBRR program, but this has been evaluated as poor as it is not applied consistently across affected sites or sustained over time.

Table 293. White Supplejack protection requirements and recommendations for invasive plants (weeds)

Requirement	Recommendation
Priority management actions	Not required for this hazard based on the overall risk level of medium.
Potential management actions	<ul style="list-style-type: none"> • Targeted weed control needs to be scheduled following major disturbance events including fire and flood; and • Once established, a weed control program needs to be maintained at regular intervals and monitored for its effectiveness across the highest priority sites most affected by flooding.

4.60 Whiteroot (*Lobelia purpurascens*)

The Whiteroot was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the East Gippsland (100% of modelled habitat) RFA region. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.60.1 Risk Assessment

Table 294. Whiteroot risk ratings in the East Gippsland RFA region:

	Drying climate	Increased fire frequency and intensity	Forestry operations	Invasive vertebrate (deer)
Consequence	Major	Major	Moderate	Major
Likelihood	Almost certain	Likely	Likely	Likely
Overall risk rating	High	High	Significant	High

4.60.2 Climate change

Drying climate

The species is highly susceptible to climatic warming and drying, resulting in the contraction of available habitat. This hazard is likely to interact with inappropriate fire regimes, in that the dying climate will likely result in more intense bushfire, and as a result change the composition of the vegetation to become more fire prone leading to reduce suitable habitat for the species. This hazard extends across approximately 70% of the species' habitat.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 295. Whiteroot protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none">Collect seed for the VCS from across the species' range as insurance against catastrophic loss.

4.60.3 Fire

Increased fire frequency and intensity

Bushfire is appearing to become more frequent and severe because of climate change. This is likely to be a feedback loop where increased effects of climate change lead to more intense and frequent bushfire, leading to habitat becoming unsuitable for the species to survive. This hazard extends across approximately 80% of the species' habitat.

Current controls for this hazard include:

- Planned burning. This control may be effective in reducing the risk of severe bushfires in this species' habitat depending on the location of the burns and the time elapsed since their implementation. Strategic fuel breaks and associated backburning may also provide valuable protection in some cases for this species and its habitat from severe bushfires.

Table 296. Whiteroot protection requirements and recommendations for increased fire frequency and intensity

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Collect seed for the VCS from across the species' range as insurance against catastrophic loss; and • Ensure that important populations are mapped, recorded, and made available for fire management planning purposes.

4.60.4 Forestry operations

Forestry operations

The majority of the species' sites are along river and creek banks that have code prescriptions for buffer zones, and therefore no harvesting, however there are still several sites for which a buffer zone would not apply. The species' habitat has been exposed to timber harvesting in the past and it is considered that the post timber harvesting recovery of vegetation will most likely be adversely affected, due to significant disturbance to the forest canopy and ground hydrology, leading to drying of the habitat which will reduce this species' ability to survive in the short to medium term. Habitat disturbance during access to coupes can also impact the species. Based on the 2015 net harvest area layer, around 17% of the species' modelled habitat is in merchantable areas. Using the revised operable area layer this is reduced to 5%.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This control has been evaluated as poor to satisfactory. There are species-specific prescriptions under the Code, but only in the Otways FMA where this species does not occur. However, Code prescriptions for waterway buffers and rainforest would provide some protection to the species.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 60% of the species' modelled distribution and 57% of important populations are within the reserve system.

Table 297. Whiteroot protection requirements and recommendations for forestry operations

Requirement	Recommendation
Interim protections	Not required for this hazard due to the small proportion of its likely habitat impacted by this hazard and its relatively high representation within reserved areas.
Priority management actions	<ul style="list-style-type: none"> • Comprehensively search likely habitat and map important populations; and • Establish monitoring sites and collect baseline data.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Where appropriate divert proposed roading/track building away from other than dry upper parts of gullies; • <i>Ex-situ</i> propagation and seed collection from a range of populations to store at VCS. This plant is dioecious, so if living collections are maintained, it is critical that both male and female plants are represented. Seed collections probably provide a safer, simpler mode of protection of genetic diversity; and • Expand species-specific code prescriptions to the East Gippsland RFA region where this species occurs.

4.60.5 Invasive species

Invasive vertebrate (deer)

Pugging, wallowing and excavation by Sambar is a threat to the species, as it opens the shrub layer leading to the drying of habitat. Browsing and pugging caused by deer is likely to have an adverse cumulative effect in relation to the climate change hazard by rendering areas to be unsuitable habitat. With conditions changing to drier, warmer ones, habitat that is attractive to non-native herbivores like Sambar is likely to contract to more permanent streams, focusing destructive activities on those sites, potentially to the further detriment of Whiteroot. This hazard extends to up to 80% of the species' distribution.

While threats are real and acknowledged, Whiteroot is a tenacious species, with an ability to propagate from disturbed root fragments. In many (not all) contexts, it can compete with other disturbance weeds. However, it is rarely a dominant species of the ground layer and is typically patchy.

Current controls for this hazard include:

- The Victorian Deer Control Strategy including aerial and ground shooting. This control has been evaluated as poor, as shooting will only have a very minor effect in reducing populations, and damage by Sambar will continue to increase. Similarly damage by pigs is likely in some areas with some significant patches of damage noted along tributaries of the Genoa River (Neville Walsh pers. obs.).

Table 298. Whiteroot protection requirements and recommendations for invasive vertebrate (deer)

Requirement	Recommendation
Priority management actions	May be required for this hazard. This will be addressed through the development of the action statement.
Management actions	<ul style="list-style-type: none">• Investigate feasible and effective options to protect important populations; and• Establish <i>ex-situ</i> propagation and collecting seeds from a range of populations to store at the VCS.

4.61 Wiry Bog-sedge (*Schoenus carsei*)

The Wiry Bog-sedge was listed as Endangered in Victoria under the FFG Act in May 2021. The species has modelled habitat in the West (92% of modelled habitat) and Gippsland (8% of modelled habitat) RFA regions. Permanent protections are recommended to address any hazards identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management planning.

4.61.1 Risk Assessment

Table 299. Wiry Bog-sedge risk ratings in the West and Gippsland RFA regions:

	Drying climate	Invasive vertebrate (deer and pigs)
Consequence	Major	Moderate
Likelihood	Likely	Likely
Overall risk rating	High	Significant

Table 300. Wiry Bog-sedge risk ratings in the West RFA region only:

	Plantations
Consequence	Moderate
Likelihood	Likely
Overall risk rating	Significant

4.61.2 Climate change

Drying climate

Climatic drying increases the risk of lowering water tables and drying out of peaty wetland habitats, resulting in a contraction in the local extent of suitable habitat. This hazard, combined with increased bushfire at repeat intervals approaching the tolerable fire interval for the species, has the capacity to eliminate recruiting stands permanently with little opportunity for recolonisation since the species has no mechanism for long-distance dispersal. This hazard extends across all the species' distribution.

Current control measures for this hazard are strategic in nature and are not considered effective in managing the risk to this species at the scale relevant to its conservation at this stage.

Table 301. Wiry Bog-sedge protection requirements and recommendations for drying climate

Requirement	Recommendation
Priority management actions	Not required for this hazard as it is a longer-term threat.
Potential management actions	<ul style="list-style-type: none"> Consider options to conserve this species under climate change, including protection of refuges, maintenance of hydrological regimes, translocation to more secure sites and gene mixing to improve its adaptability.

4.61.3 Forestry operations

Plantations

Past harvesting of surrounding forests, including softwood plantations, increases the risk of lowering water tables and drying out of peaty wetland habitats, resulting in a contraction in the local extent of suitable habitat. A history of recurrent timber harvesting in some districts maintains forests in surrounding catchments in permanently young age classes with

well-documented declines in downstream water availability. Approximately 30% of the species' modelled distribution and 9% of the species' VBA points in the West RFA region are within 200 m of plantations and therefore could be impacted.

Current controls for this hazard include:

- The *Code of Practice for Timber Production 2014*. This has been evaluated as satisfactory as controls are consistently applied and appear to be effective, however this has not been demonstrated.
- The CAR reserve system. The effectiveness of this control for this species has been evaluated as satisfactory as 28% of the species' modelled distribution and 97% of important populations are within the reserve system.

Table 302. Wiry Bog-sedge protection requirements and recommendations for plantations

Requirement	Recommendation
Interim protections	Not required for this hazard.
Priority management actions	<ul style="list-style-type: none"> • Work with plantation managers to identify important populations.
Permanent protections	Additional permanent protections may be required in the longer-term.
Potential management actions	<ul style="list-style-type: none"> • Establish <i>ex-situ</i> propagation to safeguard populations if there is a drastic decline in populations.

4.61.4 Invasive species

Invasive vertebrate (deer and pigs)

The habitat of the species is susceptible to destructive excavation by feral pigs. Some wetlands are also threatened by pugging and wallowing by Sambar or Hog Deer (*Axis porcinus*). Combined with the drying climate these hazards are likely to be increased due to deer and pigs seeking out the moist to wet refugia habitat and causing a significant level of habitat damage. This hazard impacts around 20% of the species' distribution.

Current controls for this hazard include:

- Aerial and ground shooting. This has been evaluated as poor as controls are consistently applied however appear not to be effective.

Table 303. Wiry Bog-sedge protection requirements and recommendations for invasive vertebrate (deer and pigs)

Requirement	Recommendation
Priority management actions	Not required for this hazard.
Potential management actions	<ul style="list-style-type: none"> • Establish <i>ex-situ</i> propagation as a safeguard in case populations suffer significant declines; and • Investigate feasible and effective options to protect important populations.

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Appendix 1 – Hazards rated Significant or High

Table 304. Species with high or significant hazards per RFA region.

		Hazard themes rated as significant or high per RFA region					
Common name	Scientific Name	Climate Change	Fire	Forestry Operations	Habitat	Invasive Species	Population Dynamics
Reptiles							
Lace Monitor	<i>Varanus varius</i>		CH, EG, G, NE, W				
Aquatic Fauna							
Claytons Spiny Crayfish	<i>Euastacus claytoni</i>	EG	EG	EG		EG	
East Gippsland Spiny Crayfish	<i>Euastacus bidawalus</i>	EG	EG	EG			
Tubercle Burrowing Crayfish	<i>Engaeus tuberculatus</i>			CH			
Variable Spiny Crayfish	<i>Euastacus yanga</i>	EG	EG	EG			
Plants							
Baw Baw Berry	<i>Wittsteinia vacciniacea</i>		EG			EG	
Beech Finger-fern	<i>Notogrammitis angustifolia</i> subsp. <i>nothofageti</i>	CH, G, W	CH, G, W	G		CH, G	
Black Bog-sedge	<i>Schoenus melanostachys</i>		EG				
Bog Saw-sedge	<i>Gahnia subaequiglumis</i>	EG		EG			
Bolwarra	<i>Eupomatia laurina</i>	EG	EG	EG		EG	
Brackish Plains Buttercup	<i>Ranunculus diminutus</i>	CH, G, NE, W			CH, G, NE, W	CH, G, NE, W	
Bristly Shield-fern	<i>Lastreopsis hispida</i>		CH, EG, W	CH, EG		CH, EG	
Creeping Shield-fern	<i>Lastreopsis microsora</i> subsp. <i>microsora</i>		EG	EG		EG	

Hazard themes rated as significant or high per RFA region							
Common name	Scientific Name	Climate Change	Fire	Forestry Operations	Habitat	Invasive Species	Population Dynamics
Eastern Pomaderris	<i>Pomaderris discolor</i>						
Errinundra Pepper	<i>Tasmannia xerophila</i> subsp. <i>robusta</i>	EG	EG	EG			
Errinundra Shining Gum	<i>Eucalyptus denticulata</i>						
Finger Hakea	<i>Hakea dactyloides</i>	EG	EG	EG		EG	EG
Fingerwort	<i>Lepidozia procera</i>		CH		CH		
Flat Raspwort	<i>Gonocarpus serpyllifolius</i>	EG				EG	
Floodplain Violet	<i>Viola betonicifolia</i> subsp. <i>novaguineensis</i>	CH, EG, G, NE, W				CH, EG, G, NE, W	
Forest Geebung	<i>Persoonia silvatica</i>	EG, G	EG, G	EG		EG, G	
Forest Phebalium	<i>Phebalium squamulosum</i> subsp. <i>squamulosum</i>			CH, EG, G			
Forest Sedge	<i>Carex alsophila</i>						
Gippsland Stringybark	<i>Eucalyptus mackintii</i>						
Jungle Bristle-fern	<i>Abrodictyum caudatum</i>		CH, EG	EG	CH, EG		
Lacey River Buttercup	<i>Ranunculus amplus</i>	G, W		G, W	G, W	G, W	
Lake Mountain Grevillea	<i>Grevillea monslacana</i>						
Lax Twig-sedge	<i>Baumea laxa</i>	G, W			G, W		
Leafless Pink-bells	<i>Tetradlea subaphylla</i>		EG, G	EG		EG, G	EG, G
Long Pink-bells	<i>Tetradlea stenocarpa</i>	CH			CH	CH, NE	
Mountain Bird-orchid	<i>Chiloglottis jeansii</i>			CH			
Naked Sun-orchid	<i>Thelymitra circumsepta</i>		EG, G, W	EG, G, W		EG, G	
Native Hemp	<i>Androcalva rossii</i>	EG	EG			EG	

Hazard themes rated as significant or high per RFA region							
Common name	Scientific Name	Climate Change	Fire	Forestry Operations	Habitat	Invasive Species	Population Dynamics
Oval Fork-fern	<i>Tmesipteris ovata</i>	CH, EG, G	CH, EG, G	EG			
Pale Hickory-wattle	<i>Acacia sporadica</i>			NE	NE	NE	
Purple Coopernookia	<i>Coopernookia barbata</i>	EG	EG			EG	
Rough-barked Apple	<i>Angophora floribunda</i>						
Sandfly Zieria	<i>Zieria smithii</i>		EG, G	EG			
Satinwood	<i>Nematolepis squamea</i> subsp. <i>squamea</i>		EG, W	EG		EG, W	
Selma Saddle Grevillea	<i>Grevillea miqueliana</i> subsp. <i>cincta</i>		G	G			
Slender Fork-fern	<i>Tmesipteris elongata</i>		CH, G, W			CH, G, W	
Small Autumn Greenhood	<i>Pterostylis reflexa</i>	EG					
Small Fork-fern	<i>Tmesipteris parva</i>	CH, EG, G	CH, EG, G	EG			
Small-leaf Star-hair	<i>Astrotricha parvifolia</i> subsp. 1		G	G			
Snowdrop Wood-sorrel	<i>Oxalis magellanica</i>	CH, EG					
Soft Skullcap	<i>Scutellaria mollis</i>					EG	
Spicy Everlasting	<i>Ozothamnus argophyllus</i>						
Sticky Wattle	<i>Acacia howittii</i>			G		G	
Tall Plume-grass	<i>Dichelachne robusta</i>						
Tasmanian Wax-flower	<i>Philotheca virgata</i>	EG	EG			EG	
Tree Geebung	<i>Persoonia arborea</i>	CH				CH	
Tullach Ard Grevillea	<i>Grevillea polychroma</i>		EG, G	EG			
Upright Pomaderris	<i>Pomaderris virgata</i>	EG	EG			EG	EG

Hazard themes rated as significant or high per RFA region								
Common name	Scientific Name	Climate Change	Fire	Forestry Operations	Habitat	Invasive Species	Population Dynamics	
Veined Pomaderris	<i>Pomaderris costata</i>	EG	EG			EG		
Velvety Geebung	<i>Persoonia subvelutina</i>		G, NE					
Violet Bladderwort	<i>Utricularia violacea</i>	W		W	W			
Wallaby-bush	<i>Beyeria lasiocarpa</i>		EG, G	EG, G				
Wavy Swamp Wallaby-grass	<i>Amphibromus sinuatus</i>	EG, G, W			EG, G, W	EG, G, W		
White Supplejack	<i>Ripogonum album</i>		EG	EG		EG		
Whiteroot	<i>Lobelia purpurascens</i>	EG	EG	EG		EG		
Wiry Bog-sedge	<i>Schoenus carsei</i>	G, W		W		G, W		
RFA Regions							Total	
Central Highlands totals (High, Significant)		6, 2	6, 2	0, 4	1, 3	3, 4	0, 0	16, 15
East Gippsland totals (High, Significant)		18, 3	20, 8	2, 20	0, 2	9, 12	2, 1	51, 46
Gippsland totals (High, Significant)		9, 1	6, 8	1, 7	1, 3	5, 6	0, 1	22, 26
North East totals (High, Significant)		1, 1	0, 2	0, 1	1, 1	2, 2	0, 0	4, 7
West totals (High, Significant)		7, 1	2, 4	0, 4	2, 3	4, 3	0, 0	15, 15

Key: **Red** = High risk; **Blue** = Significant risk.

CH = Central Highlands RFA region; EG = East Gippsland RFA region; G = Gippsland RFA region; NE = North East RFA region; W = West RFA region.

Appendix 2 – Methods

Summary of methods

These methods are broadly based on the DELWP risk management guidelines, but they have been modified for application to an environmental context.

Step 1: Establish the context

For each species some key information was provided (pre-filled) to set the context for the species or community. This information included listing status, information on the spatial distribution, fire history and tenure of modelled habitat. A stocktake of relevant literature was also provided where available.

Experts were asked to:

- provide information about their knowledge of the species;
- provide any recommended further sources of information on the species; and
- provide an overall comment on the accuracy of the species Habitat Distribution Model, Important Populations Data Set and VBA records

Step 2: Conduct the hazard assessment per RFA region

In this step experts were asked to describe the major hazards operating on the species or community within each RFA region that it occurs. A hazard can apply equally in each region or may vary between regions. Experts were asked to complete one page per hazard per region (or multiple regions if risk and control ratings are equivalent).

Experts were asked to refer to the information provided in Step 1 in making their assessment.

Experts were asked to:

- identify the hazard or describe any additional hazards;
- provide hazard details (i.e. Any additional information on the hazard, if required such as 'only impacts near the Snowy River');
- describe the mechanism of impact of the hazard on the species; and
- provide a statement on the interaction with other hazards.

Step 3: Evaluation of existing controls

A risk assessment should be performed to establish a realistic view of risks requiring consideration and/or treatment within the context of the risk assessment. Therefore, when performing the risk assessment and discussing hazards, the current controls or policy settings were to be considered.

For each hazard experts were asked to:

- List the controls currently operating to mitigate the hazard, drawing on the general controls list provided to populate this field with any relevant mechanism;
- Assess the effectiveness of the controls (see Table 302 below); and
- Provide an explanation for the rating of the effectiveness of the existing control.

Step 4: Risk assessment

Current risk assessment is an assessment of the risk rating as it stands today, with consideration of all existing controls currently in place. Experts were asked to assess the consequence on the species if the hazard occurs, given the vulnerability of the species or community to the hazard and the effectiveness of the current controls. Experts were then asked to make a judgement on the likelihood of the hazard having the expected consequence and determine the overall risk level according to the likelihood and consequence scales.

In this step experts were asked to provide the following for each risk listed for each RFA region per species or community:

- Consequence (see Table 303 below);
- Likelihood (see Table 304 below);
- Overall risk level (see Table 305 below); and
- Confidence in assessment (see Table 306 below).

Step 5: Urgency

Experts were asked to assess the likelihood of serious or irreversible environmental damage prior to May 2023 to determine if any interim protections are needed in the short term. Experts are asked to provide:

- Likelihood rating of serious or irreversible damage prior to May 2023; and
- An explanation of their rating.

Step 6: Potential measures

Risk management is fundamentally about identifying risks and then treating the risks to ensure that the risk profile is kept within a tolerable level. While it is unlikely that the risks will be eliminated entirely, the purpose of treating risks is to achieve an acceptable risk exposure in the most effective and efficient manner.

This step required experts to identify possible mitigations for the hazards identified in Step 2 where those hazards have been assessed as significant or high overall. We acknowledged that some risks/threats are more manageable than others – if, in the opinion of the assessor, there was no feasible and effective mitigation, this should be stated.

Experts were asked to propose feasible, realistic measures (including regulatory controls, active management and/or further knowledge acquisition) that should be considered to mitigate the identified significant or high risks. Proposed measures could include modifications to existing measures.

Repeat Step 2 – 6 for all relevant hazard/region combinations.

Moderation of risk assessments

A subsequent moderation process was conducted to review all risk assessments to ensure consistency in application of the ratings system. The moderation process involved experienced policy and planning staff to ensure ratings for control effectiveness, consequence and likelihood had been consistently applied, in consultation with expert assessors where relevant.

Reassessment

After the 2021 risk assessment, DELWP was provided with new spatial data from VicForests on their operable area in April 2022. This represents VicForests' view of available and suitable timber resources and covers approximately 160,000 hectares. VicForests have advised that most, but not all, operations will occur within this footprint. In light of this new data, DELWP reassessed the risk of forestry operations to seven rainforest affiliated species (Bolwarra, Bristly Shield-fern, Creeping Shield-fern, Jungle Bristle-fern, Oval Fork-fern, Small Fork-fern and White Supplejack) that were initially assessed as being at risk from forestry and for which the narrowed footprint of potential impact may result in a different view of risk by experts. The revised risk assessments workshops were conducted online with a facilitator from the University of Melbourne, with seven experts participating as assessors. Assessors were chosen to include technical and operational knowledge of the items being assessed and included academics, consultants, ARI researchers and DELWP staff. Assessors considered the potential risk associated with the revised potential area of forestry operations and any new science that has arisen since the 2021 risk assessment was conducted.

Risk was assessed at the end of a 20-year time horizon (at 2042), assuming, for State forests, that:

- No more than 5,000 ha harvesting would occur outside the specified operable area, as mapped;
- Eight years of harvesting (2022 – 2030), consistent with current government policy; and
- No harvesting would occur in the subsequent 12 years (2031 – 2042).

Although details of the spatial configuration of harvesting were unspecified, the aggregate area of harvesting within the delineated operable area over the next eight years was assumed to be no greater than 30,000 ha (of the approximate

160,000 ha contained in the operable area). For the HVP Plantations estate in the Strzelecki Ranges (part of the Gippsland RFA region), it was assumed continued harvesting throughout the assessment horizon to 2042.

The methods used in the assessments followed those of the 2021 risk assessment methodology with three changes. The assessment of likelihood used only quantitative intervals corresponding to the four risk categories (low, medium, significant, high) rather than the more extensive descriptors provided in the guidance document. To accommodate the very considerable uncertainty presented by the context of the assessments, assessors were encouraged to use plausible lower and upper bound likelihood judgments, leading to lower and upper bound judgments of risk. To assess the adequacy of proposed protective measures, each assessor assessed risk under two scenarios: current controls and specified additional protective measures.

The approach to elicitation of expert judgment sought to use elements of best practice where possible. Specifically, assessors included a range of professional backgrounds and organisational perspectives; judgments were made anonymously to insulate against groupthink and deference to authority; assessment sought to reduce language-based ambiguity through discussion of scenarios, hazards and mechanism of harm, and controls; and a second round of assessment following presentation of all round one judgments was conducted to insulate against overconfidence.

Analyses of risk using a matrix represent ordinal data, for which the median is an appropriate descriptor of the pooled judgment of a group of experts. The median judgment for both lower and upper bound risk were reported.

Reference tables

Table 305. Control effectiveness rating

Control Rating	Description
Good	Controls are consistently applied through time and space where the hazard exists and have been demonstrated to be effective.
Satisfactory	Controls are consistently applied through time and space where the hazard exists and appear to be effective, but this has not been demonstrated.
Poor	Controls are consistently applied through time and space where the hazard exists but appear not to be effective or have been demonstrated not to be effective. or Controls are not consistently applied through time and space where the hazard exists.
Uncontrolled	No controls are applied where the hazard exists.

Table 306. Consequence descriptions

Category	Descriptors
Extreme	Extent: Impacts on almost all (> 80%) of the extent of the species/community range OR a majority of particularly high value sites. Severity: Very serious effect on the species' persistence, significant reduction in population size and/or associated habitat: species/community likely to go extinct across the range in the <u>RFA region</u> or any of the discrete sub-populations within a region within the timeframe due to the hazard Duration: Impacts expected to endure over a long time period (e.g. 20 + years) or populations are not expected to recover
Major	Extent: Impacts on a large proportion (60-80%) of the extent of the species /community range or a major amount of high value sites Severity: major effect on the species or community persistence, major reduction in population size and/or associated habitat, species/community may be threatened with extinction across the range in the RFA region or any of the discrete sub populations within the region. Duration: Impacts expected to endure over a major time period 10-20 years
Moderate	Extent: Impacts on moderate proportion (30-60%) of the extent of the species /community range or a moderate amount of high value sites Severity: Moderate effect on the species or community persistence, may be a reduction in population size, unlikely to be threatened with extinction from this hazard Duration: Impacts expected to endure over a moderate time period 5-10 years
Minor	Extent: Limited impacted on the extent of the species/community range (10-30%) or high value sites Severity: minor effect on the species or community persistence, unlikely to lead to population reduction Duration: Impacts expected to endure over a short time period 1-4 years

Category	Descriptors
Negligible	<p>Extent: Negligible effect on the extent of the species/community range, Contained locally within a single site/area</p> <p>Severity: Negligible effect on the species or community persistence:</p> <p>Duration: Impacts expected to endure for a negligible time period and/or under 1 year.</p>

Table 307. Likelihood descriptors

Rating	Description
Almost Certain	<p>The hazard is expected to occur constantly or frequently within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence.</p> <p>In the case of an isolated event, the probability of occurrence is >80% over 20 years at a scale that will cause the expected consequence.</p>
Likely	<p>The hazard is likely to occur in most circumstances within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence.</p> <p>In the case of an isolated event, the probability of occurrence is 50-80% over 20 years at a scale that will cause the expected consequence.</p>
Possible	<p>The hazard might occur within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence.</p> <p>In the case of an isolated event, the probability of occurrence is 20-49% over 20 years at a scale that will cause the expected consequence.</p>
Unlikely	<p>The hazard is unlikely to occur within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence.</p> <p>In the case of an isolated event, the probability of occurrence is 5-19% over 20 years at a scale that will cause the expected consequence.</p>
Rare	<p>The hazard may only occur in exceptional circumstances.</p> <p>In the case of an isolated event, the probability of occurrence is <5% over 20 years at a scale that will cause the expected consequence.</p>

Table 308. Risk matrix

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Extreme
Almost Certain	Medium	Significant	High	High	High
Likely	Medium	Medium	Significant	High	High
Possible	Low	Medium	Medium	Significant	High
Unlikely	Low	Low	Medium	Medium	Significant
Rare	Low	Low	Low	Medium	Significant

Table 309. Confidence in risk assessment¹

Confidence level	Descriptor	Supporting evidence
Highest	Assessed likelihood, consequence or risk is easily assessed to one level, with almost no uncertainty	Recent historical event of similar magnitude to that being assessed in the community of interest or Quantitative modelling and analysis of highest quality and length of data relating directly to the affected community, used to derive results of direct relevance to the scenario being assessed
High	Assessed likelihood, consequence or risk has only one level, but with some uncertainty in the assessment	Recent historical event of similar magnitude to that being assessed in a directly comparable community of interest or Quantitative modelling and analysis use sufficient quality and length of data to derive results of direct relevance to the event being assessed
Moderate	Assessed likelihood, consequence or risk could be one of two levels, with significant uncertainty	Historical event of similar magnitude to that being assessed in a comparable community of interest or Quantitative modelling and analysis with reasonable extrapolation of data required to derive results of direct relevance to the event being assessed
Low	Assessed likelihood, consequence or risk could be one of three or more levels, with major uncertainty	Some comparable historical events through anecdotal information or Quantitative modelling and analysis with extensive extrapolation of data required to derive results of relevance to the event being assessed
Lowest	Assessed likelihood, consequence or risk could be one of four or more levels, with fundamental uncertainty	No historical events or quantitative modelled results to support the levels

1. National Emergency Risk Assessment Guidelines Handbook “: Confidence level descriptions” (page 42), Australian Institute for Disaster Resilience

Appendix 3 – Soil absorption of EVCs

The following tables indicate which ecological vegetation classes (EVCs) fall in which soil absorption capacity (vbt5) type. Wider buffers will apply to low absorption capacity soils for both crayfish and galaxiid prescriptions. EVCs have been assigned to high or low absorption capacity classes in accordance with Nyman et al. (2022) as well as further advice provided by Nyman, Shelley, Lane and Noske (pers. comm. 10/08/2022). Note that the EVCs listed below are only a small subset of all Victorian EVCs. Soil absorption capacity has not yet been assigned to other EVCs.

High absorption capacity EVCs	
Montane Damp Forest	
Montane Herb-rich Woodland	
Montane Wet Forest	
Shrubby Wet Forest	
Swampy Riparian Complex	
Swampy Riparian Woodland	
Wet Forest	
Low absorption capacity EVCs	
Alpine Grassy Heathland	Montane Riparian Thicket
Banksia Woodland	Montane Riparian Woodland
Blackthorn Scrub	Montane Rocky Shrubland
Clay Heathland	Plains Grassy Forest
Clay Heathland/Wet Heathland/Riparian Scrub Mosaic	Riparian Forest
Creekline Herb-rich Woodland	Riparian Forest/Swampy Riparian Woodland/Riparian Shrubland/Riverine Escarpment Scrub Mosaic
Damp Forest	Riparian Scrub
Damp Sands Herb-rich Woodland	Riparian Scrub/Swampy Riparian Woodland Complex
Dry Valley Forest	Riverine Escarpment Scrub
Foothill Box Ironbark Forest	Rocky Outcrop Shrubland
Grassy Dry Forest	Sedge Wetland
Grassy Woodland	Shrubby Damp Forest
Heathy Dry Forest	Shrubby Dry Forest
Heathy Woodland	Shrubby Foothill Forest
Herb-rich Foothill Forest	Shrubby Foothill Forest/Damp Forest Complex
Limestone Box Forest	Sub-alpine Woodland
Lowland Forest	Tableland Damp Forest
Lowland Herb-rich Forest	Valley Grassy Forest
Montane Dry Woodland	Wet Heathland
Montane Grassy Woodland	

Appendix 4 – Maps

The following maps display the location of proposed interim protection measures.

Map 1: Clayton's Spiny Crayfish

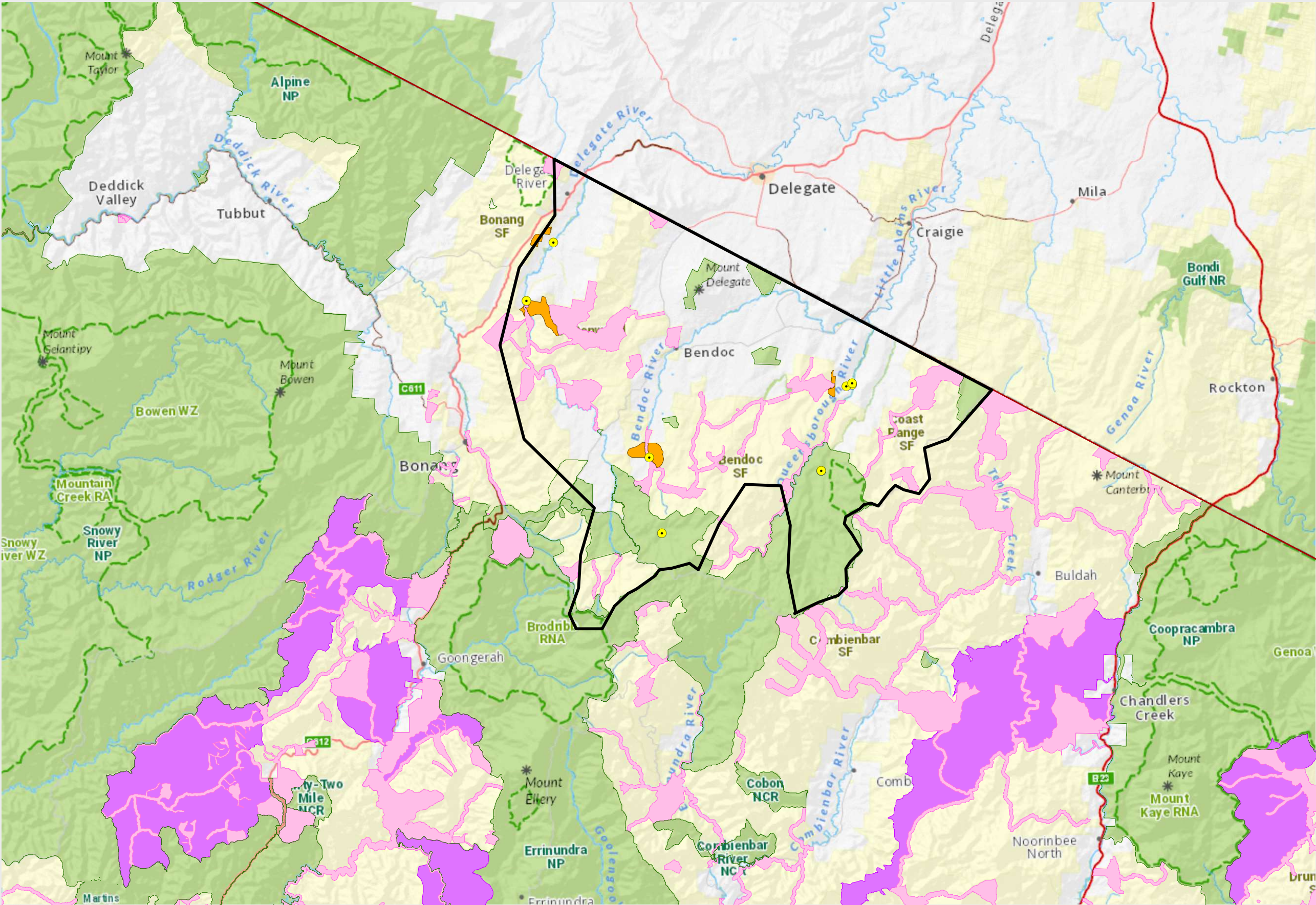
Map 2: East Gippsland Spiny Crayfish

Map 3: Variable Spiny Crayfish

Map 4: Warm and Cool Temperate Rainforest

Map 5a, b: Rainforest affiliated species

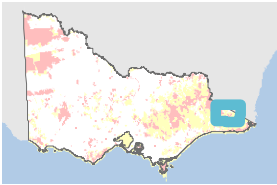
Map 6a, b: Restricted and limited range plants



Legend

- Detections
- Proposed Special Management Zone
- Catchment boundary
- RFA boundary
- Parks and reserves
- Special Protection Zone
- Immediate Protection Area

SMZ boundaries have been drafted to reflect topography but are provisional and subject to change.



22 August 2022

Map Scale 1:250,000

Kilometres

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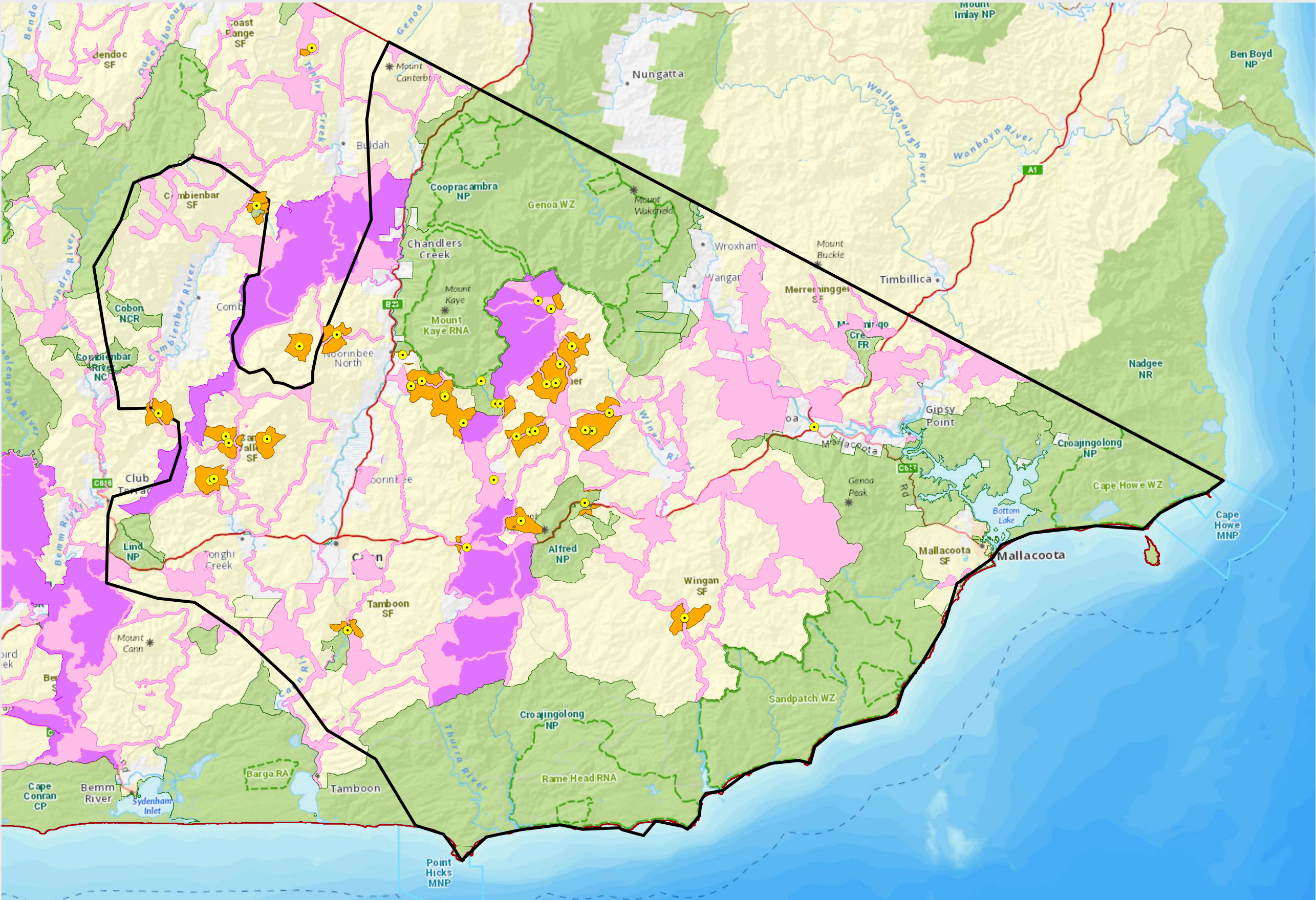
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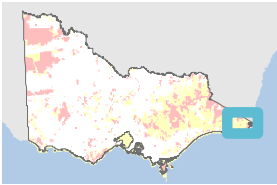
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Legend

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- Special Protection Zone
- Immediate Protection Area

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Map Scale 1:318,657

Kilometres

0 4.5 9

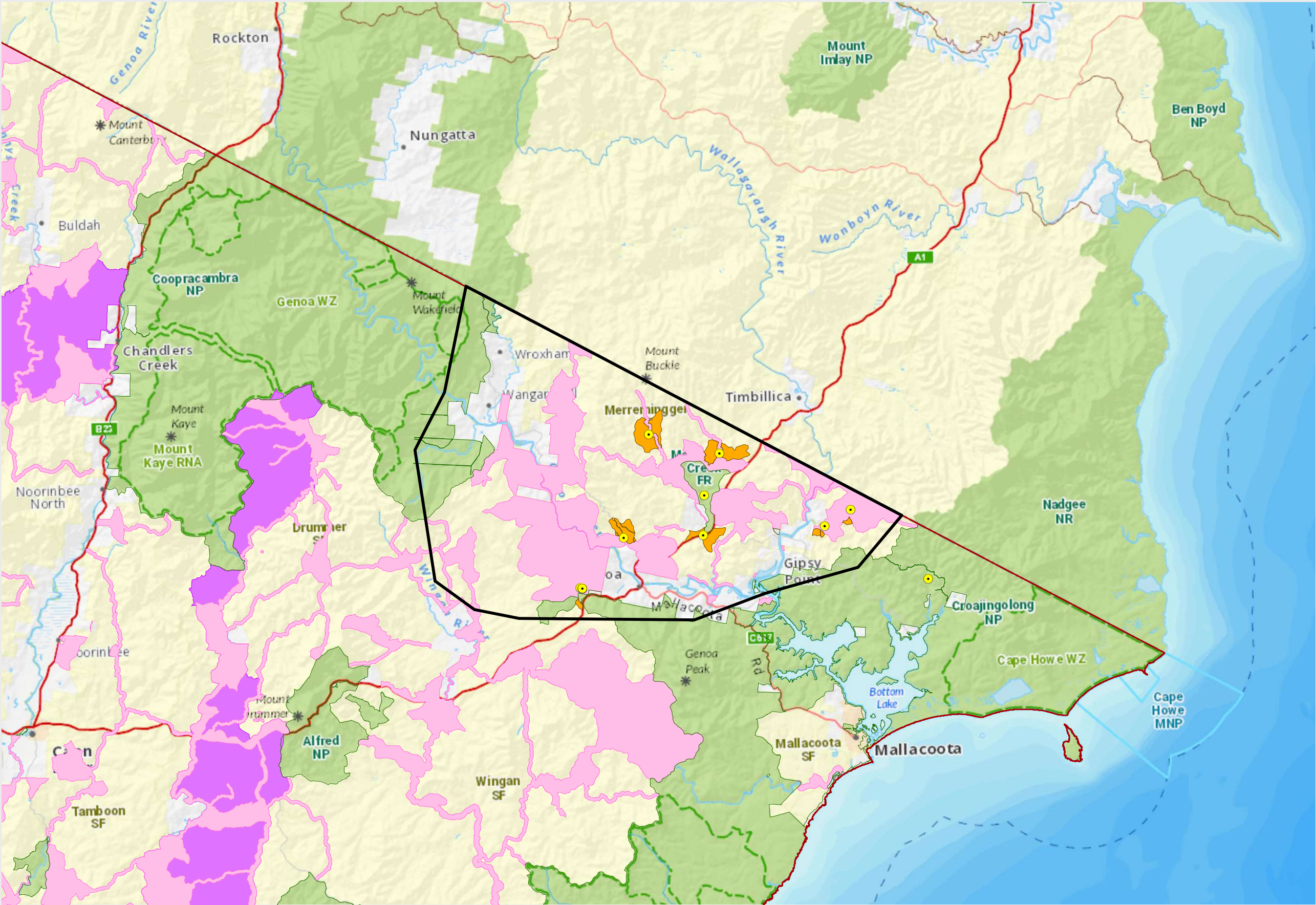
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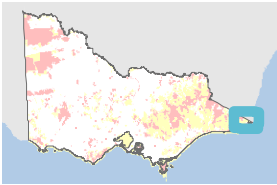
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- Legend**
- Detections
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22 August 2022

Map Scale 1:250,000

Kilometres

0 3.5 7

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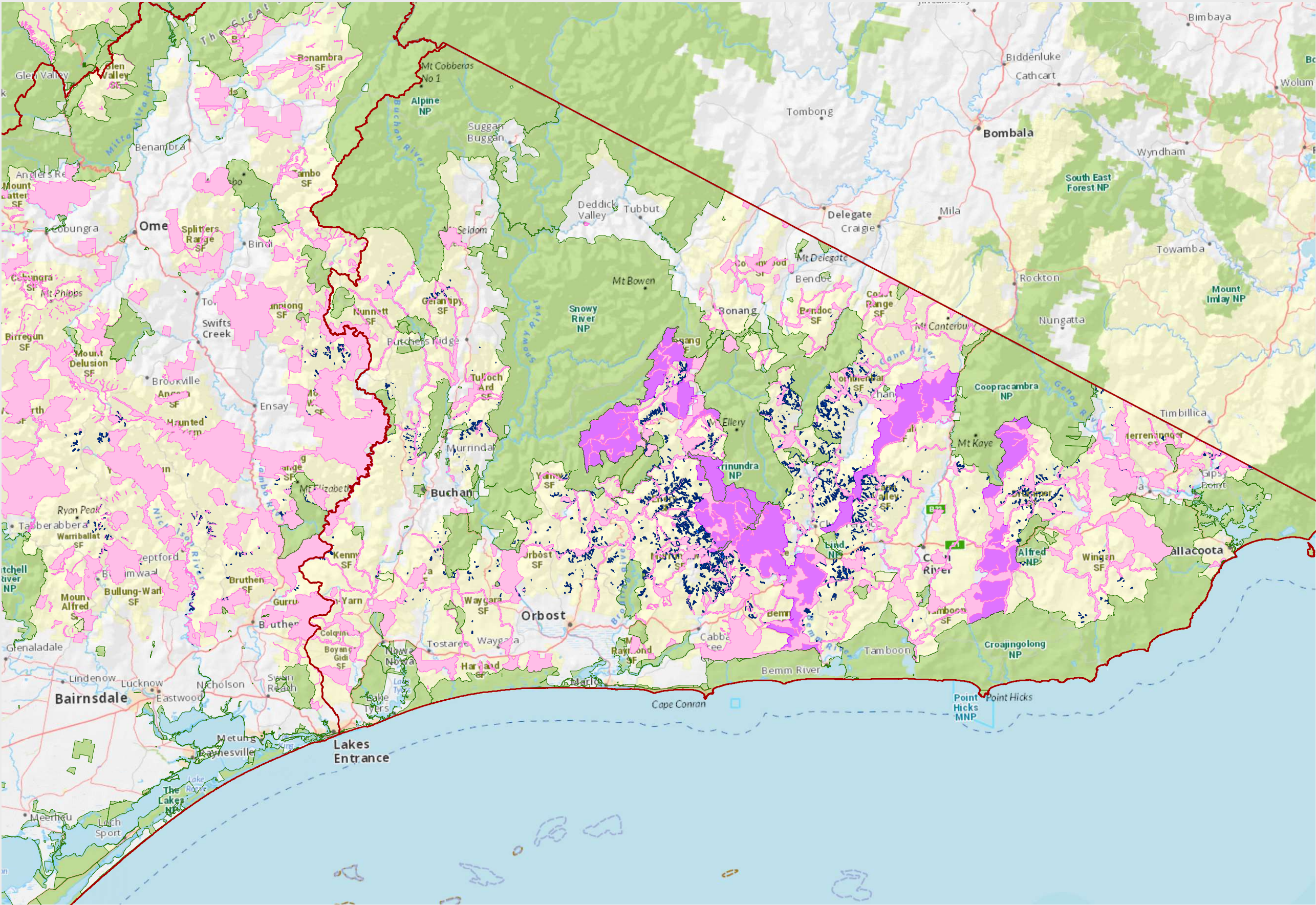
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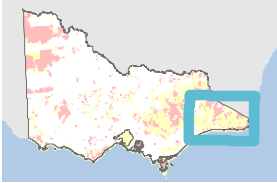
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Rainforest patch buffers impacted by high severity fire in the last 10 years



- Legend**
- Proposed Special Protection Zone
 - RFA boundary
 - Parks and reserves
 - Special Protection Zone
 - Immediate Protection Area



22 August 2022

Map Scale 1:670,964

Kilometres

0 5 10

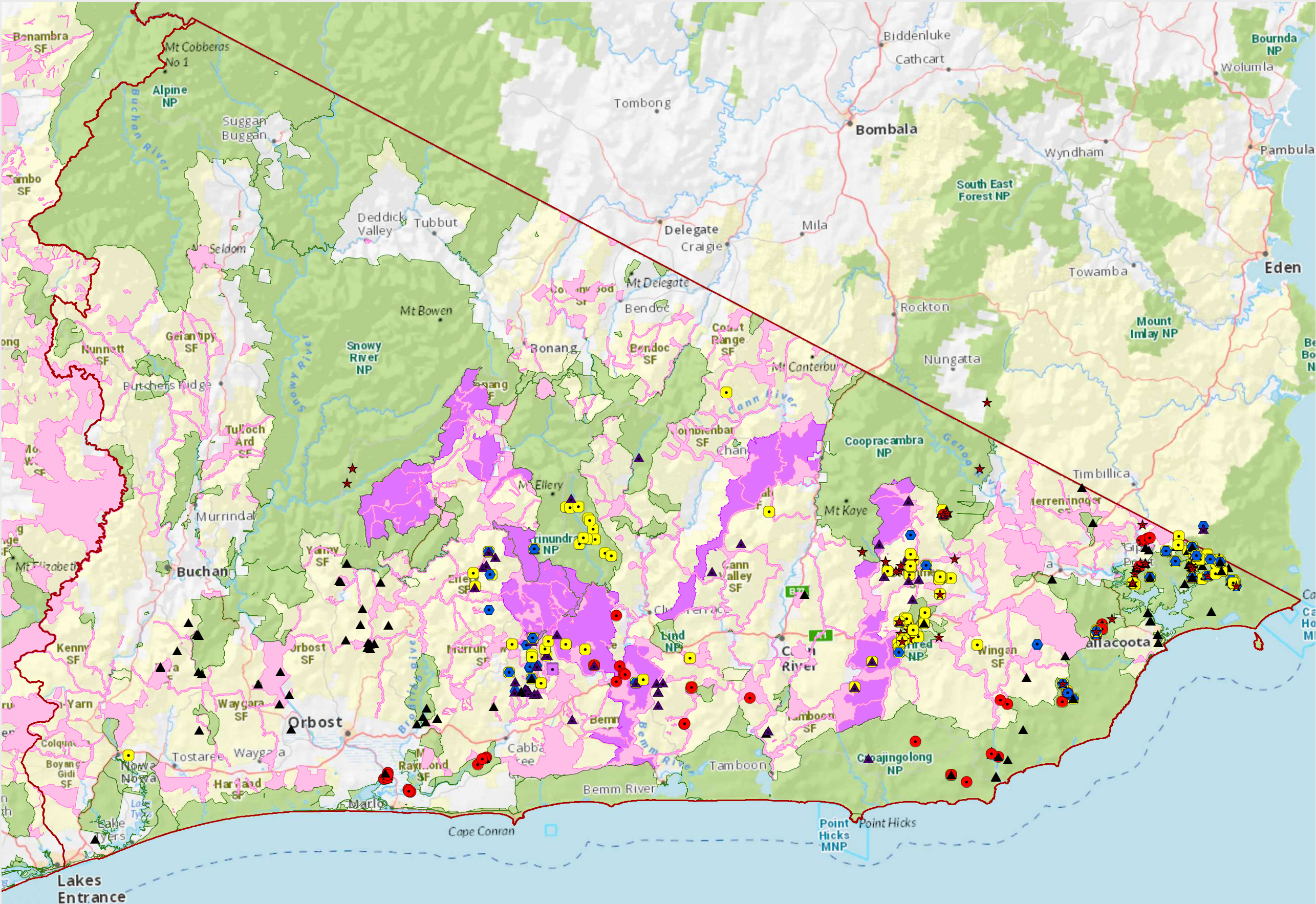
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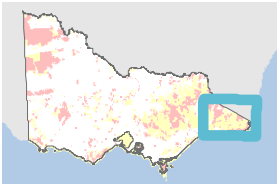
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- ▲ Bolwarra
- Bristly Shield-fern
- ★ Creeping Shield-fern
- ⬡ Jungle Bristle-fern
- ▲ Oval Fork-fern
- Small Fork-fern
- White Supplejack
- Special Management Zones
- RFA boundary
- Parks and reserves
- Special Protection Zone
- Immediate Protection Area



23 August 2022

Map Scale 1:546,019

Kilometres

0 5 10

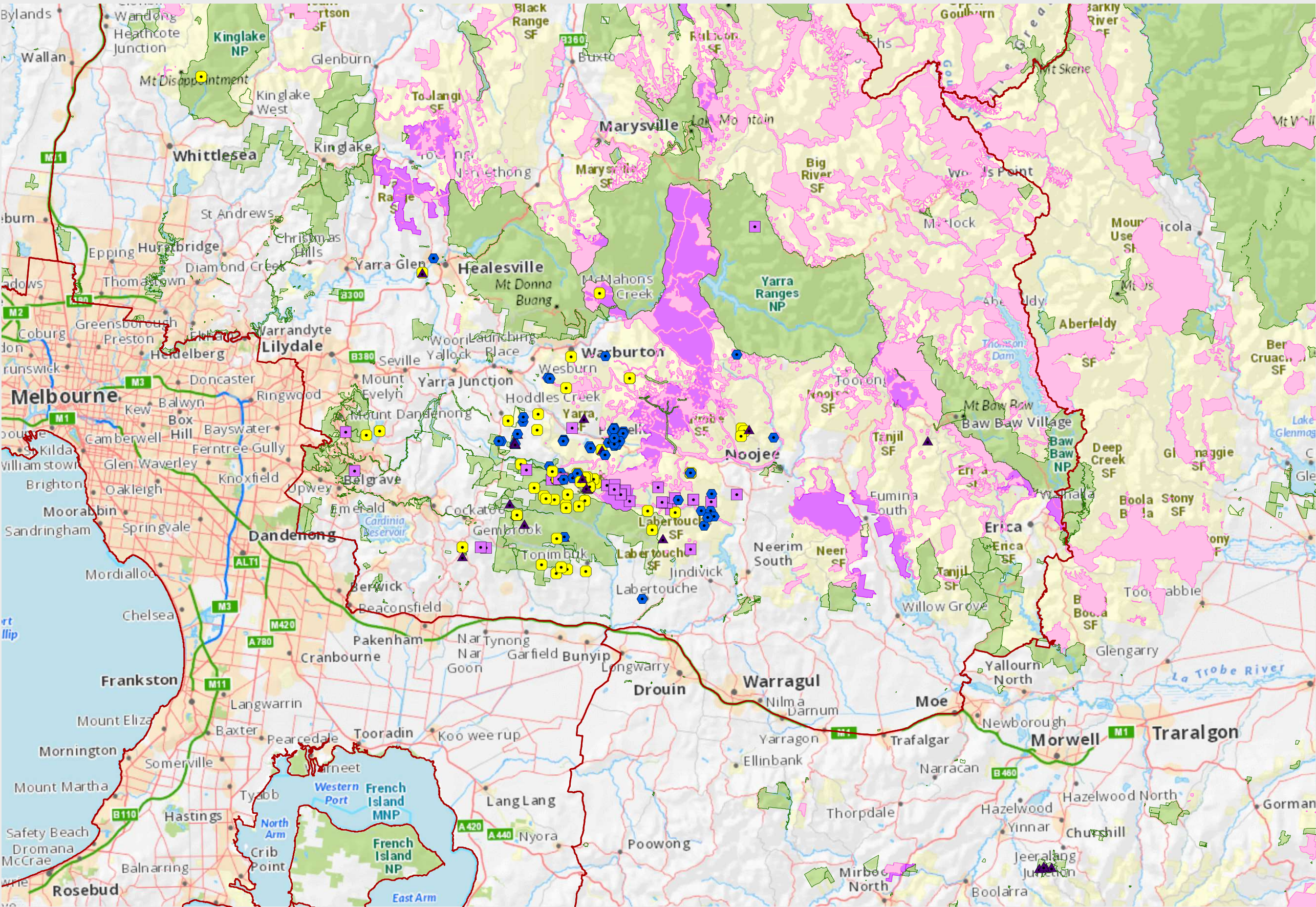
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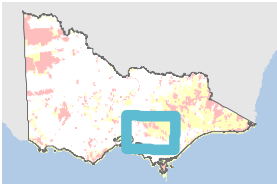
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- Bristly Shield-fern
- ◆ Jungle Bristle-fern
- ▲ Oval Fork-fern
- Small Fork-fern
- Special Management Zones
- ▭ RFA boundary
- Parks and reserves
- Special Protection Zone
- Immediate Protection Area



23 August 2022

Map Scale 1:500,000

Kilometres

0 5 10

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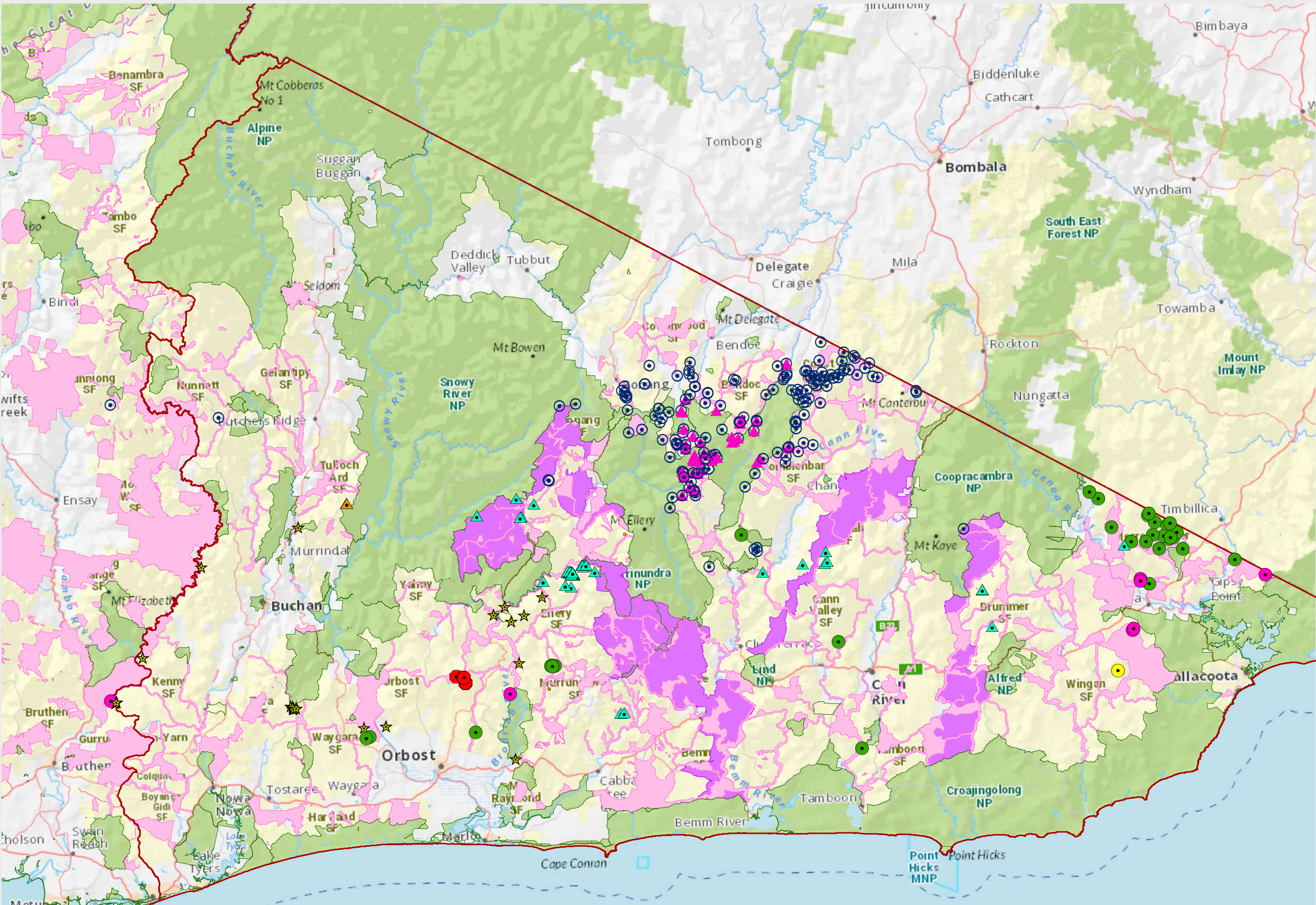
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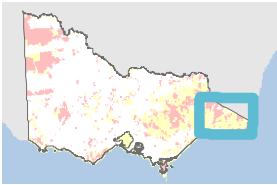
Restricted and limited range plants (inc. long lived understorey species)

MAP 6A

Victorian Biodiversity Atlas records post-1970 (greater than 100m accuracy) buffered by 200m



- Errinundra Pepper
- Finger Hakea
- Forest Geebung
- Forest Phebalium
- Leafless Pink-bells
- Sandfly Zieria
- Satinwood
- Tullach Ard Grevillea
- Wallaby-bush
- Proposed Special Management Zones
- RFA boundary
- Parks and reserves
- Special Protection Zone
- Immediate Protection Area



22 August 2022

Map Scale 1:550,000

Kilometres 0 5 10

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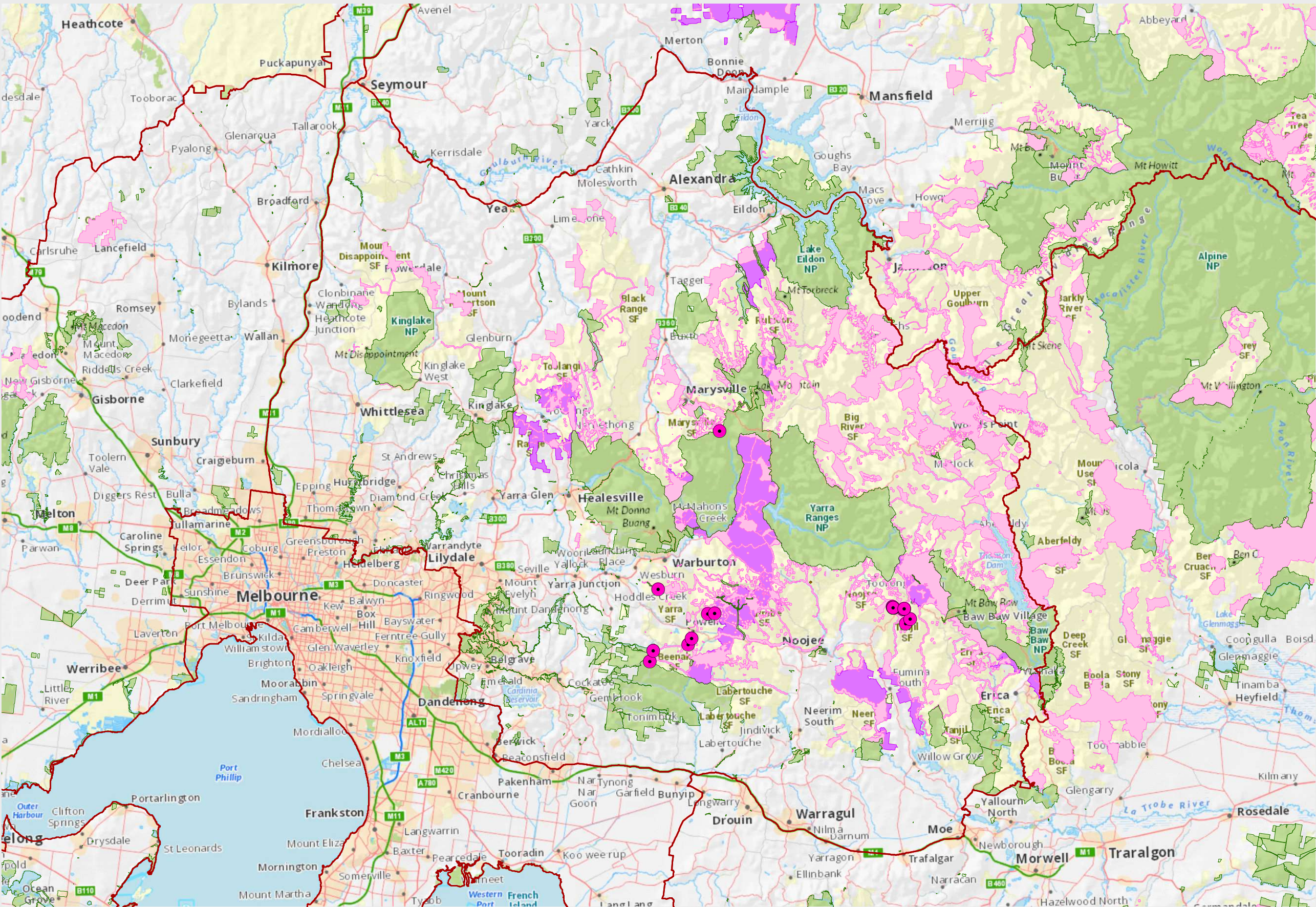
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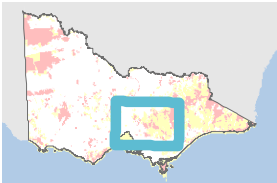
Restricted and limited range plants (inc. long lived understorey species)

MAP 6B

Victorian Biodiversity Atlas records post-1970 (greater than 100m accuracy) buffered by 200m



- Forest Phebalium
- Proposed Special Management Zones
- RFA boundary
- Parks and reserves
- Special Protection Zone
- Immediate Protection Area



22 August 2022

Map Scale 1:654,174

Kilometres

0 5 10

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